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

Report of the Ninth Session of the Scientific Committee

Victoria, Seychelles, 6-10 November 2006

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1. OPENING OF THE SESSION

1. The Ninth Meeting of the Scientific Committee (SC) was opened on 6 November 2006 in Victoria, Seychelles, by the Executive Secretary Mr. Alejandro Anganuzzi in the absence of Dr. Geoffrey Kirkwood (United Kingdom), the Chair of the SC who passed away in April 2006.

2. The Scientific Committee observed one minute of silence in remembrance of Dr. Kirkwood.

3. Dr. Francis Marsac (EC) was chosen to chair the meeting in a caretaker role. Dr. Marsac welcomed the participants (Appendix I).

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

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

3. ADMISSION OF OBSERVERS

5. Pursuant to Rule XIII.9 of the Rules of Procedure, the Scientific Committee acknowledged the presence of Observers from the FAO, Russian Federation and Birdlife International, and invited experts from Taiwan,China.

4. DATA COLLECTION AND STATISTICS

4.1 Status of the IOTC Databases

6. The Secretariat presented IOTC-2006-SC-INF01 summarising the main activities carried out in relation to data acquisition and data processing since the last SC meeting, and the status of the databases at the IOTC Secretariat.

7. The SC noted with concern that the levels of reporting of all data categories were lower in 2006 than in previous years. The levels of reporting and a summary of the state of data submissions for 2005 are provided in Appendix IV. Low levels of reporting directly affect the reliability of the assessments conducted by the Working Parties. Late reports compromise the validation, verification and utility of data, especially when data are submitted close to or during Working Party meetings.

8. The Scientific Committee noted once again that the IOTC Secretariat has, with the support of the IOTC-OFCF project, undertaken a significant quantity of work related to fisheries statistics in 2005/2006, especially relating to artisanal fisheries in the coastal countries of the Indian Ocean. The SC recalled that the artisanal fisheries in the coastal countries of the Indian Ocean take approximately half of the total catch (equivalent to around 500,000 t) and this component alone is about the size of the respective total tuna catches of the Atlantic Ocean (ICCAT area) and eastern Pacific Ocean (IATTC) — oceans where industrial fisheries (offshore longliners and large purse seiners) dominate. The SC noted that the IOTC is the only RFMO in the world that has to cope with such a large workload.

9. The SC noted that many Indian Ocean coastal countries (several of which are not members of the Commission) have limited statistical systems and lack the ability to provide the fine-scale statistical data required by the IOTC Working Parties for their stock assessments. Given that these artisanal fisheries are always very difficult to sample, most of the countries in the region need strong support from IOTC in the areas of data collection and data processing (and this often includes personnel training). In particular, the Scientific Committee noted the negative consequences on the assessments of skipjack and yellowfin for both of which the artisanal fisheries are poorly monitored and continue to increase their catches.

10. The Scientific Committee concluded that only a considerable increase in resources will enable the IOTC Secretariat to continue to provide this essential support to the statistical systems of the countries in the region.

11. The SC made the following recommendations that represent the highest priority areas for members. It is expected that if these recommendations are realised, they will result in a marked improvement in the standing of the data currently available at the secretariat and ultimately the provision of scientific advice to the Commission. The SC noted that these recommendations are made over and above the existing obligations and technical specifications relating to the reporting of data.

1. **Improve the certainty of catch and effort data from artisanal fisheries, by:**
   - Requesting Yemen, Comoros and Madagascar to implement fisheries statistical collection and reporting systems.
   - Requesting countries having artisanal fisheries, notably Indonesia and Sri Lanka, to improve the collection and reporting of species and gear information.
   - Requesting fisheries data collection agencies in each country, notably India and Sri Lanka, to collaborate and produce one consistent set of catch statistics.
   - Requesting members to increase sampling coverage to obtain acceptable levels of precision in their catch and effort statistics.
2. **Improve the certainty of catch and effort data from industrial fisheries by:**
   - Requesting the Republic of Korea to improve the consistency of its catch-and-effort statistics.
   - Reducing the amount of catches from non-reporting fleets by encouraging all members to uphold their obligations with respect to IUU vessels.
   - Urging members to report on total discards of IOTC species.
   - Urging members to report on IOTC species taken as bycatch.
   - Requesting members to ensure log book coverage is appropriate to produce acceptable levels of precision in their catch and effort statistics.
   - Requesting Indonesia and Taiwan,China to collect and report catch and effort data for their fresh tuna longline fleets.
3. **Increase the amount of size data available to the Secretariat:**
   - Requesting members to collect and report size data for artisanal fisheries for yellowfin tuna taken by gillnet, handline and troll fisheries; in particular Yemen, Comoros and Indonesia.
   - Requesting India to report their existing size data.
   - Requesting size frequency data from Thailand purse seiners.
   - Requesting Taiwan,China to collect and provide size data from their fresh tuna longliners.
   - Requesting Philippines and Seychelles to provide size data from their longline fleets.
   - Requesting members to review their existing sampling schemes to ascertain that the data collected are representative of their fisheries.
4. **To estimate the levels of catches of IOTC non-target species by:**
   - Urging members to implement appropriate sampling programmes to collect data on the catches of sharks, sea-birds, sea-turtles, sea-mammals in the first instance.
5. **Reduce uncertainty in the following biological parameters important for the assessment of stock status of IOTC species:**
   - Conversion relationships: by urging members to submit to the Secretariat the basic data that could be used to establish length-age keys, length-weight keys, processed weight-live weight keys focusing on the major tuna species, swordfish and neritics and sharks in the first instance.
   - Sex ratio: by urging members to undertake research on the sex ratios of billfish species.
   - Encourage all members to collect biological information on all the significant species caught in their fisheries, notably through observer programmes, and provide this information and the raw data to the Secretariat.

12. Whilst the countries mentioned above are those that contribute most to uncertainty in data the SC stressed the need for other countries having uncertain statistics (referred to in the report) to implement the same recommendations.

13. The SC acknowledged the IOTC-OFCF Project for its significant contribution to the improvement of the quality of data collected in several countries of the region.

14. The SC reiterated its concerns about the lack of detailed statistics for the Maldives pole-and-line fishery which is considered as one of the major artisanal fisheries in the region in recent years. The SC recommended that the Secretariat make every possible effort to improve the reporting of data from Maldives.

15. The SC noted again the importance of the Yemeni fishery that was estimated to catch 40,000 t of tunas (mostly yellowfin tuna), and reiterated the need to establish linkages with initiatives in Yemen (such as the World Bank Project) to expedite the establishment of an effective statistical system. In this respect, the Secretariat confirmed that it is planning a fact-finding mission before the end of 2006. The SC also recommended the possible of use of trade statistics to assist in the estimation of past catches, possibly by size categories be investigated.

16. India informed the SC that 82 longliners are currently operating within the Indian EEZ and the data relating to these vessels and their activities will be made available to the Secretariat in the near future. India also indicated that the historical effort and size frequency data from its artisanal fleets will be made available in the near future. The SC acknowledged these undertakings and stressed the importance that these data sets are likely to have on the assessments of IOTC species, especially the neritic tunas.

17. The SC also noted with concern reports indicating that large numbers of fresh-tuna longliners that used to operate from Indonesian ports, and whose catches were estimated by existing sampling programmes, have now moved to other areas of the Indian Ocean that may not be covered by catch-monitoring schemes. The SC was informed by the invited experts from Taiwan,China that a consultation meeting with Indonesia has been held in 2006 to discuss possible joint efforts to enhance the monitoring and management of Indonesian longline fisheries. Furthermore, programmes are being undertaken to improve the management of the Taiwanese fresh tuna longline fleet including encouraging the installation of VMS on the vessels fishing in the Indian Ocean. The SC welcomed such efforts and progress and anticipated an improvement in the statistics from this fleet as a result of these initiatives.

4.2 Review of data on species

18. In addition to the list of recommendations listed above, the SC endorsed the specific data recommendations made by the respective Working Parties for Billfish (IOTC-2006-WPB-R). Tropical Tunas (IOTC-2006-WPTT-R) and Bycatch (IOTC-2006-WPBy-R).

4.3 Progress Report of the IOTC-OFCF Project

Recent activities

19. The recent activities of the IOTC-OFCF[1] Project during 2006 were described in IOTC-2006-SC-08. Highlights included:

- Fact finding missions to Kenya and Tanzania; and a new program in Kenya to enter the historical data on sport fishing into a database.
- A total of 260,002 fish were weighed and 36,549 fish measured in the Indonesia sampling programme during 2005 (representing approximately 40% of the fishing trips). Indonesian authorities have committed to continue the sampling program by themselves from January 2007.
- Fresh tuna longline (63,393 fish were weighed in 2005) and coastal purse seine sampling in Phuket, Thailand continued during 2006.
- A total of 1,044 fish were weighed and 20,585 fish measured in the Sri Lanka programme during 2005 (sampling will continue until December 2006).

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

Highlights over the last five years

20. The SC noted that the current IOTC-OFCF Project is in its 5th year of operation and field activities will conclude in December 2006 and the programme as a whole will conclude in March 2007. While noting a comprehensive report on the Project will be published in 2007, the SC recalled the following highlights:

- Fact finding activities were conducted and country reports were compiled for 13 countries (Indonesia, Thailand, Sri Lanka, India, Iran, Oman, Maldives, Seychelles, Mozambique, Mauritius, Tanzania, Kenya and South Africa). Collaboration with scientists in each country contributed greatly to the exchange of technical information.
- Sampling programmes were implemented in six countries (Indonesia, Thailand, Sri Lanka, Oman, Maldives and Kenya)
- Training and technical advice on database design and/or database management was provided to technicians from 11 countries (Mauritius, Thailand, Seychelles, Malaysia, Indonesia, Sri Lanka, Maldives, India, Australia, Reunion and Iran)
- A Regional Workshop on Data Collection and Statistical Systems provided the opportunity to review problem areas in each country and increase awareness of importance on Fisheries statistics.
- Field support to sampling programmes was provided in Indonesia, Thailand, Sri Lanka, Oman, Maldives and Kenya.
- Publication of a range of documents was produced including: the Regional Workshop Report on Data Collection and Statistical Systems, the FINNS user's manual; a range of sampling manuals or training materials relating to specific fisheries. The IOTC Field Manual is still in preparation.

The future

21. The SC was unanimous in congratulating the IOTC-OFCF Project for its excellent work and most valuable contribution to improving the data available to IOTC and building capacity in the participating countries to implement and strengthen data collection regimes. The SC also congratulated the participant countries for the improvements achieved in their fisheries data collection systems.

22. Noting that the current IOTC-OFCF Project Manager Mr. Koichi Sakonju is leaving the programme in March 2007, the SC thanked Mr Sakonju for his professionalism, good humour and the tireless efforts and dedication over the last five years and wished well in his future endeavours. The SC also thanked Mr Shunji Fujiwara, the IOTC-OFCF Fishery Expert for his contributions over the last three years, and indicated its support for his participation in a second phase of the programme should it proceed.

23. The SC stressed the need for resources to be made available to continue a programme of improving data collection processes in the Indian Ocean fisheries and recommended that the Commission consider how such resources might be made available after the completion of the current IOTC-OFCF initiative.

24. The SC recalled Resolution 05/03 Relating to the establishment of an IOTC programme of inspection in port that obliges countries having foreign vessels operating in their ports to collect data on vessels activities and landings (per species) and report these to the Secretariat annually.

25. The SC welcomed the commitments made by Indonesia to maintain at least the current activities implemented through the IOTC-OFCF programme and encouraged the other countries that have benefited from the programme to make similar commitments.

4.4 Standardisation of logbooks

26. The SC agreed that a standardised logbook for IOTC industrial purse seine and bait boat fleets would be advantageous and agreed on the minimum data requirements for these fleets. An explanation of the types of data required and a logbook template (for illustrative purposes only) are provided in Appendix V.

27. The SC recommended that CPC's that have industrial purse seine or bait boat fleets base their logbooks on the standards agreed and acknowledged the advantages of using an electronic logbook system to collect the data.

28. The SC noted that most large-scale longline fleets already used a common logbook to reports its activities, which is not the case for fresh-tuna longliners. The SC therefore recommended that the Secretariat

work with CPC's that have fresh tuna longline vessels to develop a standardised template for a logbook for fresh tuna longliners and present it to the next SC meeting.

5. PRESENTATION OF NATIONAL REPORTS

29. National Reports were presented by Seychelles (IOTC-2006-SC-INF03), EU-Spain (IOTC-2006-SC-INF07), Japan (IOTC-2006-SC-INF08), Korea (IOTC-2006-SC-INF09), United Kingdom (IOTC-2006-SC-INF12), China (IOTC-2006-SC-INF16), Australia (IOTC-2006-SC-INF17), Sri Lanka (IOTC-2006-SC-INF18), Thailand (IOTC-2006-SC-INF19), EU-France (IOTC-2006-SC-INF20) and India (IOTC-2006-SC-INF21). Abstracts of these reports are given in Appendix VI.

30. The SC noted with concern the small number of national reports that were made available to the SC in 2006 (ten reports from an expected 28). The SC recalled that it is mandatory for all Contracting and Cooperating non-Contracting Parties (CPCs) to provide written national reports to the SC (following the guidelines set out by the SC – and available on the IOTC website) even when not attending the meeting. Furthermore, the SC requested the SC Chairperson to present a report on the numbers and completeness of national reports to the Commission at its annual session.

31. The SC thanked the Russian Federation and the Invited Experts from Taiwan,China for their respective reports (Appendix VII).

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

6.1 Report of the Working Party on Tropical Tunas (WPTT) and presentation of the Executive Summaries for bigeye, skipjack and yellowfin tunas

32. The Eighth Meeting of the Working Party on Tropical Tunas (WPTT) took place in Seychelles, 24-28 July, 2006. The Chairman of the WPTT (Dr Iago Mosqueira) introduced the 2006 WPTT report (IOTC-2006-WPTT-R). The key objectives of the meeting were to undertake a major review of the stock status of bigeye and update the stock indicators for yellowfin and skipjack.

33. The SC acknowledged that considerable work had been carried out by the WPTT intersessionally. This was facilitated to a large extent by the establishment of an internet forum by the working party scientists. The SC noted that this enabled the WPTT to exchange ideas and produce more comparable analyses before the meeting, making the 2006 WPTT meeting more productive than many previous ones. The SC congratulated the WPTT for this initiative and recommended that the other WP's also take this approach to progress their work intersessionally.

34. The SC was informed that thousands of fish aggregating devices (FADs) are deployed each year by industrial purse seine in the Indian Ocean and the effects of these FADs on the behaviour of tuna that are attracted to them (e.g. as suggested by the 'FAD-trap' hypothesis) may be an important consideration for stock assessments. The SC recommended that countries with industrial purse seine fleets undertake research to better understand the interactions between tuna behaviour and FADs, and that this subject be further examined in the next meeting of the WPTT.

35. The SC noted that estimated catches for yellowfin and skipjack tunas by artisanal fisheries have been increasing over the last two decades. Given that the artisanal fisheries take a significant amount of the total catches of yellowfin (around 30 %) and skipjack (around 60 %), this lack of information is likely to affect the quality of future stock assessments, despite of the availability of new data from the tagging programmes. Given this, the SC stressed the need to implement alternative measures to improve the data collection and reporting for artisanal fleets.

36. The SC recommended that the WPTT examines the updated stock indicators for skipjack and stressed the need for the WP to work intersessionally to prepare these data prior to the meeting. Furthermore, noting the importance of the Maldives bait boat fisheries (which take around 20 % of the total catch of skipjack in the Indian Ocean), the SC stressed the need for an expert from Maldives to attend the next WPTT meeting and contribute the most recent statistics available for the analyses.

37. The Scientific Committee endorsed the WPTT's research recommendations (reproduced as Appendix VIII) and commended it for its work in 2006.

38. The SC reviewed and accepted the new assessment of bigeye tuna developed by WPTT and adopted the revised Executive Summary (given in Appendix IX). The SC noted that the availability for the first time of size frequency data from 1980 to 2004 for the Taiwanese industrial longline fleet had improved the reliability of the assessment.

39. The SC reiterated their previous recommendation that, whenever assessments are considered by IOTC Working Parties, the computer programs used and all input and output files must be lodged with the Secretariat at the termination of the meetings.

40. In addition, the SC recommended that the priority matters for WPTT to address at its 2007 meeting should be:

- To undertake a revised stock assessment of yellowfin tuna.
- To review in depth the stock status indicators for skipjack tuna.
- To update the stock status indicators for bigeye

41. The SC congratulated scientists from Japan and Taiwan,China for the considerable work they conducted in 2006 to better understand CPUE trends for bigeye tuna. However, it noted that considerable uncertainty remains in the Taiwanese CPUE standardisation. The SC strongly encouraged Taiwanese scientists, in collaboration with other WPTT scientists, to continue their work to derive a robust CPUE index for the Taiwanese long line fleet.

42. The Executive Summaries for skipjack and yellowfin tunas were adopted (Appendix IX), noting that they have been amended slightly to reflect the latest available catch data, but the advice and recommendations remain unchanged.

6.2 Report of the Working Party on Billfish (WPB) and presentation of the Executive Summary on the status of Swordfish

43. The Fifth Meeting of the Working Party on Billfish (WPB) took place in Colombo, Sri Lanka, 27-31 March 2006. The caretaker chairperson at this meeting (Mr. Kevin McLoughlin) introduced the 2006 WPB report (IOTC-2006-WPB-R).

44. The SC recognised the paucity of data available for all billfish species and, in particular, isthiophorid species (marlins and sailfish) which are most often caught as bycatch, and recommended that the WPB consider what approaches are available to provide advice on these species in data-poor circumstances.

45. The SC noted that data on billfish has been collected by several observer programmes and recommended that whenever possible these data be used to adjust and validate the catches of billfish species reported by commercial fisheries.

46. The SC congratulated the WPB for the major advances in the stock assessments of Indian Ocean swordfish in 2006. The SC also congratulated scientists from Japan and Taiwan,China for the considerable work they conducted in 2006 to better understand CPUE trends for swordfish. However, it noted that the differences in the CPUE indices from the Japanese and Taiwanese longline fisheries remain and the reasons for this are poorly understood by the WPB. The SC strongly encouraged scientists to carry out the investigations recommended by the WPB to address this matter.

47. The SC adopted the revised Executive Summary for swordfish tuna (Appendix IX) and endorsed the WPB's research recommendations as listed in Appendix VIII. The SC recommended that the WPB should focus on reviewing the stock status indicators for marlins and sailfish at its next meeting.

6.3 Other species

6.3.1 Executive Summary on the status of albacore tuna.

48. The Executive Summary for albacore tuna was adopted (Appendix IX), noting that it has been amended slightly to reflect the latest available catch data, but the advice and recommendations remain unchanged.

6.3.2 Executive Summaries on the status of neritic tunas.

49. To progress the work of the Working Party on Neritics that has been unable to meet to-date, the Secretariat provided draft Executive Summaries for seven neritic tuna species for the consideration of the SC. These summaries were based on information compiled by the Secretariat and summarised in document IOTC-2006-SC-INF11.

50. The Executive Summaries for narrow-barred Spanish mackerel, kawakawa, bullet tuna, wahoo, longtail tuna, frigate tuna and Indo-Pacific king mackerel were adopted (Appendix IX).

51. The SC thanked the Secretariat for its work and encouraged scientists to further contribute to the contents of these documents.

52. Noting that IOTC's neritic tunas species include both oceanic and coastal species, the SC recommended that the WPNT identify which stocks might be best assessed at a sub-regional level. Furthermore, given the large number of neritic species, the SC recommended that the WPNT determine which species would be assessed in the first instance.

6.4 Management advice.

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

MANAGEMENT ADVICE

BIGEYE TUNA (*THUNNUS OBESUS*)

The results of the stock assessments conducted in 2006 were broadly similar and, in general, were more optimistic than previous ones. The ASPM results indicate that the 2005 catch is close to the MSY. Furthermore, spawning stock biomass seems to be above the level that would produce MSY, and the fishing mortality in 2004 seems to below the MSY level. Current (2004) catches of juveniles bigeye by the surface fleets are also less detrimental in terms of yield-per-recruit that previous patterns.

However, the current outlook could revert to a more pessimistic one, if the exploitation pattern is to return to the pre-2003 levels, as expected. Changes in the fishery occurred in 2003 and 2004, but these were due to the exceptional catches of yellowfin, which seem to be the result of anomalous conditions. In 2005, the fishery is already showing a return to the previous pattern of exploitation, which is likely to increase the catches of bigeye tuna associated with floating objects.

If the level in catch in numbers of juvenile bigeye tuna by purse seiners fishing on floating objects returns to pre-2003 levels, this is likely to be detrimental to the stock, as fish of these sizes are below the optimum size for maximum yield-per-recruit.

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

In view of the most current assessment, the SC recommended that catches should not exceed the MSY and fishing effort should not increase further from the 2004 levels.

YELLOWFIN TUNA (*THUNNUS ALBACARES*)

While there was greater consistency in the 2005 assessment results than previously, the Scientific Committee emphasised that there remain considerable uncertainties in the assessments, as none as yet are able to fully explain the observed trends in standardized longline CPUEs over the duration of the fishery.

In interpreting the high catches of yellowfin 2003, 2004 and 2005, the Scientific Committee noted that if the hypothesis of one or two high recruitments entering the adult stock is correct, the increased catches from these year classes are unlikely to be detrimental to the stock, but these catches would not be sustainable in the longer term unless supported by continued high recruitments. On the other hand, there could be serious consequences if the hypothesis that there was an increased catchability during this time is correct. In this case, the very large catches would represent a much higher fishing mortality and certainly would not be sustainable. Furthermore, they could lead to a sudden decline of the existing adult biomass of yellowfin tuna, potentially reducing the stock to below MSY levels. If such is the case, management action might be needed to reduce catches and fishing mortality to below the levels prevailing in 1999 – 2002 to allow the stock to recover. If, as the Scientific Committee believes, the most likely cause of the exceptional catches is a combination of these factors, then some reduction of stock biomass is to be expected in the future. However, the extent of any such reduction will only become apparent in several years following detailed stock assessments.

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. The current fishing pressure on juvenile yellowfin by both purse seiners fishing on floating objects and artisanal fisheries is likely to be detrimental to the stock if it continues, as fish of these sizes are well below the optimum size for maximum yield per recruit estimated in 2002.
2. The Scientific Committee also noted that juvenile yellowfin tuna are caught in the purse-seine fishery that targets primarily skipjack tuna. Some measures to reduce the catches of juvenile yellowfin tuna in the FAD fishery will be accompanied by a decrease in the catches of skipjack tuna.
3. Fishing mortality rates between 1999 and 2002 were probably slightly below or around F_{MSY}, and total catches during that period, at an average level of 347,000 t, were probably close to, or possibly above MSY. Total catches in 2003, 2004 and 2005 were substantially above MSY; see above for interpretation of the possible reasons for and possible effects of these catches.

In conclusion, the Scientific Committee recommended that any further increase in both effective fishing effort and catch above average levels in 1999 - 2002 should be avoided.

SKIPJACK TUNA (*KATSUWONUS PELMIS*)

The high productivity life history characteristics of skipjack tuna suggest this species is resilient and not prone to overfishing, and the stock status indicators indicate that there is no need for immediate concern about the status of skipjack tuna.

ALBACORE TUNA (*THUNNUS ALALUNGA*)

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

Taking into account the absence of a reliable assessment of the status of albacore tuna and the need for a precautionary approach, the SC recommended that the Commission be very cautious in allowing increases in catch or fishing effort from the 2002 levels until the problems with the assessments have been resolved.

SWORDFISH (*XIPHIAS GLADIUS*)

On the basis of the 2006 assessments and stock indicators the SC concluded that the level of catch in 2004 (about 32,000 t) is above the MSY and unlikely to be sustainable. Furthermore, while the assessments indicated that the stock i.e. for the Indian Ocean overall is probably not currently overfished, catch rate data from the southwest Indian Ocean suggest that overfishing of swordfish may be occurring in localised areas, in particular in the southwest Indian Ocean. Notwithstanding this, the reductions in catch rates have not been accompanied by reductions in average size of the fish in the catch, as has been the case in other oceans. The SC expressed concern regarding the very rapid increase in effort targeting swordfish in other areas of the Indian Ocean and the relatively large incidental catch of swordfish in fisheries targeting bigeye. These increases in effort exploiting swordfish have continued since 2000.

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

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

BULLET TUNA (*AUXIS ROCHEI*)

No quantitative stock assessment is currently available for bullet tuna in the Indian Ocean, therefore the stock status is uncertain. The SC notes the catches of bullet tuna are typically variable but relatively low compared to the other neritic species. The reasons for this are not clear: it may be problem related to reporting, or it may be a normal fluctuation in the fishery. Bullet tuna is a relatively productive species with high fecundity and rapid growth and this makes it relatively resilient and less prone to overfishing. Nevertheless, bullet tuna appears to be an important prey species for other pelagic species including the commercial tunas, therefore it should be reviewed at the first meeting of the IOTC Working Party on NeriticTunas.

FRIGATE TUNA (*AUXIS THAZARD*)

No quantitative stock assessment is currently available for the frigate tuna in the Indian Ocean, therefore the stock status is uncertain. This species is a relatively productive species with high fecundity and rapid growth and this makes it relatively resilient and not prone to overfishing. Nevertheless, frigate tuna appears to be an important prey species for other pelagic species including the commercial tunas, therefore it should be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

INDO-PACIFIC KING MACKEREL (*SCOMBEROMORUS GUTTATUS*)

No quantitative stock assessment is currently available for the Indo-Pacific king mackerel in the Indian Ocean, therefore the stock status is uncertain. This species is a relatively productive species with high fecundity and rapid growth and this makes it relatively resilient and not prone to overfishing. The SC recommends Indo-Pacific king mackerel be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

KAWAKAWA (*EUTHYNNIS AFFINIS*)

No quantitative stock assessment is currently available for kawakawa in the Indian Ocean, therefore the stock status is uncertain. The SC notes the decline in the catches since 2002. However, the reasons for this are not clear: it may be problem related to reporting, or it may be a normal fluctuation in the fishery — a similar decline occurred in the early 1990’s. Nevertheless, the SC recommends that this species be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

LONGTAIL TUNA (*THUNNUS TONGGOL*)

No quantitative stock assessment is currently available for longtail tuna in the Indian Ocean, therefore the stock status is uncertain. The SC notes the decline in the catches since 2000. However, the reasons for this are not clear: it may be problem related to reporting, or it may be a normal fluctuation in the fishery — similar declines occurred in the mid 1980’s, early 1990’s and mid 1990’s. Nevertheless, the SC recommended that this species be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

NARROW-BARRED SPANISH MACKEREL (*SCOMBEROMORUS COMMERSON*)

No quantitative stock assessment is currently available for narrow-barred Spanish mackerel tuna in the Indian Ocean, therefore the stock status is uncertain. The SC notes that Spanish mackerel is a relatively productive species with high fecundity and this makes it relatively resilient and less prone to overfishing; however, it recommends that this important species be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

WAHOO (*ACANTHOCYBIUM SOLANDRI*)

No quantitative stock assessment is currently available for wahoo in the Indian Ocean, therefore the stock status is uncertain. However, wahoo is a relatively productive species with high fecundity and rapid growth and these attributes make it relatively resilient and not prone to overfishing. The SC recommends that this species be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

54. The SC noted the contents of a report on the biology, stock status and management of southern bluefin tuna (IOTC-2006-SC-INF02) and thanked CCSBT for providing it.

7. STATUS OF SPECIES TAKEN AS BYCATCH IN INDIAN OCEAN FISHERIES

7.1 Report of the Working Party on Bycatch (WPBy)

55. The Second Meeting of the Working Party on Bycatch (WPBy) took place in Seychelles on 1 August 2006. The WPBy chairperson (Mr. Kevin McLoughlin) introduced the 2006 WPBy report (IOTC-2006-WPBy-R).

56. The SC congratulated the WPBy for the progress it achieved during the year and endorsed the recommendations of the WPBy (reproduced in Appendix VIII).

57. Recognising that accurate data on bycatch can only be obtained through observer programmes, the SC strongly encouraged further collaboration among existing observer programmes. The SC also strongly recommended the expansion of existing programmes and implementation of new observer programmes for the Indian Ocean, noting that the Secretariat should play an important role in coordinating these activities including standardization of sampling protocols

58. Noting the WPBy desire to work intersessionally, the SC recommended that the WPBy utilises the same email approach used successfully by the WPTT.

59. The SC thanked the United Kingdom for their offer to provide information to the Secretariat on the fin-body weight ratio of sharks caught in the British Indian Ocean Territories.

60. The SC was informed about the increasing number of meetings on Indian Ocean bycatch being convened at various regional and sub-regional levels and uncertainty with respect to the status and implications of the decisions and recommendations arising from these meetings. The SC noted that the IOTC is the only body with the mandate to implement management measures on bycatch applying to the whole of the IOTC area.

61. The SC discussed the matter of the current exemption of the American longline system from the requirement to use tori lines below 30 degrees south. Additional information presented in IOTC-2006-SC-INF10 indicates that this method is associated with high seabird bycatch rates in some regions. However, experimental longline cruises in the south-west Indian Ocean in 2005 found low bycatch rates. The WPBy advised the SC that the current exemption may not be warranted. The SC was not able to reach a conclusion and recommended that the issue be revisited as further data becomes available.

62. The SC recommended that further work be done to better understand the interactions between tuna fisheries and seabirds. The SC acknowledged the generous offer from Birdlife International to provide data on the distribution of albatrosses and petrels in the Southern Indian Ocean to facilitate an examination of the spatio-temporal overlap with IOTC long line fisheries for presentation to the next meeting of the WPBy. The Secretariat confirmed that this task could be initiated as soon as the data are made available.

Discussion on the integration of ecosystem considerations on IOTC management issues

63. The SC noted that the large increases in tuna catches in recent years represent the removal of top predators that could have unintended effects on the structure of the ecosystem. Furthermore, there are global processes, such as climate change, that could affect the productivity of large marine ecosystems.

64. Therefore, acknowledging the need for a responsible approach to fisheries management, the SC emphasised the necessity to incorporate all relevant information on the ecosystems into its advice. This includes consideration of the biological interactions among exploited species and other components of the ecosystem, as well as technological interactions, such as the effects of FADs and the role of the fishers as extremely efficient predators.

65. The SC also recommended that close collaboration with current and future global initiatives (e.g. the GLOBEC-CLIOTOP Programme) should be pursued to take advantage of existing knowledge. The SC noted that the first conference of the GLOBEC-CLIOTOP programme will be held on 4-7 December 2007 in La Paz, Mexico; and that details of a project on climate change and its impact on fisheries are available on www.fmsp.org.uk.

66. To achieve the above goals, the SC recommended that the terms of reference of the WPBy be expanded. To this end, a terms of reference for a Working Party on Ecosystems and Bycatch (WPEB) to replace the current WPBy was drafted (Appendix X) for the consideration of the Commission at its next meeting.

67. In response to a recent paper published in Science[2], which concludes that a dramatic loss in marine biodiversity reduces the stability, recovery potential and fisheries productivity, the SC noted that the study was mainly based on coastal and continental shelves ecosystems and the results cannot be reliably

[2] Worm et al. (2006). Impacts of biodiversity loss on ocean ecosystem services. Science, Vol. 314: p787-790.

extrapolated to high-seas ecosystems and applied to highly migratory species such as tuna and billfish which range over a very large area that support relatively low levels of biodiversity. Furthermore, high-seas ecosystems are very deep and much less degraded than coastal continental shelves ecosystems.

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

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

68. The Chief coordinator of the EU-funded RTTP-IO provided the SC with an update on the main activities carried out since the implementation of the IOTTP (no document).

69. The SC noted with satisfaction the success of the tagging operations to-date. As of November 2006, 120,000 tunas had been tagged and this was well above the minimum number set for the project (80,000) and comprised higher than expected proportions of yellowfin tuna and bigeye (which is the main target species of the programme). The SC also noted that the tagging vessels were able to attract and retain tuna schools in waters off Tanzania. The RTTP-IO which started its tagging activities in May 2005 has tagged and released 113,516 tunas so far, comprising 39,839 yellowfin (35 %), 54,167 skipjack (48 %) and 19,048 bigeye (17 %) (and 462 unidentified fish). To-date 5482 tunas have been recovered, mostly in Seychelles but also in canneries or by artisanal fishermen in Mauritius, Madagascar, Comoros, Tanzania, Thailand and Spain. A few recoveries have been also reported onboard Japanese, Korean and Seychellois longliners.

70. On the basis of this work, the SC expects that there will soon be a large amount of new biological information available on bigeye yellowfin and skipjack and this information will greatly improve the quality of the stock assessments, and consequently the management advice given by the SC to the Commission.

71. The SC also congratulated all parties involved in the project both in the release and recovery operations and paid special mention to the IOTC Secretariat for its ongoing technical supervision, and valuable administrative support to the project.

72. The SC thanked the institutions in the many countries involved with the programme for their assistance in publicising the RTTP, disseminating materials and informing the fishers about the programme.

73. The SC noted existence of the RTTP website (www.rttp-io.org) that disseminates results and other information relating to the programme.

74. The SC noted that the recovery rates of tags from longline fisheries are very low as the return of tags appears not to be a priority for longline skippers. Furthermore, the estimation of exploitation rate, migration rate and interactions between fisheries will not be possible from tags recovered from the longline fisheries unless longline reporting rates are estimated from tag seeding experiments – which are problematic to implement. Notwithstanding these matters, the SC noted that valuable information on stock structure and growth could be expected from longline recoveries.

75. The SC noted that as a result of the situation with longline recoveries, the RTTP-IO publicity programme is concentrating on boosting tag recoveries from the purse seine fisheries at unloading sites.

76. After considerable technical discussion, the SC made the following recommendations to the RTTP-IO:

- Extend the area of operation to facilitate the release of tagged tuna across a wider area of the Indian Ocean, particularly to areas that have not been yet been visited by the tagging vessels such as the Arabian Sea and Chagos archipelago.
- Increase the number of tag releases of yellowfin tuna less than 70 cm long to obtain additional information on growth rates and natural mortality for this size range.
- Increase the use of archival tags on bigeye and yellowfin
- As specimens of tagged adult bigeye tuna are going to be caught mainly by longline fisheries, there is a need to continue the efforts to recover tagged fish from the major longline fleets.

77. The IOTC Secretariat presented to the SC some preliminary results on the tag seeding experiment started in 2004 on the purse-seine fleet in Seychelles. The Secretariat indicated that so far 1,055 tags have been seeded and that the reporting rate increased from 48% in 2004 to 71% in 2006, which was probably due to the effectiveness of the publicity campaigns developed in 2005.

78. The SC recognised that tag seeding experiments are essential to estimate the reporting rate which is used by scientist to correct the recovery data and assess the recapture rate. The SC stressed the importance of such an operation and explained that tagging data cannot be used for to determine exploitation rate if the reporting rate is unknown, which is the case for the longline and artisanal fisheries.

79. The SC noted the results of the tag seeding operation and stresses the importance of such an experiment. The SC strongly recommended to pursue the operation during and after the tagging activities.

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

80. The IOTC Secretariat informed the SC about the progress of the Small-scale Tuna Tagging Project. The SC noted that the Western Sumatra Tuna Tagging Project in the Eastern Indian Ocean, funded by the Government of Japan, had been developed in February 2006 during a workshop in Indonesia. The field activities started early in October 2006, however due to abnormal climatic and oceanographic conditions that produced a negative temperature anomaly on the West Coast of Sumatra resulting in tuna migrating away from area, no tuna were tagged.

81. The SC stressed the importance of such programmes in the EIO and requested that the Secretariat resume the work as soon as normal conditions return.

82. The Fishery Survey of India presented to the SC the results of the small-scale tuna tagging in Lakshadweep Islands (IOTC-2006-SC-INF24). The project initiated in February released so far 4958 tuna (4946 from pole and line and 12 from trolling) around three islands of the Lakshadweep group. So far, 223 tuna have been recaptured, mostly in Lakshadweep but also in Maldives and by the purse-seine fleet based in Seychelles. The SC congratulated India on this work and recommended that further studies be conducted to examine more closely the fast growth rates of the recaptured yellowfin.

83. The SC recommended that tuna tagging be resumed in Maldives as this country is located in the migratory path of tunas and the Maldives fishers have a good track record of returning tags. To this end, the Secretariat indicated that there was a possibility to relocate funds from its small scale programme to support this activity.

8.3 FADIO activities

84. The SC was given an overview of the results of the EC-funded program, FADIO, that recently concluded. The SC noted the high quality of work carried out since the projects implementation and congratulated the scientists involved. The SC was supportive in principle of further work that would build on the philosophy and results FADIO.

9. RELATIONSHIPS WITH OTHER REGIONAL BODIES AND PROJECTS

85. FAO updated the SC with information on the Fisheries Global Information System (FIGIS) that now includes large information on tuna species, and the recent Methodological Workshop on the Management of Tuna Fishing Capacity (IOTC-2006-SC-INF22). FAO also requested that a representative from the Secretariat participate at the next meeting convened.

86. The SC thanked FAO for its work on capacity issues and requested that the Executive Secretary consider sending a representative if possible.

87. The EC informed the SC about the implementation of a large scale, multi-national research programme on swordfish (Indian Ocean: Structure and characteristics of the Swordfish stock, IOSSS). The SC noted that the activities proposed in this programme will address many of the research needs set for this species by the IOTC Working Party on Billfish. The SC encouraged all countries that catch swordfish in the Indian Ocean to contribute to this programme.

88. The SC was informed about the South Western Indian Ocean Fisheries Project (SWIOFP) (IOTC-2006-INF05), a regional project being a component of the Agulhas-Somali Currents Large Marine Ecosystem Programme partly funded by the Global Environment Facility. The SC welcomed this regional initiative and requested the Executive Secretary to work closely with SWIOFP and the South Western Indian Ocean Fisheries Commission (SWIOFC) to ensure that the activities of IOTC, SWIOFP and SWIOFC are complementary.

89. The SC agreed on the need to be kept up to date on the activities of the technical bodies of the other tuna commissions and suggested that the Executive Secretary invite scientists that regularly attend the meetings of the IOTC and other tuna commission to provide a brief report on the issues of relevance to the SC, in particular fishing trends, scientific methods and results and management prospects.

10. SCHEDULE OF WORKING PARTY MEETINGS IN 2007

90. The SC agreed to the following schedule of working party meetings for 2007.

Working Party	Date and place	Major topics
Tropical Tunas	16-20 July 2007, Seychelles (5 days)	• Stock assessment for yellowfin tuna • Review stock indicators for skipjack • Update stock indicators for bigeye
Temperate Tunas	Possibly 2008	-
Neritic tunas	To be advised	-
Billfish	October 2007, Seychelles	• Review stock indicators for marlins and sailfish
Methods	14 July 2007, Seychelles (1 day)	• Review and discuss stock assessmenr methods; use of tag recapture data in assessments; development of Management Strategy Evaluation tools
Ecosystems and Bycatch	11-13 July 2007, Seychelles (3 days)	• review data available to Secretariat • - review availability of observer information • - assess information available on sharks and seabirds • - consideration of ecosystem approaches

91. The SC stressed the need for a minimum number of 15 participants from as many countries as possible at the first meeting of the Working Party on Neritic Tunas, and requested that the Executive Secretary confirm the location and time for the meeting as soon as possible.

92. The SC noted the proposed schedule of working party meetings and meetings of other Commission bodies in 2007 constituted a considerable amount of work for the Secretariat and given the Secretariats current resources agreed that a meeting of the Working Party on Temperate Tunas could be deferred to a future date.

93. A meeting of the Working Party on Methods is proposed in order to review and discuss recent developments in stock assessment methods (some of them already in use by IOTC Working Parties), the use of tag recapture data for assessment purposes, and the possible development of Management Strategy Evaluation (MSE) approaches for the Indian Ocean tuna fisheries.

11. IDENTIFICATION OF MEASURES TO INCREASE THE PARTICIPATION OF NATIONAL SCIENTISTS AT IOTC WORKING PARTIES

94. The SC noted with concern that the levels of participation at working group meetings in 2006 remained low despite the Commission (at S10) encouraging to all Members to facilitate as much as possible the participation of their scientists at such meetings.

95. The SC agreed that for the working parties to fully understand the dynamics and characteristics of the important fisheries, the participation of the scientists monitoring these fisheries is required. The SC noted that many such scientists are unable to attend the meetings because of a lack of funding, particularly for scientists from developing countries. The SC recommended that the Commission create a dedicated fund to assist such scientists to attend working party meetings, and requested that the Executive Secretary develop a proposal for the creation of a fund to cover the participation of up to 10 scientists at working party meetings per year and present this to the Commission at its next meeting. The EC recalled that in the fishery agreements that it signs with countries from the region, there are provisions for facilitating the attendance of national scientists to meetings of relevant RFMOs.

12. OTHER MATTERS

12.1 Technical requirements and capabilities of the IOTC Secretariat

96. Following a presentation comparing the numbers of staff and the budgets relative to the catches the SC noted that Secretariat is grossly under resourced, compared to other tuna commission secretariats having similar responsibilities, to fulfil all the tasks being required of it by the Commission. The SC agreed that for the Secretariat to be fully efficient and effect to meet the increasing needs of the Commission it requires a considerable increase in resources.

97. The SC requested that a plan to increase the resources of the Secretariat to an appropriate level over a period of no more than three years be prepared by a task force and submitted to the Commission for consideration.

12.2 Proposed workshop on predation in tuna longline fisheries

98. Japan informed the SC about plans for a workshop on the predation in tuna longline fisheries to discuss the results and implications of the five year predation survey on tuna longline fisheries (IOTC-2006-SC-INF14). The SC noted that a two day workshop is planned to coincide the 9th session of the WPTT in 2007.

99. Seychelles informed the SC about a study on predation relating to its semi-industrial long line fishery that is to take place in November 2006. Seychelles indicated that the results of this work, especially mitigation measures, will be presented at the above workshop and the data will be provided to the Secretariat.

100. China also informed the SC that they will provide the information on predation collected by observers on Chinese longliners to the Secretariat.

101. The SC encouraged scientists with experience in predation research to contribute data and attend the workshop.

12.3 Website related activities (intersessional interface / ocean climate page / photo gallery)

102. The Chairperson the WPTT informed the SC about the creation of web tools that facilitate information exchange and discussions. The SC recalled that such a facility was highly effective in the work of the WPTT prior to the latest meeting and encouraged other WP’s also take this approach to progress their work intersessionally.

103. The SC was informed that a range of high resolution oceanographic data is now available for consideration in the stock assessments for IOTC species. The SC recommended that the raw data be made available to scientists and several maps and oceanographic indicators be illustrated on the IOTC website.

104. The SC was informed about a collection of photographs relating to tuna fisheries located at www.halios.net that is available on request. The SC thanked Michel Goujon for this facility.

12.4 Observer programmes

105. Recognising that observer programmes are a major undertaking, but they are essential to validate logbook data and collect information that is not recorded on logbooks, the SC recommended that countries conducting observer programmes present a report to the next meeting of the WPEB on the data collected and the levels of coverage.

106. The SC also agreed that a central observer database would be best handled by the IOTC Secretariat, as soon as additional resources are provided to the Secretariat.

12.5 IOTC tuna atlas

107. The SC reiterated its support for an IOTC Atlas and encouraged interested parties to progress this initiative. A series of maps at various temporal resolutions will be soon accessible at the IOTC website, thanks to a contribution of Alain Fonteneau.

11.6 Time and place for the next session of the Scientific Committee

108. The Scientific Committee recommended that its Tenth Session be held in November 2007 and asked the Commission to consider holding its annual session not more than three months after this time in order to be able to receive the most up-to-date advice and implement management measures in a timely fashion.

13. ELECTION OF THE CHAIRPERSON OF THE SCIENTIFIC COMMITTEE FOR NEXT BIENNIUM

109. The SC unanimously elected Dr. Francis Marsac (EC) as Chairperson and Dr Tom Nishida (Japan) was elected as Vice-Chairperson for the next biennium.

14. ADOPTION OF THE REPORT

110. The Report of the Eighth Session of the Scientific Committee was adopted on Friday 10 November 2006.

111. The SC thanked the caretaker Chairperson, Dr. Francis Marsac (France) for his expert guidance and considerable contribution to the success of the ninth session of the SC.

APPENDIX I

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APPENDIX II
SC9 AGENDA

1. OPENING OF THE SESSION
2. ELECTION OF THE CHAIRPERSON FOR THE 9TH SESSION OF THE SCIENTIFIC COMMITTEE
3. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION
4. ADMISSION OF OBSERVERS
5. DATA COLLECTION AND STATISTICS
6. PRESENTATION OF NATIONAL REPORTS
7. STATUS OF TUNA AND TUNA-LIKE RESOURCES IN THE INDIAN OCEAN
    - 7.1 Report of the Working Party on Tropical Tunas (IOTC-2006-WPTT-R)
        - *7.1.1 Executive Summary of the status of the bigeye tuna resource (stock assessment updated in 2006).*
        - *7.1.2 Executive Summary of the status of the yellowfin tuna resource.*
        - *7.1.3 Executive Summary of the status of the skipjack tuna resource.*
    - 7.2 Report of the Working Party on Billfish (IOTC-2006-WPB-R)
        - *7.2.1 Executive Summary of the status of the swordfish resource (stock assessment updated in 2006)*
    - 7.3 Other species
        - *7.3.1 Executive Summary of the status of the albacore tuna resource.*
        - *7.3.2 Executive Summaries of the status of neritic tunas.*
        - *7.3.3 Report on biology, stock status and management of southern bluefin tuna (from CCSBT)*
8. STATUS OF SPECIES TAKEN AS BYCATCH IN INDIAN OCEAN TUNA FISHERIES
    - 8.1 Report of the Working Party on Bycatch (IOTC-2006-WPBy-R)
    - 8.2 Discussion on the integration of ecosystem considerations into IOTC management measures
9. ACTIVITIES IN RELATION WITH THE INDIAN OCEAN TUNA TAGGING PROGRAMME (IOTTP)
    - 9.1 RTTP-IO (the large-scale project)
    - 9.2 Report on recent activities related to the IOTTP (small-scale projects)
    - 9.3 Progress Report on FADIO activities
10. RELATIONSHIPS WITH OTHER REGIONAL BODIES AND PROJECTS
11. SCHEDULE OF WORKING PARTY MEETINGS IN 2007-2008
12. IDENTIFICATION OF MEASURES TO INCREASE THE PARTICIPATION OF NATIONAL SCIENTISTS AT IOTC WORKING PARTIES
13. OTHER MATTERS
    - 13.1 Technical requirements and capabilities of the IOTC Secretariat
    - 13.2 Proposed workshop on predation in tuna longline fisheries
    - 13.3 Website related activities (intercessional interface / ocean climate page / photo gallery)
    - 13.4 Time and place for the next session of the Scientific Committee
14. ELECTION OF THE CHAIRPERSON OF THE SCIENTIFIC COMMITTEE FOR NEXT BIENNIUM
15. ADOPTION OF THE REPORT

APPENDIX III
LIST OF DOCUMENTS

Reference / Référence	Title / Titre
IOTC-2006-SC-01	[E] Draft agenda for the Scientific Committee - 2006 [F] Ordre du jour prévisionnel de la Comité scientifique - 2006
IOTC-2006-SC-02	[E + F] List of documents / Liste des documents
IOTC-2006-SC-03	[E] Executive summary of the status of the Indian Ocean swordfish resource [F] Résumé sur l'état de la ressource d'espadon dans l'océan Indien
IOTC-2006-SC-04	[E] Executive summary of the status of the skipjack tuna resource [F] Synthèse sur l'état de la ressource de listao
IOTC-2006-SC-05	[E] Executive summary of the status of the bigeye tuna resource [F] Synthèse sur l'état de la ressource de patudo
IOTC-2006-SC-06	[E] Executive summary of the status of the yellowfin tuna resource [F] Synthèse sur l'état de la ressource d'albacore
IOTC-2006-SC-07	[E] Executive summary of the status of the albacore tuna resource [F] Synthèse sur l'état de la ressource de germon
IOTC-2006-SC-08	[E] Progress Report on the IOTC-OFCF Project to improve statistical systems in Indian Ocean coastal countries [F] État d'avancement du projet CTOI-OFCF d'amélioration des systèmes statistiques dans les pays riverains de l'océan Indien
IOTC-2006-SC-09	[E] Draft Executive Summary on the status of the Spanish mackerel resource [F] Projet Synthèse sur l'état de la ressource du thazard rayé
IOTC-2006-SC-10	[E] Draft Executive Summary on the status of the kawakawa resource [F] Projet Synthèse sur l'état de la ressource de la thonine orientale
IOTC-2006-SC-11	[E] Draft Executive Summary on the status of the bullet tuna resource [F] Projet Synthèse sur l'état de la ressource du bonitou
IOTC-2006-SC-12	[E] Draft Executive Summary on the status of the wahoo tuna resource [F] Projet Synthèse sur l'état de la ressource du thazard-bâtard
IOTC-2006-SC-13	[E] Draft Executive Summary on the status of the longtail tuna resource [F] Projet Synthèse sur l'état de la ressource du thon mignon
IOTC-2006-SC-14	[E] Draft Executive Summary on the status of the frigate tuna resource [F] Projet Synthèse sur l'état de la ressource de l'auxide
IOTC-2006-SC-15	[E] Draft Executive Summary on the status of the Indo-Pacific King Mackerel resource [F] Projet Synthèse sur l'état de la ressource du thazard ponctué
IOTC-2006-WPB-R	[E] Report of the Fifth Session of the IOTC Working Party on Billfish [F] Rapport de la cinquième session du groupe de travail de la CTOI sur les poissons porte-épée
IOTC-2006-WPBy-R	[E] Report of the Second Session of the IOTC Working Party on Bycatch [F] Rapport de la deuxième session du groupe de travail de la CTOI Sur les prises accessoires.
IOTC-2006-WPTT-R	[E] Report of the Eighth Session of the IOTC Working Party on Tropical Tunas. [F] Rapport de la huitième session du Groupe de travail de la CTOI sur les thons tropicaux.
Information papers	
IOTC-2006-SC-INF01	Report on IOTC data collection and statistics
IOTC-2006-SC-INF02	CCSBT Report on biology, stock status and management of southern bluefin tuna
IOTC-2006-SC-INF03	Seychelles National Report
IOTC-2006-SC-INF04	CAPPES: CAPturabilité des grands PElagiques exploités à la Palangre dérivante dans la Zone Economique Exclusive des Seychelles – *C. Gamblin, V. Lucas, J. Dorizo, and P. Bach*
IOTC-2006-SC-INF05	An overview of the South West Indian Ocean Fisheries Project (SWIOFP). *F. Marsac, J. C. Groeneveld, R. P. van der Elst, A. P. Baloi, K. I. Katonda, R. K. Ruwa and W. L. Lane*
IOTC-2006-SC-INF06	An overview of the REMIGE project by *H. Weimerskirch and F. Marsac*
IOTC-2006-SC-INF07	National Report of EU Spain
IOTC-2006-SC-INF08	National Report of Japan
IOTC-2006-SC-INF09	National Report of Korea
IOTC-2006-SC-INF10	Seabird bycatch rates in swordfish longline fisheries worldwide
IOTC-2006-SC-INF11	Compilation of information on neritic tuna species in the Indian Ocean – a working paper
IOTC-2006-SC-INF12	National Report of the United Kingdom
IOTC-2006-SC-INF13	Report of Fisheries Management Course in 2005 (FRMC 2005). *T. Nishida T. and K. Uchida*
IOTC-2006-SC-INF14	Workshop on the predation in tuna longline fisheries. Japan
IOTC-2006-SC-INF15	Russian tuna research in 2006. *S. Leontiev and E. Feoktistov*
IOTC-2006-SC-INF16	National Report of China
IOTC-2006-SC-INF17	National Report of Australia
IOTC-2006-SC-INF18	National Report of Sri Lanka
IOTC-2006-SC-INF19	National Report of Thailand
IOTC-2006-SC-INF20	National Report of EU France
IOTC-2006-SC-INF21	National Report of India
IOTC-2006-SC-INF22	Report of the Methodological Workshop on the Management of Tuna Fishing Capacity: Stock Status, Data Envelopment Analysis, Industry Surveys and Management Options. La Jolla, CA, USA, 8-12 May 2006. FAO
IOTC-2006-SC-INF23	*not used*
IOTC-2006-SC-INF24	Small scale tuna tagging undertaken from Lakshadweep, India during 2005-06: A preliminary report. *S. Varghese, M.E. John, V.S. Somvanshi and Sijo P. Varghese.*

APPENDIX IV
AVAILABILITY OF IOTC STATISTICS FOR THE YEAR 2005
Excerpt from IOTC-2006-SC-INF01

Table 1. Proportion of the NC, CE and SF statistics available at the IOTC Secretariat compared to the total catches estimated for 2005 (as of 10th October 2006) and proportion of catches available from the flag country (SO) *versus* total catches so far available.

Statistics available for 2005	Estim. Catch	NC		CE		SF	
		BD	SC	BD	SC	BD	SC
IOTC species 1000t	1480	640	870	490	640	430	470
%Available for 2005		**43**	**58**	**33**	**43**	**29**	**32**
%Available for 2004		61	63	44	46	55	56
Tropical tunas 1000t	1100	560	765	450	590	420	460
Temperate tunas 1000t	**32**	**22**	**22**	**16**	**16**	**3**	**3**
Billfish 1000t	**60**	**25**	**27**	**12**	**13**	**6**	**7**
Neritic tunas 1000t	**290**	**30**	**55**	**17**	**17**	**0.5**	**0.5**

Estim. Catch: Total catches estimated
NC: Amount of catch available
CE: Amount of catch for which catches and effort are available
SF: Amount of catch for which size frequency data are available
SO: Amount of catch available from the flag countries
Available before the deadline for data submission (**BD**, 30th June) and at the time of the Scientific Committee Meeting (**SC**)

Table 2: Availability of IOTC statistics for the year 2005

Key Tables 2i - 2iv

Gear	Industrial purse seine (**PS**), industrial longline (**LL**) and artisanal gears (**ART**)	**NC** / **CE** / **SF**	Nominal Catch / Catch and Effort / Size Frequency — [green] Fully available; [peach] Partially available; [red] Not available
Catch	Recent catches amounting to (thousands of tonnes)		
TI	Timeliness — [blue] Good (before 1st July); [light cyan] Fair (whithin July); [yellow] Poor (after 1st August)	**SO**	Data Source — [blue] Statistics fully available from flag country; [light cyan] Statistics partially available from flag country; [yellow] Statistics fully available from countries other than flag country; [white] No statistics available at all

2i – Tropical tunas (YFT, BET, SKJ)

Gear	Fleet	Catch	Sps	NC	CE	SF	TI	SO	Comments
PS	EUROPEAN COMMUNITY	298.0	SY	Fully	Partially	Fully	Good	Fully (flag)	Effort from supply vessels not available
	SEYCHELLES	87.3	SY	Fully	Partially	Fully	Good	Fully (flag)	Effort from supply vessels not available
	IRAN I R	11.0	YS	Not	Not	Not	Poor	None	
	THAILAND	11.9	SY	Fully	Partially	Not	Fair	Fully (flag)	CE not available per 1 degree square grid
	JAPAN	4.1	SY	Fully	Fully	Not	Good	Fully (flag)	
	AUSTRALIA	0.0	S	Fully	Partially	Not	Good	Fully (flag)	CE not available for some grids (confidentiality)
	NEI	28.8	SY	Not	Not	Not	Poor	None	The ex-Soviet fleet is using the Thai flag since October 2005
LL	CHINA	13.1	BY	Fully	Fully	Partially	Fair	Fully (flag)	SF data from observers (September-December 2005)
	TAIWAN,CHINA	107.9	YB	Fully	Not	Partially	Good	Partially (flag)	SF only available for some fresh-tuna longliners (IOTC/OFCF)
	JAPAN	27.1	YB	Partially	Partially	Not	Good	Fully (flag)	Preliminary catches (not raised)
	INDONESIA	22.7	Y	Fully	Partially	Partially	Good	Fully (flag)	CE and SF not available per 5 degrees area
	SEYCHELLES	12.8	YB	Fully	Fully	Partially	Good	Fully (flag)	SF not available for the industrial longline fleet
	KOREA REP	5.8	YB	Fully	Fully	Partially	Fair	Fully (flag)	SF not available per 5 degrees area
	PHILIPPINES	4.5	YB	Fully	Partially	Not	Good	Fully (flag)	CE not available per 5 degrees area
	MALAYSIA	2.9	Y	Fully	Partially	Not	Good	Fully (flag)	CE not available per 5 degrees area
	EUROPEAN COMMUNITY	1.7	BY	Partially	Partially	Not	Good	Fully (flag)	NC and CE not available for all EC flags
	IRAN I R	0.8	Y	Not	Not	Not	Poor	None	
	BELIZE	0.3	YB	Fully	Partially	Not	Good	Fully (flag)	CE inconsistent (size of squares)
	OMAN	0.2	YB	Not	Not	Not	Poor	None	
	SOUTH AFRICA	0.1	BY	Fully	Fully	Fully	Poor	Fully (flag)	
	THAILAND	0.1	BY	Fully	Partially	Not	Fair	Fully (flag)	CE not available per 5 degrees area
	AUSTRALIA	0.1	YB	Fully	Partially	Partially	Good	Fully (flag)	CE not available for some grids (confidentiality); SF not per area
	MAURITIUS	0.1	YB	Not	Not	Not	Poor	None	
	KENYA	0.0	B	Not	Not	Not	Poor	None	
	GUINEA	0.0	Y	Fully	Partially	Not	Good	Fully (flag)	CE not available per 5 degrees area and month
	FRANCE-TERRITORIES	0.0	Y	Not	Not	Not	Poor	None	
	INDIA	0.0	Y	Not	Not	Not	Poor	None	
	SENEGAL	0.0	Y	Fully	Partially	Not	Good	Fully (flag)	CE not available per 5 degrees area and month
	NEI-FROZEN[1]	6.1	YB	Not	Not	Not	Poor	None	
	NEI-FRESH[2]	4.1	BY	Partially	Partially	Partially	Good	Other countries	Data partially available from IOTC/OFCF sampling schemes
Artisanal	MALDIVES	153.8	SY	Fully	Partially	Not	Poor	Fully (flag)	CE not available per 5 degrees area
	IRAN I R	93.3	SY	Not	Not	Not	Poor	None	
	SRI LANKA	81.3	SY	Partially	Partially	Partially	Poor	Partially (flag)	Data partially available from IOTC/OFCF sampling schemes
	INDONESIA	54.8	SY	Not	Not	Not	Poor	None	
	YEMEN AR RP	31.3	Y	Not	Not	Not	Poor	None	
	OMAN	16.0	Y	Fully	Not	Not	Fair	Fully (flag)	
	COMOROS	9.1	YS	Not	Not	Not	Poor	None	
	PAKISTAN	6.3	SY	Not	Not	Not	Poor	None	
	INDIA	5.9	SY	Not	Not	Not	Poor	None	
	FRANCE-TERRITORIES	0.9	SY	Not	Not	Not	Poor	None	
	TANZANIA	0.7	Y	Not	Not	Not	Poor	None	
	EUROPEAN COMMUNITY	0.4	Y	Fully	Fully	Not	Good	Fully (flag)	
	MAURITIUS	0.1	Y	Not	Not	Not	Poor	None	
	KENYA	0.1	Y	Not	Not	Not	Poor	None	
	JORDAN	0.0	s	Not	Not	Not	Poor	None	
	UK-TERRITORIES	0.0	Y	Fully	Not	Not	Good	Fully (flag)	
	SEYCHELLES	0.0	Y	Fully	Fully	Not	Good	Fully (flag)	
	AUSTRALIA	0.0	S	Fully	Partially	Not	Good	Fully (flag)	CE not available for some grids (confidentiality)
	EAST TIMOR	0.0	Y	Not	Not	Not	Poor	None	
	SOUTH AFRICA	0.0	Y	Fully	Fully	Not	Good	Fully (flag)	

Sps Yellowfin tuna (**Y**), bigeye tuna (**B**) and skipjack tuna (**S**)

1 Bolivia, Cambodia, Equatorial Guinea, Georgia, Iceland, Mongolia, Namibia, St. Vincent and the Grenadines and Togo

2 Indonesian vessels operating in countries other than Indonesia

2ii – Temperate tunas (ALB, SBF)

Gear	Fleet	Availability of statistics: Catch	Sps	NC	CE	SF	TI	SO	Comments
PS	AUSTRALIA	5.3	S						CE and SF not available for some grids (confidentiality)
	EUROPEAN COMMUNITY	0.1	A						Effort from supply vessels not available
	SEYCHELLES	0.0	A						Effort from supply vessels not available
	IRAN I R	0.0	A						
LL	CHINA	0.1	A						
	TAIWAN,CHINA	10.4	A						SF only available for some fresh-tuna longliners (IOTC/OFCF)
	JAPAN	9.1	SA						Preliminary catches (not raised)
	INDONESIA	4.6	AS						CE and SF not available per 5 degrees area
	EUROPEAN COMMUNITY	0.8	A						NC and CE not available for all EC flags
	BELIZE	0.7	A						CE inconsistent (size of squares)
	KOREA REP	0.2	A						
	THAILAND	0.1	A						CE not available per 5 degrees area
	SEYCHELLES	0.1	A						
	MAURITIUS	0.0	A						
	PHILIPPINES	0.0	A						CE not available per 5 degrees area
	MALAYSIA	0.0	A						CE not available per 5 degrees area
	AUSTRALIA	0.0	A						CE not available for some grids (confidentiality)
	SOUTH AFRICA	0.0	A						
	KENYA	0.0	A						
	OMAN	0.0	A						
	NEI-FROZEN[1]	0.6	A						
	NEI-FRESH[2]	0.2	A						Data partially available from IOTC/OFCF sampling schemes
ART	EUROPEAN COMMUNITY	0.1	A						
	AUSTRALIA	0.0	A						CE not available for some grids (confidentiality)
	FRANCE-TERRITORIES	0.0	A						

Sps Southern bluefin tuna (**S**) and albacore (**A**)
1 Bolivia, Cambodia, Equatorial Guinea, Georgia, Iceland, Namibia, St. Vincent and the Grenadines and Togo
2 Indonesian vessels operating in countries other than Indonesia

2iii – Billfish (SWO, MARL, SFA, SSP)

Gear	Fleet	Availability of statistics: Catch	Sps	NC	CE	SF	TI	SO	Comments
LL	CHINA	0.9	S						
	TAIWAN,CHINA	13.5	SM						SF only available for some fresh-tuna longliners (IOTC/OFCF)
	EUROPEAN COMMUNITY	7.2	S						NC, CE and SF not available for all EC flags
	INDONESIA	3.8	SM						CE and SF not available per 5 degrees area
	JAPAN	2.1	SM						Preliminary catches (not raised)
	SEYCHELLES	1.3	S						No SF for the industrial longline fleet
	GUINEA	0.8	S						CE not available per 5 degrees area and month
	MAURITIUS	0.7	S						
	KOREA REP	0.6	SM						SF not available per 5 degrees area
	MALAYSIA	0.4	SF						CE not available per 5 degrees area
	KENYA	0.3	S						
	AUSTRALIA	0.3	S						CE not available for some grids (confidentiality); SF not per area
	SOUTH AFRICA	0.2	S						
	SENEGAL	0.1	S						CE not available per 5 degrees area and month
	PHILIPPINES	0.1	S						CE not available per 5 degrees area
	BELIZE	0.1	S						CE inconsistent (size of squares)
	IRAN I R	0.1	S						
	THAILAND	0.0	MS						CE not available per 5 degrees area
	OMAN	0.0	MS						
	FRANCE-TERRITORIES	0.0	S						
	INDIA	0.0	S						
	NEI-FROZEN[1]	3.6	MS						
	NEI-FRESH[2]	0.2	S						Data partially available from IOTC/OFCF sampling schemes
Artisanal	IRAN I R	12.1	F						
	SRI LANKA	4.2	FM						Data partially available from IOTC/OFCF sampling schemes
	INDIA	4.1							
	PAKISTAN	1.0							
	INDONESIA	0.8							
	TANZANIA	0.6							
	COMOROS	0.4	F						
	MAURITIUS	0.3							
	KENYA	0.2	F						
	OMAN	0.2	F						
	UN ARAB EMIRATES	0.1							
	EUROPEAN COMMUNITY	0.0	S						
	SAUDI ARABIA	0.0	F						
	FRANCE-TERRITORIES	0.0	F						
	SEYCHELLES	0.0	F						CE not available per 5 degrees area
	UK-TERRITORIES	0.0	M						
	AUSTRALIA	0.0	S						CE not available for some grids (confidentiality)

Sps Swordfish (**S**), blue marlin and/or black marlin and/or striped marlin (**M**), Indo-Pacific sailfish (**F**) and short-billed spearfish (**P**)
1 Bolivia, Cambodia, Equatorial Guinea, Georgia, Iceland, Mongolia, Namibia, St. Vincent and the Grenadines and Togo
2 Indonesian vessels operating in countries other than Indonesia

2iv – Neritic tunas (FRZ, LOT, KAW, COM, GUT, STS, WAH)

Gear	Fleet	Availability of statistics					TI	SO	Comments
		Catch	Sps	NC	CE	SF			
PS	IRAN I R	1.5	L						
	EUROPEAN COMMUNITY	0.4	F						Statistics incomplete
	SEYCHELLES	0.2	F						Statistics incomplete
	NEI	4.2	L						
LL	INDONESIA	0.1	W						CE and SF not available per 5 degrees area
	CHINA TAIWAN,CHINA	0.0	W						Statistics incomplete
	EUROPEAN COMMUNITY	0.0	W						NC and CE not available for all EC flags
	AUSTRALIA	0.0	W						
	FRANCE-TERRITORIES	0.0	W						
	OMAN	0.0	W						
	BELIZE	0.0	W						CE inconsistent (size of squares)
	KENYA	0.0	W						
	NEI-FROZEN[1]	0.0	W						
	NEI-FRESH[2]	0.0	W						Data partially available from IOTC/OFCF sampling schemes
Artisanal	INDIA	76.0	CK						
	INDONESIA	46.9	CG						
	IRAN I R	42.5	LK						
	THAILAND	17.0	K						NC and CE not fully available per species
	PAKISTAN	15.3	CL						
	MALAYSIA	14.5	KL						NC and CE not fully available per species
	OMAN	12.5	LC						
	MADAGASCAR	12.0	C						
	YEMEN AR RP	10.2	LK						
	UN ARAB EMIRATES	8.4	CL						
	MALDIVES	7.8	FK						
	SAUDI ARABIA	6.4	C						
	SRI LANKA	5.8	CF						Data partially available from IOTC/OFCF sampling schemes
	EGYPT	5.3	C						
	KENYA	1.2	C						
	QATAR	1.0	C						
	COMOROS	0.7	K						
	TANZANIA	0.5							
	AUSTRALIA	0.3	C						CE not available for some grids (confidentiality)
	KUWAIT	0.2	G						
	ERITREA	0.1	C						
	SEYCHELLES	0.1	K						CE not available per 5 degrees area
	FRANCE-TERRITORIES	0.1	W						
	EUROPEAN COMMUNITY	0.1	W						
	BANGLADESH	0.1							
	DJIBOUTI	0.1							
	BAHRAIN	0.1	C						
	JORDAN	0.0	K						
	SUDAN	0.0	C						
	SOUTH AFRICA	0.0	G						
	UK-TERRITORIES	0.0	K						

Sps	Longtail tuna (**L**), frigate tuna and/or bullet tuna (**F**), kawakawa (**K**), narrow-barred Spanish mackerel (**C**), Indo-Pacific king mackerel (**G**), streaked seerfish (**S**) and wahoo (**W**)
1	Bolivia, Cambodia, Equatorial Guinea, Georgia, Iceland, Namibia, St. Vincent and the Grenadines and Togo
2	Indonesian vessels operating in countries other than Indonesia

APPENDIX V

LOGBOOK TEMPLATE

DEPART / SALIDA / DEPARTURE	ARRIVEE / LLEGADA / ARRIVAL	NAVIRE / BARCO / VESSEL	PATRON / PATRON / MASTER	FEUILLE HOJA / SHEET N°
PORT / PUERTO / PORT DATE / FECHA / DATE HEURE / HORA / HOUR LOCH / CORREDERA / LOCH	PORT / PUERTO / PORT DATE / FECHA / DATE HEURE / HORA / HOUR LOCH / CORREDERA / LOCH			

		CALEE LANCE SET				CAPTURE ESTIMEE ESTIMACION DE LA CAPTURA ESTIMATED CATCH												ASSOCIATION ASSOCIACION ASSOCIATION						COMMENTAIRES OBSERVATIONES COMMENTS		COURANT CORRIENTE CURRENT	
DATE FECHA DATE	POSITION (chaque calée ou midi) POSICION (cada lance o mediadia) POSITION (each set or midday)	Portant / Positivo / Successful	Nul / Nulo / Nil	Heure / Hora / Time préciser/especificar/specify TU+	N° Cuve / Cuba / Well	1 ALBACORE RABIL YELLOWFIN		2 LISTAO LISTADO SKIPJACK		3 PATUDO PATUDO BIGEYE		AUTRE ESPECE préciser le/les nom(s) OTRA ESPECIE dar el/los nombre(s) OTHER SPECIES give name(s)			REJETS préciser le/les nom(s) DESCARTES dar el/los nombre(s) DISCARDS give name(s)			Banc libre/Banco libre/Free school	Epave / Objeto / Log **N** (naturelle/natural), **A** (artificielle/artificial)	Bateau d'assistance Barco de appoyo / Supply	Balise / Baliza / Beacon	Requin Baleine Tiburon Ballena / Shark Wale	Baleine / Ballena / Whale	Route/Recherche, problèmes divers, type d'épave (naturelle/artificielle, balisée, bateau), prise accessoire, taille du banc, autres associations, … Ruta/Busca, problemas varios, tipo de objeto (natural/artificial, con baliza, barco), captura accesoria, talla del banco, otras asociaciones, … Steaming/Searching, miscellaneous problems, log type (natural/artificial, with radio beacon, vessel), by catch, school size, other associations, …	T° Mer / Mar / Sea	Direction / Direccion / Direction Degrés / Grados / Degree	Vitesse / Velocidad / Speed Nœuds / Nudos / Knots
						Taille Talla Size	Capture Captura Catch	Taille Talla Size	Capture Captura Catch	Taille Talla Size	Capture Captura Catch	Nom Nombre Name	Taille Talla Size	Capture Captura Catch	Nom Nombre Name	Taille Talla Size	Capture Captura Catch										
Une calée par ligne / Uno lance cada línea / One set by line																											

Instructions for filling the logbook form (EU purse seine and baitboats template)
Notice explicative pour utiliser la fiche de pêche (senneurs et canneurs, modèle UE)

EN-TÊTE / CABECERA / HEADING

DEPART / SALIDA / DEPARTURE

- ✓ Port / Puerto / Port
- ✓ Date / Fecha / Date
- ✓ Heure / Hora / Hour
- ✓ Loch / Corredera / Loch

ARRIVEE / LLEGADA / ARRIVAL

- ✓ Port / Puerto / Port
- ✓ Date / Fecha / Date
- ✓ Heure / Hora / Hour
- ✓ Loch / Corredera / Loch

NAVIRE / BARCO / VESSEL

PATRON / PATRON / MASTER

FEUILLE / HOJA / SHEET N°

Remplir l'information correspondante au départ et au retour. Le loch au départ et au retour permettent d'estimer la distance parcourue par le navire pendant sa marée, et donc indirectement la surface prospectée. Les feuilles seront numérotées de 1 à n pour chaque marée.

Fill in the corresponding information at departure and arrival of the boat. Loch at departure and arrival allows to estimate the distance run during the trip, and indirectly the prospected surface. Sheets will be numbered from 1 and following for each trip.

DONNÉES SUR LA PÊCHE / DATOS SOBRE LA PESCA / FISHING DATA

Toute les informations concernant les activités, captures, incidents, … qui se sont produits pendant la marée doivent être reportées aussi précisément que possible.

All information regarding activities, catches, incidents, …which occurred during the trip should be reported as precisely as possible.

DATE/FECHA/DATE

Remplir au moins une ligne par jour, même s'il n'y a pas eu d'activité de pêche (cape, avarie, …).

Fill in at least one line by day, even in case of no fishing activities.

POSITION (chaque calée ou midi)/POSICION (cada lance o mediadia)/POSITION (each set or midday)

Utiliser une ligne différente pour chaque calée (y compris les calées nulles), et noter la position de cette calée. S'il n'y a pas eu de pêche, noter la position aux environs de midi. Si nécessaire, les informations sur la calée peuvent utiliser plusieurs lignes sans changer les informations générales (date, position, …).

Use one line for each set (including negative ones), and note its position. If no set have been made, note the position around midday. If necessary, information for one set can use several lines, without changing the general information (date and position).

CALEE /LANCE .SET

- ✓ Portant / Positivo / Successful
- ✓ Nul / Nulo / Nil

Cocher la case correspondante selon que le coup est nul ou portant.

Tick the corresponding column according that the set was positive or not.

- ✓ Heure / Hora / Time : Préciser / Especificar / Specify (TU+ ?)

Mettre l'heure de début de la calée ; préciser le cas échéant l'heure utilisée par le bord (TU+ ??).

Indicate the time at the beginning of the set ; if necessaty, precise the time used on board (TU+ ??).

- ✓ N° Cuve / Cuba / Well

Indiquer le numéro de la/les cuve(s) où la capture sera stockée.

Indicates the well number where the catch will be stored.

CAPTURE ESTIMEE / ESTIMACION DE LA CAPTURA / ESTIMATED CATCH

- ✓ ALBACORE / RABIL / YELLOWFIN
  - Taille / Talla / Size
  - Capture / Captura / Catch
- ✓ LISTAO / LISTADO / SKIPJACK
  - Taille / Talla / Size
  - Capture / Captura / Catch

- ✓ PATUDO / PATUDO / BIGEYE
    - Taille / Talla / Size
    - Capture / Captura / Catch

Pour chacune des principales espèces de thons mentionnées, indiquer la capture estimée ainsi que la taille/poids moyen ou la gamme de taille/poids des poissons (par exemple 5-15 kg, 10kg, >30 kg, …). Si la distinction entre espèces n'est pas connue, remplir à cheval sur les 3 colonnes.

For each of the main tuna species indicated, note the estimated catch as well as the average size/weight or size/weight range (for example, 5-15 kg, 10 kg, > 30 kg, …). In case you cannot separate species, fill in on the 3 columns.

- ✓ AUTRE ESPECE (préciser le/les nom(s))//OTRA ESPECIE (dar el/los nombre(s))/OTHER SPECIES (give name(s))
    - Nom / Nombre / Name
    - Taille / Talla / Size
    - Capture / Captura / Catch

Remplir comme pour les espèces de thons, en précisant en plus le/les nom(s) de/des espèce(s) pêchées.

Fill in as for tuna species, indicating also the name(s) of the fished species.

- ✓ REJETS (préciser le/les nom(s))/DESCARTES (dar el/los nombre(s))/DISCARDS (give name(s))
    - Nom / Nombre / Name
    - Taille / Talla / Size
    - Capture / Captura / Catch

Remplir comme pour les espèces de thons, en précisant en plus le/les nom(s) de/des espèce(s) rejetées.

Fill in as for tuna species, indicating also the name(s) of the discarded species.

ASSOCIATION / ASSOCIACION / ASSOCIATION

- ✓ Banc libre/Banco libre/Free school
- ✓ Epave / Objeto / Log : N (naturelle/natural), A (artificielle/artificial)
- ✓ Bateau d'assistance / Barco de appoyo / Supply
- ✓ Balise / Baliza / Beacon
- ✓ Requin Baleine / Tiburon Ballena / Shark Wale
- ✓ Baleine / Ballena / Whale

Cocher la colonne correspondant au type d'association observé. Pour une pêche sur épave, préciser si elle est naturelle (N) ou artificielle (A), ainsi que si elle a ou non une balise. Indiquer également si on a travaillé en association avec un bateau d'assistance. Plusieurs associations sont bien sur possibles, et on peut signaler d'autres associations dans la rubrique « Commentaires »..

Tick the case corresponding to the association type observed. For log sets, indicates if the log is natural (N) or artificial (A), as well as if there bear or not a beacon. Indicates also if fishing was done in association with a supply. Of course, several associations are possible, and others than indicated may be mentioned in the "Comments" field.

COMMENTAIRES / OBSERVATIONES / COMMENTS

Route/Recherche, problèmes divers, type d'épave (naturelle ou artificielle, balisée, bateau), prise accessoire, taille du banc, autres associations, …

Steaming/Searching, miscellaneous problems, log type (natural or artificial, with radio beacon, vessel), by catch, school size, other associations,

T° Mer / Mar / Sea

Indiquer la température de la mer (au 1/10 de degré) si elle est disponible.

Indicates the sea surface temperature (1/10 degree) if known.

COURANT / CORRIENTE / CURRENT

Direction / Direccion / Direction (Degrés / Grados / Degree)

Vitesse / Velocidad / Speed (Nœuds / Nudos / Knots)

Indiquer la vitesse et la direction du courant si disponible.

Indicates the current speed and direction if known.

APPENDIX VI
NATIONAL REPORT ABSTRACTS

AUSTRALIA

Document IOTC-2006-SC-INF17. Pelagic longline and purse seine are the two main fishing methods used by Australian vessels to target tuna and billfish in the IOTC area. In 2005, Australian longliners caught 301 t of broadbill swordfish, 36 t of yellowfin tuna and 31 t of bigeye tuna. These catches are significantly less than 20% of peak catches taken in 2001 and 2002. The number of active longliners and levels of fishing effort have declined significantly due to reduced profitability, caused by lower fish prices and high costs. Only six longline vessels fished in 2005, compared with 13 in 2004 and 45 in 2001. The purse seine fishery caught 5,210 t of southern bluefin tuna in 2005 but insignificant amounts of skipjack tuna. In 2002, 1144 t of skipjack tuna were caught by purse seine.

CHINA

Document IOTC-2006-SC-INF16. Longlining is the only fishing method used by Chinese vessels to catch tuna and tuna-like species in the IOTC waters. The number of longliners operating in the Indian Ocean has decreased from 120 vessels in 1998 to 67 vessels in 2005. The number of large scale deep frozen longliners has increased from 16 vessels in 2003 to 38 in 2005. In 2005, fishing was concentrated in the area 40-85ºE, 25ºN-25ºS while some of deep frozen longliners obtained seasonal licences to fish in the EEZ’s of Pakistan and Tanzania. The total nominal catch of tuna and tuna-like species in the IOTC waters in 2005 was 14,307 t (round weight). This represented a 7.38 % increase from 2004. The catch of bigeye tuna increased from 8, 321 t in 2004 to 8,867 t in 2005; similarly catches of yellowfin tuna increased from 3,781 t to 4,259 t. The catch of other species including swordfish and albacore was 1,181 t. Shanghai Fisheries University has been responsible for the programmes of the training and data collection and compilation of the Indian Ocean tuna fishery statistics with the cooperation of the Branch of Distant Water Fisheries of China Fisheries Association.

Chinese authorities will continue to strengthen the management its tuna fisheries by: implementation of a fishing license system; requiring regular monthly reporting by fishing companies; continuing the national tuna observer programme in three oceans (one observer will be dispatched on board the fresh tuna longliners in the Indian Ocean in August 2006); installation of VMS on all the large scale tuna longliners starting from 1st October 2006; strengthening relationships with nations who are willing to provide access to Chinese tuna boats; encouraging scientists to conduct research on the incidental catch of sea turtles and sea birds; requesting fishing companies to report incidental catches of sea turtles and sea birds; implementing a logbook system (which will be a prerequisite for the renewal of fishing licenses); improving the data reporting system and submitting fisheries statistics to regional tuna fisheries management organizations as required. In addition, China will strictly implement the measures recommended in the GOA meeting, such as limiting the number of fishing vessel and capacity,

EC-SPAIN

Document IOTC-2006-SC-INF07. Two Spanish fleets operated in the Indian Ocean in 2005: a purse seine fleet of 20 vessels targeting tropical tuna (yellowfin, skipjack and bigeye) and a longline fleet of 23 vessels targeting swordfish. The total catch by Spanish vessels in 2005 was 187,228 t, comprising: 77,519 t yellowfin, 94,312 t skipjack, 10,290 t of bigeye, 48 t albacore and 5,079 t swordfish. The purse seine catch in 2005 increased by 19% as a consequence of a major increase (by 30%) in the catch of skipjack. Tropical multi-species tuna sampling in 2005 included 1,745 samples and 307,216 fish measured. The biological sampling program (including sex ratio and maturity) in the Seychelles cannery (started in 2003) was ongoing. For the longline fleet, in 2005, 19,443 swordfish were been measured (19 % of the total landings) and sex at age for most spatio-temporal strata has been collected. Research programs are carried out in order to implement the scientific recommendations of IOTC and focus on collecting information on supply vessels and fishing on FADs. For this purpose a joint IEO-AZTI working plan has been established. To estimate the bycatch associated with the purse seine fishery, a total of 9 trips were covered by observers in the Indian Ocean in 2004, 12 trips in 2005 and 9 trips in first ten months of 2006. Opportunistic tagging of swordfish and bycatch of longline catch included 45 swordfish, 58 sharks and individuals from other by-catch species (one swordfish was recaptured). An experimental cruise by two Spanish longliners, with the permanent scientific observers from IEO was carried out during 2005 and 75 tunas (mainly bigeye) were tagged (two tagged bigeye were have been recovered). Other research was carried out in the Indian Ocean, with the participation of four Spanish fishing boats (two purse seiners and two supply vessels) to understand and decrease the impact of FAD fishing on the juveniles of non-target tuna species (yellowfin and bigeye) and reduce entanglements of turtles without reducing the catch of the target species. Preliminary results of these projects were presented to the WPBy and WPTT.

EC-FRANCE

Document IOTC-2006-SC-INF20. General Fishery Statistics. Three French fleets are operating tuna fishing activities in the Indian Ocean: purse seiners which mainly operate from the Seychelles, longliners based in Reunion, and to a lesser extent the artisanal fishery in Reunion. The total catches of tuna and tuna-like species for the French fleet in the Indian Ocean reached 110,958 t in 2005. This level is slightly superior to that of 2004 (109,113 t).

Purse seiners. Despite the arrival of an additional purse seiner, nominal fishing effort remained globally stable in 2005, concerning transportation capacity, the number of fishing and searching days and the number of squares prospected. However, the total number of sets increased (+9%), on objects (+11%) and in free schools (+8%). After a decrease in the catch between 1994 and 1998, due essentially to a decrease in the number of purse seiners, since then there has been a regular increase in the total catch, particularly marked at first and stable since 2003; the total catch reached 107,140 t in 2005. Although decreasing, the catches of yellowfin tuna remain high (57,300 t, -10%), while those of skipjack (43,200 t, +14%) and bigeye tuna (6,500 t, +11%) have notably increased. Concerning catches per fishing day, the total CPUE in 2005 remained exceptionally high for all species, although decreasing since 2003, and this is mainly due to the constantly high yield in free schools for yellowfin. The catch per positive set trends are the same, with high catches per set though decreasing on objects and free schools. Finally, like in 2003 and 2004, the most remarkable fact is that the fishery is spatially highly concentrated in a relatively small area compared to the usual average situation. Globally, the average weights remained high and stable in 2005 in relation to the period previous to 2003 (for all species and fishing gears), but they are generally inferior to the weights observed at the beginning of the fishery.

Longliners. The total number of longliners slightly increased from 30 in 2004 to 36 in 2005. Swordfish remains the target species of this fleet. After a marked decrease in the catch (between 2000 and 2002), followed by a stabilization, a slight increase in the landed weight was observed in 2004 for swordfish and the three main tuna species. In 2005, 36 longliners caught 3,441 t of tuna and tuna-like species. Between 1994 and 2004, only swordfish sizes had been monitored but since the beginning of 2005 the main species of large pelagics caught by the Reunion longline fleet have been sampled.

Artisanal fishery. The artisanal fleet represents 80 % of the Reunion fishing vessels. The fleet consists mainly of 5-7 m motorized boats and 7-12 m more powerfully motorized boats, both using mainly line fishing techniques (troll, bottom, set and drifting lines) and gillnet. The catch of large pelagics represents an important part of the catches of this fleet (around 60% in weight) and reached 618 t in 2005.

Response to the recommendations of the IOTC Scientific Committee. Most of the recommendations made by the different working parties concerning France have been or are about to be implemented; they are detailed in the EU-France National Report (IOTC-2006-SC-INF20). Among them, we can mention an observer programme onboard French purse seiners which has been implemented since October 2005, and another one should start at the beginning of 2007 onboard longliners based in Reunion.

Research programme.

IRD. Since January 2005, the IRD reconfigured its tuna research system into two structures:

A service department, OSIRIS (Observatoires et systèmes d'information des pêches tropicales[3]), was restructured and continues to carry out most of the previous "Tuna observatory" activities, concerning collection, analysis and management of resources but in a larger framework now exceeding the mere tuna framework;

A research department, THETIS, that carries out a research programme on dynamics of tropical ecosystems and tuna fisheries in the Indian Ocean, and for which the configuration of the programme was revised in 2005, including an extension of the perimeter of activities in comparison with the previous 2001-2004 programme, in order to include the behaviour of tuna around drifting FADs. For the 2005-2008 period, the topics covered by the THETIS project are: tuna gregariousness and dynamics around FADs, habitat characteristics for tuna, interactions between resources and exploitation, effects of climate and fisheries on high sea ecosystems, development of numerical ecosystem models.

New programmes launched for a period of three years on the basis of exterior fundings started in 2006:

the REMIGE project concerning the reactions of Indian Ocean top predator populations (tuna, birds, marine mammals) to worldwide climate changes;

several projects funded by the PFRP of Hawaii, conducted in collaboration with American teams (definition of new electronic tags for tuna, development of habitat models for the standardization of longline CPUE);

the OTOCAL project which examines the mechanisms of otholith formation and the use of trace elements to build up life history parameters.

The two IRD departments actively participated in the work conducted by the IOTC in its working parties and also in larger researches on high sea ecosystems. These activities are described in detail in the National Report (CTOI-2005-SC-Inf08).

IFREMER. A new system of fisheries monitoring (SIH : Système d'Information Halieutique[4]) was implemented in 2005 to improve the quality of statistical data and make it last. A study on genetic structure of swordfish stocks in the western Indian

[3] Observatories and Information Systems on Tropical Fisheries

[4] Halieutic Information System

Ocean was initiated in December 2005. On the basis of encouraging scientific results of this first phase, the Ifremer organized a workshop gathering participants of 10 countries, which took place in September 2006. It led to the elaboration of a future research project of 4 years, centred on genetic structure of stocks, use of otoliths and external parasites as population tracers, and acquisition of biological data, especially on maturation status of gonads.

University of Reunion. The ECOMAR laboratory of the University of Reunion is conducting a programme on dynamics of seabird populations. The development of bio-indicators based on a demographic and biological monitoring of some colonies helps characterizing marine ecosystems and determining their health situation. These researches will take an increasing importance in the ecosystemic approach of fisheries that is implemented step by step at a worldwide level and that the Fisheries Commissions will have to integrate in their assessments.

JAPAN

Document IOTC-2006-SC-INF08. General fisheries statistics regarding longline and purse seine fisheries in recent 5 years are summarised. In addition, progress on the implementation of recommendations of the past Scientific Committee (including collection of size data, searching for historical weight data, improvement of the CPUE Standardization and the predation survey) and progress on national research programs (including tagging in the eastern Indian Ocean (NRIFSF) and tagging in the Indian Ocean (JAMARC)) are described.

INDIA

Document IOTC-2006-SC-INF21. India caught around 82,449 t of tunas and tuna like fishes during 2005. Of this, 80,506 t was taken by the coastal fisheries. The neritic tunas (skipjack, kawakawa, frigate mackerel and yellowfin tuna) contributed to about 37,000 t, billfishes 3,000 t, and seer fishes (mackerels, wahoo) 40,000 t. The main gears used were gillnets, pole and line, hook and line and longlines (the longline catch was around 1,943 t and comprised mainly yellowfin tuna and billfish). 72 Indian owned industrial tuna longliners caught a total of 1,856 t. Under the new scheme of converting the shrimp trawlers to tuna longliners, six such vessels landed about 42 tonnes of tunas.

The Government of India has launched a scheme to strengthen database and information networking for the fisheries sector. In 2005 a marine fisheries census encompassing the fishermen population, their fishing crafts and gear was undertaken for the main land and the Andaman and Nicobar, and Lakshadweep islands. The preliminary findings of the census show that the fisher-folk population of the country is estimated to be 35.75 lakhs belonging to 3,322 fishing villages and 1,414 landing centres. In order to monitor and initiate further action on IOTC decisions/resolutions the Dept. of Animal Husbandry, Dairying & Fisheries (Ministry of Agriculture, Government of India) has constituted a Working Group. The Working Group meets to examine the provisions under Resolutions and suggests appropriate actions on conservation and management measures for tuna and allied species. Survey and research activities facilitate the collection of scientific data as required under various resolutions and activities of IOTC. Current scientific research programmes include: tuna surveys in several areas, remote sensing, investigations of marine fish biodiversity, estimation of biological parameters, abundance, stock status and the spatio-temporal distribution patterns of tuna species, studies on the oceanographic parameters influencing tuna and swordfish distribution. Information on incidental catches, if any, of seabirds, turtles, marine mammals and on the instances of predation on longline caught tunas, is also being collected.

KOREA

Document IOTC-2006-SC-INF09. The Korean tuna longline fishery has shown a decreasing trend from the late 1970s to recent years in both number of fishing vessels and annual catches. In 2005, total catch by 28 longliners amounted to 6,985 t and was a record low for the Korean longline fishery in this area. This was mainly due to the shift of longliners from the Indian to the Pacific Ocean. The catch consisted of 32 t of southern bluefin tuna, 3,295 t of yellowfin tuna, 183 t of albacore, 2,481 t of bigeye tuna, 400 t of other tunas and 566 t of billfishes. The National Fisheries Research and Development Institute (NFRDI) began to operate fisheries observer program in 2002 to monitor the Korean distant-water fisheries for tunas and to meet the requirements of regional fisheries bodies. NFRDI dispatched one scientific observer to monitor the Korean tuna longline vessel in the Indian Ocean from August to September 2006. The results of observer program for the Indian Ocean during 2006 will be reported later.

SEYCHELLES

Document IOTC-2006-SC-INF03. The Seychelles National Report summarizes activities of the industrial purse seine and longliners fleet licensed to operate inside the Seychelles EEZ, the Seychelles registered vessels and the local “semi industrial’’ longline fishery, for the period 2001 to 2005. No significant changes have been recorded in the purse seine fleet over the past 5 years. A slight downward trend is observed in the overall fishing effort over the past 3 years. However an increase in the number of sets on free-swimming schools and in yellowfin catches on free-swimming schools was recorded during that period. The Seychelles fleet has recorded increase in both catches and effort throughout the period under study. In 2005 all the longline data were transferred into FINSS, was verified, corrected or flagged. Increases in fishing effort and total catch were recorded for all fleet between 2001 and 2004. The catch rate of all fleet has remained more or less stable while for the

Seychelles fleet, the catch rate has increased between 2001 and 2005. Bigeye tuna dominated the total catch of the Seychelles registered longliners between 2001 and 2004 and was replaced by Yellowfin tuna in 2005. A significant increase in the activities of the semi-industrial vessels was recorded in 2005, compared to the previous 3 years. The estimated catch reported for 2005 is estimated at 290.32 t with an estimated catch rate of 1.48 t/1000 hooks. While swordfish remained the dominant species in the catch (58% in 2005), its share has decreased (80% in 2004) with yellowfin and bigeye tuna being more targeted than previously. Although the restriction for export of swordfish on the EU market was lifted in February 2005, most of the local vessels have not returned back to targeting swordfish and tuna as was expected. In 2005 a total of 10 vessels conducted 83 sharks fishing trips and landed a total of 19.48 MT of shark meat and 17.27 t of shark fins. In 2004 a total of 32.9 t of shark meat and 11.4 t of shark fins were landed resulting from 22 trips conducted by 4 vessels.

Document IOTC-2006-SC-INF04 described the CAPPES (CAPturabilité des grands PElagiques exploités à la Palangre dérivante dans la Zone Economique Exclusive des Seychelles) project undertaking longline research to help the local semi-industrial longline fishery. Gear behaviour, habitat of target species (swordfish and tuna) and bait tests were studied during 11 cruises. A total of 29,449 hooks were deployed and 1,478 fishes were caught. Some interesting results were obtained during the bait tests. Depredation rates by marine mammals and sharks were also assessed. Future work will take place during the SWIOFP.

SRI LANKA

Document IOTC-2006-SC-INF18. No abstract supplied.

THAILAND

Document IOTC-2006-SC-INF19. The total tuna catch from the Indian Ocean in 2005 was 29,216.62 t of which 58% and 42% were neritic and oceanic tunas respectively. skipjack tuna, kawakawa, king mackerel, and longtail tuna were the dominant species in the catch composition followed by yellowfin and bigeye tunas. Four main fishing gears were employed to catch tunas in the Indian Ocean, namely purse seine, longline, gillnet and trawl for king mackerels. Purse seine contributed the highest catch which was 23,072 t followed by trawl (4,360 t), gill net (1,505 t), and longline (279.62 t). Thailand has seriously implemented the recommendations adopted in the IOTC Scientific Committee including the following actions: Collecting scientific data and information of neritic tunas distributing in the Thai waters; conducting research surveys in the Eastern Indian Ocean to collect scientific data and information of oceanic tunas distributing in the high sea; Monitoring fishing operation of Thai tuna fishing vessels operating in the high seas both purse seiners and long liners (include 3-month catch report and port sampling program); collecting information of foreign tuna longline vessels operating in the Indian Ocean and unloading their catch in fishing port in Thailand; collecting information and reporting Bigeye statistical document and re-export certificate

UNITED KINGDOM

Document IOTC-2006-SC-INF12. The UK National Report summarises fishing by vessels licensed to fish for tuna and tuna like species in the British Indian Ocean Territory (Chagos Archipelago) Fisheries Conservation and Management Zone (FCMZ) during the 2005 / 2006[5] fishing season. Two UK flagged vessels were also registered with IOTC to fish during 2005, but they did not fish in the BIOT FCMZ, and are reported to IOTC by the UK Department for Environment Food and Rural Affairs (DEFRA) to the European Commission (EC) In 2005/06 27 licences were issued to 24 longline vessels of two size classes (±100 GRT). The estimated total catch was 916 t comprising 34% yellowfin tuna, 48% bigeye tuna, and 28% other species. 56 licences were issued to 54 Purse seine vessels that year. The total catch for the 2005/06 season by purse seiners was 13,865 tonnes. The reported species composition (before correction) was dominated by yellowfin tuna (77.93%) followed by skipjack tuna (20.95%), and bigeye tuna (1.08%), based on catch reports and logbooks where catch composition available. It is estimated that a further 15 t of tuna were landed by recreational fishers on Diego Garcia. Two observers were deployed on purse seine vessels during 2005/06. New stock assessment models were applied to the assessment of bigeye tuna for the WPTT in July. BIOT fisheries legislation was amended (SI No. 1 2006 shark regulations) in respect of IOTC resolution 05/05 concerning the conservation of sharks.

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5 For the purposes of this report, the fishing season for the BIOT FCMZ (Chagos Archipelago) is defined as running from the 1st of April through to the 31st of March the following year. This season definition is used because the main historical peaks in the purse seine and longline seasons in the BIOT FCMZ (Chagos Archipelago) occur during the months of December and January.

APPENDIX VII
REPORTS BY OTHER BODIES

RUSSIAN FEDERATION

Document (IOTC-2006-SC-INF15) describe research conducted on two Thai purse seiners between April and June 2006 in the West Central Indian Ocean. Data were collected on skipjack, bigeye, yellowfin and frigate tunas and many other species. Size-age, spatial distribution and biological data was collected on the major species. The incidental catch of marine mammals, and hydrological and weather information were recorded.

TAIWAN,CHINA

The SC noted the following update on Taiwanese fisheries and statistical system provided by the invited experts. The number of Taiwanese LSTLVs (over 100 GRT) declined significantly in 2005 from 337 to 308 vessels as a result of a large scale fleet reduction programme. As a result of the fleet reduction and change of target species, the 2005 catches of albacore, bigeye and swordfish decreased from previous years while the catches of yellowfin tuna increased. There were six observer trips conducted in 2005 (compared with three in 2004). A change in the format of the logbooks was undertaken in 2004 and it is anticipated that total catch, catch/effort and size data for each of the three major species of sharks will be able to be estimated and provided to IOTC in 2007 when new format logbooks are returned. Several other data improvement programmes have been introduced to (1) increase collection of fishery-independent size data through an expansion of the observer programme at sea and conducting port sampling in canneries/unloading ports (the first sampling was undertaken in Mauritius in 2005); (2) improve catch-effort data through the verification of these data with some independent information such as VMS data; and (3) increase collection of operational information and biological samples to better understand fishing efficiency and stock parameters through a scheme of sampling trips in the main bigeye fishing ground (each with two observers onboard) and expansion of the observer programme. The feasibility of using photographic images of fish to obtain measurements of fish lengths is also being examined.

The SC expressed its appreciation for the efforts of Taiwan,China in 2006 in developing the above programme of work designed to improve their fisheries statistics and biological data, and encourage the continuation of these activities.

APPENDIX VIII

CURRENT RESEARCH RECOMMENDATIONS AND PRIORITIES BY IOTC WORKING PARTIES

Tropical Tunas

(from IOTC-2006-WPTT-R)

Scientists are strongly encouraged to extend the collection of biological samples and data for all tuna species, especially yellowfin and bigeye. For example, sampling programmes at the canneries could prove an essential source of biological data on maturity, growth and other parameters.

The differences between both longline indices of abundance, and the relative impact of the various factors introduced in the standardization procedure should be further explored. The dependency of all assessment methods to these indices as sources of information on stock trends makes the work on this area essential for the successful assessment of the resource.

Scientists are encouraged to continue their work on the use of integrated statistical assessment models. Their ability to make use of other sources of information, such as that obtained from tagging, makes them the more valuable given the current uncertainties observed in the indices of abundance and the development of the Indian Ocean Tagging Programme currently underway.

Further exploration of a number of ecosystem end environmental indicators of possible relevance to Indian Ocean fisheries is to be pursued. The recent events regarding yellowfin catches have demonstrated how limited our understanding of Indian Ocean oceanography and its impact on fisheries still is, and how useful in terms of management such knowledge could be.

Exploration of the likely impact of uncertain events such as the recent yellowfin catches could be greatly aided by the development of Management Strategy Evaluation systems and/or Operating Models of the tropical tuna fishery. Work along this line is to be encouraged and scientists should report on their developments.

Bycatch

(from IOTC-2006-WPBy-R)

Work plan

The following work plan was agreed to by the WPBy for 2006-2007:

- Identify which species should be a priority for the WPBy, then make a concerted effort to ascertain the availability of data on these species with a view to obtaining access to the data and storing it on IOTC database (to be undertaken intersessionally by the WPBy).
- Members to source information on non-tuna data holdings, including socio-economic data (ongoing).
- Comment on the potential of the available bycatch data to develop estimates of bycatch catch rates for the wider Indian Ocean and/or specific regions (to be undertaken by the Secretariat for the next meeting).

Recalling Resolution 06-04 Paragraph (1) in which the Commission resolves to develop within a year, effective mechanisms to enable CPC's to record and exchange data on seabird interactions, begin to formulate options; and Paragraph (7) in which the Commission resolves to consider adopting additional measures for the mitigation of any incidental catch of seabirds (including those applied and tested by the Convention on the Conservation of Antarctic Marine Living Resources) at its annual meeting in 2007; and in anticipation of advice being required by the Commission or individual members:

- Develop options to enable CPC's to record and exchange data on seabird interactions.
- Examine the efficacy of alternative measures for the mitigation of any incidental catch of seabirds.

Recommendations

1. Members are encouraged to submit all relevant data on bycatch to IOTC Secretariat

2. Information on the efficacy of the American longline system to mitigate the incidental bycatch of seabirds in longline fisheries be put forward for consideration by the Scientific Committee.

3. Recognising that the best opportunities for obtaining accurate data on bycatch are likely to come from observer programmes, the WPBy strongly encourages further collaboration between observer programmes and expansion and implementation of new observer programmes for the Indian Ocean. Furthermore, the following attributes in any such programme are desirable:

- All the major fleets should be covered and the levels of coverage should be such that estimates of total catch have an acceptable precision, including those for rare species.
- Observers should focus on areas such as the nature and extent of discards as the opportunities for obtaining such information are short-lived compared to information on target species (some of which can be collected at the dock).

4. Bycatch species specialists should be encouraged to participate in the WPBy.
5. Bycatch mitigation experts should be encouraged to participate in the WPBy.

Billfish

(from IOTC-2006-WPB-R)

Priorities

Response to the request from the Commission at S9 in relation to apparent localised Swordfish depletions

Following the presentation of the 2004 report of the Scientific Committee (IOTC-2004-SC-R) to the Commission at S9, the Commission noted (para 21) the technical recommendations made by the SC regarding the status of the swordfish resource and agreed that the issue of local depletion was serious and requested the SC to undertake area-specific analyses, with particular emphasis for the southwest Indian Ocean, for the Commission's future consideration. The 2006 WPB was unable to undertake any work on this matter and agreed to make it a priority task for the next WPB meeting.

Recommendations in general

Despite having advanced the stock assessment for swordfish, the WPB acknowledged that many of the recommendations made in 2004 had not been addressed and as a consequence most of these recommendations are carried forward in this report. Several new recommendations have been made as a result of the stock assessment modelling.

Recommendations concerning data

1) Taiwanese data: The WPB recognized the valuable contribution in new data and analyses provided by Taiwanese scientists, particularly in relation to information on gear configuration of Taiwanese longliners (e.g. hooks per basket) and the heterogeneity of the configuration among vessels. It was noted that these data were only collected after 1995. In the Taiwanese analyses, data prior to 1979 were aggregated by 5x5 degree areas. Taiwan,China reported that since 2003 their longline vessels logbooks has included a field for time of setting the line, which the WPB noted was critical for evaluating the targeting practices of this important fleet. It is also recommended that data related to the use of lightsticks and bait types should be recorded for catch rate standardization. Catch, effort and size data for the Taiwanese deep-freezing longline fleet were made available for use at the meeting, and a Taiwanese scientist provided valuable scientific support to the WPB. These efforts are acknowledged and appreciated.

2) Marlins and sailfishes: there is a critical lack of statistical data for this group of fishes. It is strongly recommended to better estimate catches and discards by species and by gear, by size and sex.

3) Purse seine landings: It is strongly recommended that past and future catches of marlins taken as by-catches by purse seiners be estimated. The historical yearly landing of marlins by tropical purse seiners could be estimated from observer data, and in the future, landings data should be monitored (preferably by species and by size). It is also recommended to develop permanent observer programmes on these fleets, at least at a small scale, in order to better estimate by-catches of billfishes.

4) Sex ratio by size: It is desirable to sample the size of swordfish and marlins as a function of their sex whenever possible.

5) IOTC-OFCF project: The WPB emphasizes its support to the IOTC-OFCF project and recommends that priority be given to countries with substantial catches of swordfish and billfishes which are not properly monitored or are reported as aggregates (e.g.: Sri Lanka gillnet fisheries).

6) Written statistical reports should be obtained from scientists from each fishing country on all fisheries, even when a country cannot participate in the working group meeting. The IOTC Secretariat should request these reports before WPB meetings**.**

7) Billfishes length measurements: Length data should be reported to the IOTC in a standard format to facilitate comparison of data from different countries. When these lengths are collected in a non-standard way, they should be converted to the standard form of reporting using robust methods. The basic data used to establish these conversions should be kept by IOTC. The WPB strongly recommends that size measurements should be always taken in straight length, never in round length (this is because the condition factors and shapes of fishes are highly variable at a given size between time and area strata).

Research recommendations

1) Swordfish stock structure and migratory range — using genetics techniques: Analysis of mtDNA and 6 microsatellite loci showed a strong heterogeneity within populations. These preliminary results indicate that there may be a unique stock in this region; however, the geographic scale and the sample size are probably too small to observe significant differences between these 4 areas. Following the results from a pilot genetic study (outlined in IOTC-2006-WPB-04), there are plans to develop a new program encompassing the whole Indian Ocean, with more sampling sites and samples. This program will be developed on a multidisciplinary approach including genetic, otolith microchemistry, reproductive biology, and mercury contamination to improve knowledge on the swordfish stock structure and migratory range. The WPB encouraged IOTC members to participate or contribute to the project as much as possible.

2) Swordfish stock structure and movement rates — using tagging techniques: The WPB considered tagging swordfish was a useful method to examine stock structure, and in particular to make realistic hypotheses on movement rates between strata. It was recognized that tagging of swordfish is a difficult and expensive task. However, taking into account the absolute need to validate growth and to determine stock structure, the WPB strongly recommend conducting swordfish tagging in the IOTTP (as was planned in the original IOTTP). Such tagging could be done in various ways such as:

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

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

4) Size data analyses: The following additional analyses of Taiwanese size data are recommended:

- Conversion of lengths to ages using different assumptions on sex ratios at size/age.

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

The WPB noted that although much of the technical advice on swordfish in this document is presented relative to MSY reference points, this does not suggest that these should be adopted as target reference points for the species. Investigation of appropriate reference points is a research priority.

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

7) CPUE Standardisation: Following analyses at the 2004 and 2006 WPB the following further efforts towards standardization of the CPUE series from Taiwanese and Japanese fleets are recommended, including:

- Spatial and temporal analyses of the number of hooks per basket (Shallow, normal, deep and ultra deep LL) and their relationships to the SWO distribution need to be studied to understand the effect of the number of hook per basket on the SWO CPUE.
- Research to examine if nominal SWO CPUE in the normal LL and the deep LL are overestimated and the one for the ultra deep LL are less affected.
- Improving the definition of variables that could be used as a proxy for targeting. In addition to hooks per basket considerations, this should include examining the effects of set-times, moon-phase, light-sticks and bait-types.
- Consideration of alternative ways of combining area-specific indices into a global index using different weighting schemes.
- Consideration should be given to defining area strata that take into account environmental factors and fishery distribution and characteristics.
- Many of these factors might be examined by using the Japanese shot by shot data that already exists. For other fleets additional data collection might be required to duplicate these analyses.

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

Efforts should be made to provide additional CPUE series from other fisheries (e.g. La Réunion, Seychelles) for the next WPB.

8) Stock assessment: Further development of stock assessment models for swordfish and undertaking research to reduce the uncertainties in the following areas (highlighted during the 2006 assessment):

- Uncertainty in the utility of the CPUE indices as an estimate of relative abundance. In particular, there is a need to better understand the effects of changing gear configuration and setting practices over time and space.
- Uncertainty in the total catch time series.
- The production models used in the assessment have limited flexibility to represent complicated fisheries dynamics, including recruitment variability and transient age structure effects. And they cannot include additional data relating to size frequencies, sex composition or spatial dynamics. The explicit use of age- and sex- and/or spatially-structured models to represent these characteristics realistically however, is not recommended given the paucity of input data.
- Unknown stock structure.
- Uncertainty in the representativeness of life history and production paramenters derived from Pacific Ocean swordfish.

9) Research on biology of Istiophorids: The WPB recommended that following research on istiophorids be undertaken.

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

Temperate tunas

(from IOTC-2004-WPTMT-R)

Note the WPTMT did not meet in 2005 or 2006

Data

The following problem areas were identified in the IOTC database for albacore:

- Lack of size-frequency data from the Republic of Korea and Philippines, Taiwan,China since 1989 and low sample sizes for the Japanese longline fleet.
- Lack of catch and effort data for the Taiwanese fleets for the area between 20-30°E for the whole time series.
- Poor knowledge of the catches, effort and size-frequency from fresh tuna longline vessels, especially from Taiwan,China and several non-reporting fleets.
- Poor knowledge of the catches, effort and size-frequency from non-reporting fleets of deep-freezing tuna longliners, especially since the mid 1980s.
- Lack of accurate catch, effort and size-frequency data for the Indonesian longline fishery in recent years.
- Poor knowledge of the catches, effort and size-frequency data for non-reporting purse seiners.

Biology

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

Stock assessment

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

APPENDIX IX
EXECUTIVE SUMMARIES ON THE STATUS OF TUNA RESOURCES

Executive summary of the status of the albacore tuna resource

(As adopted by the IOTC Scientific Committee 10 November 2006)

BIOLOGY

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

Albacore is a highly migratory species and individuals swim large distances during their lifetime. It can do this because it is capable of thermoregulation, has a high metabolic rate, and advanced cardiovascular and blood/gas exchange systems. Pre-adults (2-5 year old albacore) appear to be more migratory than adults. In the Pacific Ocean, the migration, distribution availability, and vulnerability of albacore are strongly influenced by oceanographic conditions, especially oceanic fronts. It has been observed on all albacore stocks that juveniles concentrate in cold temperate areas (for instance in a range of sea-surface temperatures between 15 and 18°C), and this has been confirmed in the Indian Ocean where albacore tuna are more abundant north of the subtropical convergence (an area where these juvenile were heavily fished by driftnet fisheries during the late 1980's). It appears that juvenile albacore show a continuous geographical distribution in the Atlantic and Indian oceans in the north edge of the subtropical convergence. Albacore may move across the jurisdictional boundary between ICCAT and IOTC.

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

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

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

FISHERIES

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

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

The catches of albacore increased rapidly during the first years of the fishery, remaining relatively stable until the mid-1980s, except for some very high catches recorded in 1973, 1974 and 1982. The catches increased markedly during the 1990's due to the use of drifting gillnets, with total catches reaching around 30,000 t. Catches have steadily increased since 1993, after the drop recorded in 1992 and 1993 as a consequence of the end of the drifting gillnet fishery. Catches between 1998 and 2001 were relatively high (ranging from 37,700 t to 40,600 t). By contrast, recent catches have been much lower at 25,000 t, 22,800 t and 19,300 t (for 2003, 2004 and 2005, respectively).

Longliners from Japan and Taiwan,China have been operating in the Indian Ocean since the early 1950s and they have been the major fishers for albacore since then (Table 1). While the Japanese albacore catch ranged from

8,000 t to 18,000 t in the period 1959 to 1969, in 1972 catches rapidly decreased to around 1,000 t due to changing the target species mainly to southern bluefin and bigeye tuna, then ranged between 200 t to 2,500 t as albacore became a bycatch fishery. In recent years the Japanese albacore catch has been around 2,000 to 4,000 t. By contrast, catches by Taiwanese longliners increased steadily from the 1950's to average around 10,000 t by the mid-1970s. Between 1998 and 2002 catches ranged between 21,500 t to 26,900 t, equating to just over 60 % of the total Indian Ocean albacore catch. Since 2003 the albacore catches by Taiwanese longliners have been less that 13,200 t .

The catches of albacore by longliners from the Republic of Korea, recorded since 1965, have never been above 10,000 t. Important albacore catches of around 3,000 t to 5,000 t have been recorded in recent years for a fleet of fresh-tuna longliners operating in Indonesia (Figure 3).

Large sized albacore are also taken seasonally in certain areas (Figure 5), most often in free-swimming schools, by the purse seine fishery.

A feature of Indian Ocean albacore fisheries is that it is the only ocean where juvenile albacore are rarely targeted by fisheries. In the Atlantic and Pacific oceans surface fisheries often actively target small albacore to the extent that juveniles contribute to the majority of albacore catches. This, however, does not discount the possibility that the juvenile albacore from the Indian Ocean are not being subjected to significant levels of fishing pressure as the small fish targeted off the west coast of South Africa may have migrated to the Atlantic Ocean from the Indian Ocean (Figure 1).

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

Nominal Catch (NC) Data

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

Catch-and-Effort (CE) Data

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

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

Size Frequency Data

The size frequency data for the Taiwanese longline fishery for the period 1980-2004 is now available. In general, the amount of catch for which size data for the species are available before 1980 is still very low. The data for the Japanese longline fleets is available; however, the number of specimens measured per stratum has been decreasing in recent years. Few data are available for the other fleets.

STOCK ASSESSMENT

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

MANAGEMENT ADVICE

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

Taking into account the absence of a reliable assessment of the status of albacore tuna and the need for a precautionary approach, the SC recommended that the Commission be very cautious in allowing increases in catch or fishing effort from the 2002 levels until the problems with the assessments have been resolved.

ALBACORE TUNA SUMMARY

Maximum Sustainable Yield:	unknown
Preliminary catch in 2005 *(data as of October 2006)*	19,300 t
Mean catch over the last 5 years (2001-05)	28,200 t
Catch in 2004	22,800 t
Catch in 2002	33,100 t
Current Replacement Yield	-
Relative Biomass ($B_{current}/B_{MSY}$)	unknown
Relative Fishing Mortality ($F_{current}/F_{MSY}$)	unknown

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

Table 1. *Best scientific estimates of the catches of albacore tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1956-2005 (in thousands of tonnes).*
Data as of October 2006

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Purse seine	Other Fleets																									0.0	0.0	0.0
	Total																									0.0	0.0	0.0
Longline	Taiwan,China	0.5	0.7	1.0	1.2	1.1	1.4	1.3	1.6	1.5	1.1	1.7	1.6	7.6	7.7	7.2	7.0	7.0	12.0	17.4	6.4	9.7	9.8	12.8	15.0	11.0	12.3	21.9
	Indonesia																			0.0	0.1	0.1	0.1	0.2	0.3	0.2	0.2	0.2
	Japan	5.1	4.7	6.3	10.4	11.1	15.2	17.6	12.6	17.8	11.4	13.1	14.1	10.1	8.6	4.9	3.3	1.4	2.0	2.8	1.3	1.2	0.4	0.4	0.4	0.6	1.2	1.3
	Korea, Republic of										0.5	0.6	6.2	0.9	4.4	1.7	2.4	3.8	9.1	9.8	3.9	4.2	2.1	4.6	2.0	1.8	0.9	0.6
	Other Fleets									0.1	0.2	0.2	0.0	0.8	0.2	0.7	0.6	0.5	0.4	0.2	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.1
	Total	5.6	5.3	7.3	11.6	12.1	16.6	19.0	14.1	19.4	13.2	15.6	22.0	19.3	20.9	14.4	13.3	12.7	23.5	30.2	11.7	15.3	12.5	18.1	17.7	13.7	14.7	24.2
All	Total	5.6	5.3	7.3	11.6	12.1	16.6	19.0	14.2	19.4	13.2	15.6	22.0	19.4	20.9	14.4	13.4	12.8	23.5	30.3	11.7	15.3	12.5	18.2	17.7	13.7	14.8	24.7

Gear	Fleet	Av01/05	Av56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Purse seine	France	0.3	0.2		0.3	0.5	0.2	0.2	0.2	0.0	0.0	0.9	1.4	0.3	0.3	0.4	0.4	0.5	0.5	0.2	0.4	0.7	0.3	0.6	0.1	0.1
	Spain	0.2	0.2		0.2	0.1		0.0	0.1		0.1	1.1	1.5	0.9	1.8	0.6	0.8	1.0	0.3	0.2	0.4	0.3	0.2	0.5	0.1	0.0
	Other Fleets	0.2	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.1	0.5	0.4	0.4	0.5	0.8	0.2	0.4	0.3	0.3	0.4	0.1	0.0
	Total	0.8	0.5	0.0	0.6	0.7	0.2	0.2	0.3	0.0	0.3	2.2	3.3	1.3	2.6	1.3	1.6	2.0	1.6	0.6	1.2	1.3	0.8	1.5	0.2	0.2
Longline	Taiwan,China[6]	16.9	10.2	17.0	13.9	6.2	11.1	13.1	11.0	7.1	5.8	13.1	11.1	12.0	14.4	14.2	16.9	15.2	21.6	22.5	21.7	26.9	21.5	13.1	12.5	10.4
	Indonesia	3.5	0.6	0.2	0.3	0.3	0.1	0.3	0.3	0.4	0.4	0.3	0.5	0.4	0.6	0.7	1.3	1.6	1.5	1.7	2.7	2.9	2.6	4.8	4.4	2.7
	Japan	3.2	4.6	1.7	1.8	2.3	2.5	2.3	1.3	0.9	1.0	1.0	1.8	1.3	1.8	2.0	2.4	3.2	3.2	2.3	2.6	3.0	3.3	2.2	3.7	3.7
	NEI-Deep-freezing	2.0	1.4			0.0	0.7	0.7	1.7	1.0	1.2	2.5	1.8	3.2	4.2	4.2	7.3	4.8	9.0	9.4	8.2	4.5	2.9	1.3	0.6	0.6
	Seychelles	0.7	0.1																	0.0	0.4	0.8	1.1	1.2	0.1	0.1
	France-Reunion	0.5	0.1									0.0	0.0	0.1	0.1	0.1	0.3	0.2	0.3	0.3	0.5	0.6	0.3	0.3	0.4	0.7
	Korea, Republic of	0.2	1.3	0.6	0.4	0.5	0.4	0.4	0.4	0.3	0.2	0.3	0.1	0.1	0.1	0.1	0.2	0.3	0.2	0.1	0.2	0.1	0.0	0.1	0.4	0.2
	Other Fleets	0.5	0.3	0.2	0.2	0.0	0.1	0.2	0.2	0.6	0.6	0.6	0.7	0.7	0.8	0.5	0.3	0.3	0.8	0.7	0.4	0.5	0.5	0.4	0.5	0.5
	Total	27.3	18.6	19.6	16.7	9.3	14.8	17.0	15.0	10.2	9.1	17.8	16.0	17.8	22.2	21.9	28.8	25.6	36.5	37.0	36.6	39.2	32.2	23.4	22.4	19.0
Gillnet	Taiwan,China		1.8			0.7	15.2	12.2	14.4	14.4	21.1	9.0	1.3													
	Total		1.8			0.7	15.2	12.2	14.4	14.4	21.1	9.0	1.3													
All	Total	28.2	20.9	19.8	17.4	10.8	30.2	29.4	29.7	24.6	30.5	29	20.7	19.2	24.8	23.2	30.4	27.7	38.2	37.7	37.9	40.6	33.1	25.0	22.8	19.3

[6] includes catches for the fresh tuna longline fleet from 2001 onwards

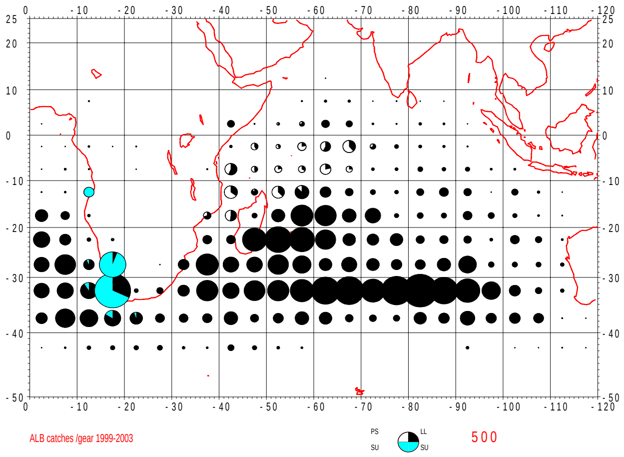


Figure 1. *Average albacore catches by gear during the period 1999-2003. Map shows the distribution of albacore extending from the Indian Ocean to the Atlantic Ocean. LL = longline, PS = purse seine, SU = pole and line.* *Data as of October 2006*

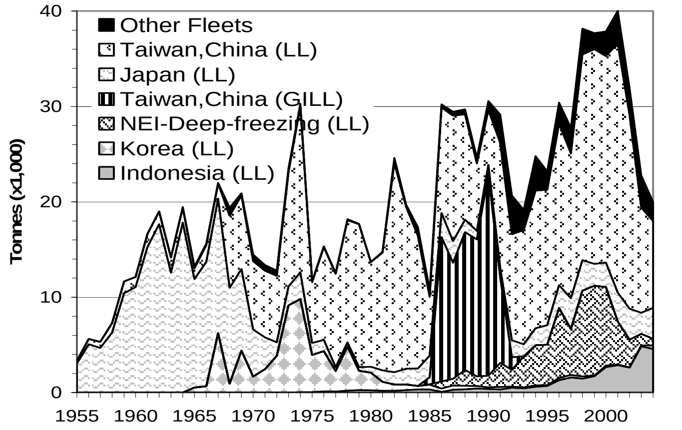


Figure 2. *Catches of albacore per fleet and year recorded in the IOTC Database (19562005).* *Data as of October 2006*

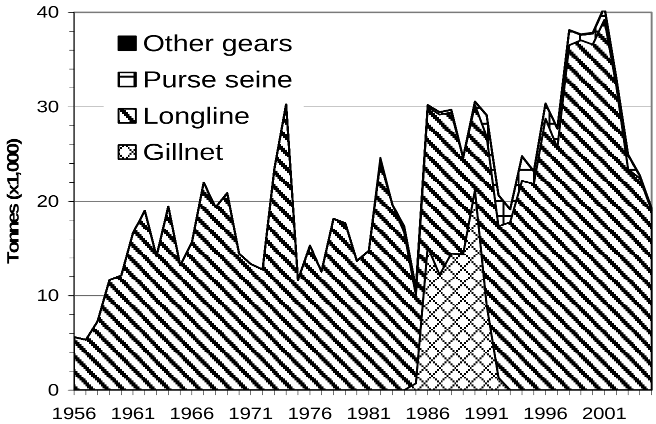


Figure 3. *Annual of catches albacore (thousand of metric tonnes) by gear from 1956 to 2005.* *Data as of October 2006*

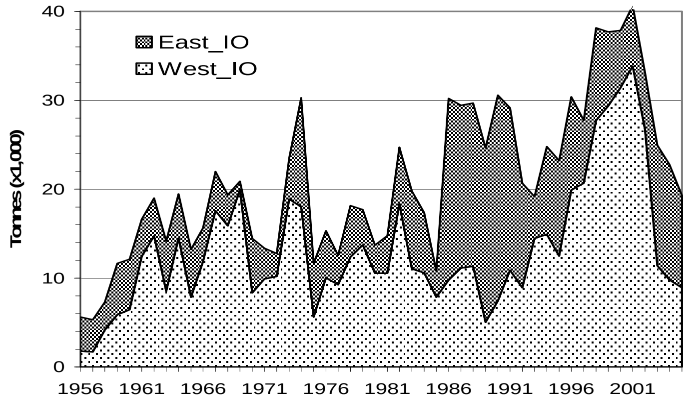


Figure 4. *Catches of albacore in relation to the eastern and western areas of the Indian Ocean (1956-2005).*
Data as of October 2006

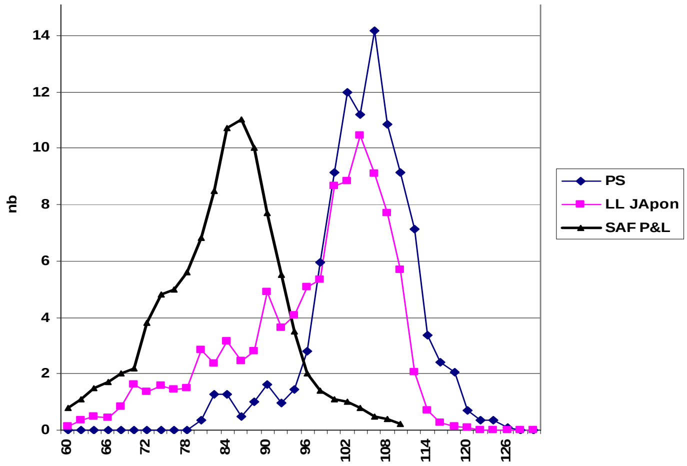


Figure 5. *Average sizes of albacore taken by various fisheries in the Indian Ocean, longliners and purse seiners, and by the pole-and-line fishery in the west coast of South Africa (Atlantic Ocean).*

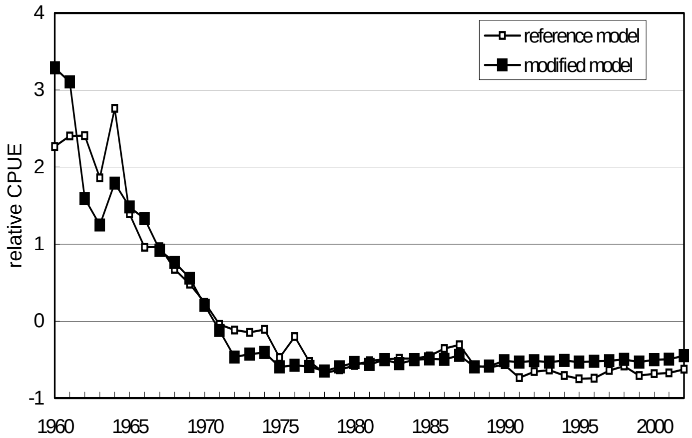


Figure 6. *Standardized CPUEs for the reference and modified models. The CPUE for the modified model were calculated using only from Area 2 and Area 4 where albacore is generally abundant. Both CPUEs were adjusted with taking the difference to mean and dividing it by the standard deviation*

Executive summary of the status of the bigeye tuna resource

(As adopted by the IOTC Scientific Committee 10 November 2006)

BIOLOGY

Bigeye tuna *(Thunnus obesus)* inhabit the tropical and subtropical waters of the Pacific, Atlantic and Indian Oceans in waters down to around 300 m. Juveniles frequently school at the surface underneath floating objects with yellowfin and skipjack tunas. Association with floating objects appears less common as bigeye grow older.

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

Of the three tropical tuna species, bigeye tuna lives the longest (more than 15 years) and that makes it the species most vulnerable, in relative terms, to over-exploitation. Bigeye have been reported to grow to 200 cm (fork length) long and over 200 kg and start reproducing when they are approximately three years old, at a length of about 100 cm.

THE FISHERIES

Bigeye tuna is mainly caught by industrial fisheries and appears only occasionally in the catches of artisanal fisheries. Total annual catches have increased steadily since the start of the fishery, reaching the 100,000 t level in 1993 and peaking at 150,000 t in 1999. Total annual catches averaged 123,000 t over the period 2001 to 2005. Bigeye tunas have been caught by industrial longline fleets since the early 1950's, but before 1970 they only represented an incidental catch. After 1970, the introduction of fishing practices that improved the access to the bigeye resource and the emergence of a sashimi market made bigeye tuna a target species for the main industrial longline fleets. Total catch of bigeye by longliners in the Indian Ocean increased steadily from the 1950's to reaching 100,000 t in 1993 and around 140,000–150,000 t for a short period from 1997-1999. (Figure 1). Taiwan,China is the major longline fleet fishing for bigeye and it currently takes just under 50% of the total catch (Table 1). Large bigeye tuna (averaging just above 40 kg) are primarily caught by longlines, and in particular deep longliners (Figure 3). Since the early 1990s bigeye tunas have been caught by purse seine vessels fishing on tunas aggregated on floating objects. Total catch of bigeye by purse seiners in the Indian Ocean reached 40,700 t in 1999, but has averaged around 25,000 t in recent years (2001-2005) (Table 1). Forty to sixty boats have operated in this fishery since 1984. Purse seiners mainly take small juvenile bigeye (averaging around 5 kg) whereas longliners much larger and heavier fish (Figures 3, 4 and 5); and while purse seiners take much lower tonnages of bigeye compared to longliners (Figure 1), they take larger numbers of individual fish (Figure 6).

By contrast with yellowfin and skipjack tunas, for which the major catches take place in the western Indian Ocean, bigeye tuna is also exploited in the eastern Indian Ocean (Figures 1 and 2). The relative increase in catches in the eastern Indian Ocean in the late 1990's was 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.

AVAILABILITY OF INFORMATION FOR ASSESSMENT PURPOSES

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

Information on biological parameters is scarce and improvements are needed in particular concerning natural mortality. The ongoing large-scale tagging programme is expected to improve knowledge on a range of biological characteristics. A new growth curve was presented in 2003 which was considered to be an important improvement over previously existing information.

In the case of the purse-seine fishery, it was not possible to derive indices of abundance from catch-and-effort information, because the interpretation of nominal fishing effort was complicated by the use of FADs and increases in fishing efficiency that were difficult to quantify. In the case of the longline fisheries, indices of abundance were derived, although there still remain uncertainties whether they fully take into account targeting practices on different species (Figure 7).

The Japanese longline standardised CPUE (1960 to 2004) for the Indian Ocean tropical waters is currently used to derive the index of bigeye abundance. In 2006, sea surface temperature and gear characteristics were included in the GLM standardisation procedure. This index generally declined from 1960 until 2002, with the exception of higher values in 1977 and 1978. Abundance values in 2003 and 2004 were higher than the lowest historical value in 2002 (Figure 7). A similar analysis of the Taiwanese CPUE series was also presented in 2006. After standardisation, this index shows a variable but generally decreasing trend, similar to that of the Japanese fleet (Figure 7). This is in contrast with previous years, when significant differences could be observed between both indices; and appears to be the result of an increase in the information input into the analysis by Taiwanese researchers. Given that the standardisation procedure of the Taiwanese index is still work in progress, the WPTT decided to apply the Japanese index in the recent stock assessment runs, while recognizing and encouraging the significant improvements achieved in the generation of an index of abundance for the Taiwanese fleet.

Catch at size and catch at age data were updated in 2006. Given that a catch-at-size matrix is an integral part of both length and age based assessment methods, the WPTT expressed their ongoing concerns about the low levels of size sampling being collected in the Indian Ocean. Notwithstanding these concerns the WPTT was encouraged by the potential of the information being obtained from the RTTP-IO in the belief that this programme is going to be important alternative source of size data in the very near future.

STOCK ASSESSMENT

In 2006, five stock assessment models were applied to the Indian Ocean bigeye tuna stock using an agreed list of input parameters. Ten year projections were also carried out for a range of scenarios.

Results

From the range of MSY estimates, the SC chose the value of 111,200 t. This was the MSY estimated by the ASPM and it was reported ahead of the estimates from the other methods because ASPM results have been reported in previous executive summaries; and the WPTT noted that several of the other assessment approaches used in 2006 needed further exploration and development. Given that the mean annual catch for the period 2001-2005 was 123,000 t and the preliminary catch estimate for 2005 is 112,400 t, it appears that the stock is being exploited at around its maximum level. Results from the ASPIC analysis plotting the annual catches as a function of fishing mortality illustrate the MSY and its uncertainty (Figure 8).

Despite the broad agreement of the models in estimating MSY, they produced quite different estimates of absolute levels of virgin and current biomass, and thus in the ratios of current levels of F and SSB to MSY. This was probably due to how the variations in CPUE were interpreted by each model. While acknowledging the value of assessing the status of bigeye from a wide range of modelling perspectives, the WPTT recommended that the results of the ASPM (Table 2) would be used in the Bigeye Executive Summary in 2006.

The ASPM results indicate that the 2005 catch is close to the MSY. Furthermore, spawning stock biomass appears to be above the level that would produce MSY, and the fishing mortality in 2004 appears to below the MSY level.

Biomass trajectories indicate that the spawning stock biomass is currently just above the MSY level, but it has been declining since the late 1970's (Figure 9). Similarly, the current fishing mortality is estimated be to just above the MSY level, but fishing mortality has been increasing steadily since the 1980's (Figure 10).

Ten year projections were carried out using the following scenarios:

- constant catch at 2004 levels
- with a 10% reduction in 2004 catch levels
- constant F at 2004 levels, at 2000-02 levels and at 1998-01 levels

If 2004 catch levels were to continue, SSB is predicted to decline gradually over the next 10 years (Figure 11). At a constant catch equivalent to 10 % below the 2004 catch level, the rate of decline in SSB is less severe.

Three different fishing mortality at age scenarios were selected as they reflected different patterns of exploitation for juvenile and adult bigeye. In the period 1998-2000, the fishing pressure on juveniles was higher than it was during the period 2000-2002. The 2004 scenario reflects a fishery in which there was relatively lower pressure on juveniles compared to the other time periods. Scenarios based on F levels were presented, and the results indicate that the three levels considered (2004, 2000-02 and 1998-2001) would not have a strong effect in the trajectories of future SSB, as the differences are relatively minor given the current level of uncertainty (Figure 12).

The effects of the three scenarios of fishing mortality were also considered in terms of yield per recruit. A multi-fleet YPR analysis indicated that an exploitation pattern such as the one observed in 2004 would have a positive impact on the yield per recruit obtained, when compared to the 2000-02 and 1998-01 fishing mortalities by fleet. A slightly higher yield per recruit resulted from a pattern of exploitation in which there was lower pressure on juveniles. Yield per recruit increased from 1.98 kg for the 1998-2001 pattern of exploitation, to 2.06 kg for the 2000-02 pattern, up to 2.22 kg if the 2004 pattern of exploitation were to be retained.

Despite the progress made in the 2006 assessments, uncertainties in the results and projections still exist. These uncertainties relate to:

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

Notes about exploitation patterns

The exploitation patterns observed in 2003 and 2004 could be considered anomalous, and heavily influenced by the high abundances of yellowfin tuna, which concentrated the activity of the surface fleets. The decrease in the fishing pressure on bigeye currently observed is likely to be temporal, as the fleets appear to have come back in the second half of 2005 to their previous pattern of activity.

Two other factors could also influence the short term evolution of the fishery. Rising fuel costs appear to be having an effect on the operating procedures of the surface fleets. Distances travelled at night, and consequently the number of FADs visited, are being reduced to save on fuel costs. The effect of this change could be however reduced by the increasing use of supply vessels, tasked with visiting FADs and informing purse seiners of the abundance of fish around them. The second factor is the limitation on the activity of all fishing fleets on the coast and EEZ of Somalia, due to the increase in the activity of pirates in the area. Some purse seine fleets have receive indications from their governments not to venture into those waters. An important fishery on FADs has traditionally taken place in this area on the last quarter of the year, with significant catches of juvenile bigeye.

Another factor to consider when analysing the possible futures trends in SSB is the increasing trend in effective fishing power observed in the fleets involved in this fishery.

MANAGEMENT ADVICE

The results of the stock assessments conducted in 2006 were broadly similar and, in general, were more optimistic than previous ones. The ASPM results indicate that the 2005 catch is close to the MSY. Furthermore, spawning stock biomass seems to be above the level that would produce MSY, and the fishing mortality in 2004 seems to below the MSY level. Current (2004) catches of juveniles bigeye by the surface fleets are also less detrimental in terms of yield-per-recruit that previous patterns.

However, the current outlook could revert to a more pessimistic one, if the exploitation pattern is to return to the pre-2003 levels, as expected. Changes in the fishery occurred in 2003 and 2004, but these were due to the exceptional catches of yellowfin, which seem to be the result of anomalous conditions. In 2005, the fishery is already showing a return to the previous pattern of exploitation, which is likely to increase the catches of bigeye tuna associated with floating objects.

If the level in catch in numbers of juvenile bigeye tuna by purse seiners fishing on floating objects returns to pre-2003 levels, this is likely to be detrimental to the stock, as fish of these sizes are below the optimum size for maximum yield-per-recruit.

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

In view of the most current assessment, the SC recommended that catches should not exceed the MSY and fishing effort should not increase further from the 2004 levels.

BIGEYE TUNA SUMMARY

Maximum Sustainable Yield:	111,200 t (95,000 – 128,000)
Preliminary catch in 2005 *(data as of October 2006)*	112,400 t
Catch in 2004	126,400 t
Mean catch over the last 5 years (2001-2005)	122,800 t
Current Replacement Yield	-
Relative Biomass (SSB_{2004}/SSB_{MSY})	1.34 (1.04 – 1.64)
Relative Fishing Mortality (F_{2004}/F_{MSY})	0.81 (0.54 – 1.08)
90% Confidence intervals provided in brackets	

Note: This Executive Summary has been updated to take account of recent catch data. The management advice, and stock assessment results are based on data up to 2004.

***Table 1**. Best scientific estimates of the catches of bigeye tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1956-2005 (in thousands of tonnes).*

Data as of October 2006

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Purse seine	France																										0.0	0.0
	Other Fleets																							0.0	0.0	0.0	0.0	0.1
	Total																							0.0	0.0	0.0	0.0	0.1
Longline	Taiwan,China	0.6	0.9	1.5	1.5	1.3	1.9	1.2	1.7	1.8	1.4	2.2	2.3	7.2	8.0	10.0	5.6	5.5	4.0	6.0	5.3	4.2	6.2	4.9	7.4	8.9	6.8	11.3
	Indonesia																		0.0	0.2	0.4	0.3	0.3	0.4	0.4	0.5	0.5	0.8
	Japan	12.2	11.1	10.2	8.4	14.8	13.0	17.3	11.6	16.0	17.6	21.4	21.8	23.6	14.4	12.7	11.2	8.3	5.2	6.9	5.5	2.1	3.1	10.9	4.2	5.9	7.8	11.4
	Korea, Republic of										0.2	0.2	0.6	6.8	7.6	3.5	4.9	4.9	7.3	14.7	26.2	21.8	26.1	34.1	21.5	19.3	19.4	19.5
	Other Fleets									0.2	0.4	0.4	0.1	1.9	0.5	1.6	1.3	1.2	0.9	0.5	0.2	0.1	0.2	0.2	0.0	0.2	0.3	0.3
	Total	12.8	12.0	11.7	9.9	16.1	15.0	18.5	13.3	18.0	19.5	24.1	24.8	39.5	30.4	27.7	23.0	20.0	17.4	28.3	37.7	28.5	35.9	50.5	33.5	34.9	34.8	43.4
All	Total	12.8	12.0	11.7	9.9	16.1	15.0	18.5	13.3	18.0	19.5	24.1	24.8	39.5	30.4	27.8	23.0	20.1	17.5	28.5	37.8	28.7	36.1	50.7	33.6	35.0	35.1	43.6

Gear	Fleet	Av01/05	Av56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Purse seine	Spain	9.2	3.4		0.8	1.3	1.8	5.0	6.8	5.9	4.9	6.0	3.6	5.4	5.9	12.2	11.4	15.9	11.2	16.0	11.3	7.8	10.9	8.5	8.6	10.3
	France	6.1	2.6	0.2	2.3	4.3	7.1	7.0	6.2	3.6	4.6	5.4	3.8	5.0	5.4	7.3	6.9	7.8	6.4	8.5	6.7	5.5	7.3	5.3	5.8	6.5
	Seychelles	3.8	0.5									0.0	0.0					0.9	2.0	3.0	1.8	2.8	3.7	3.4	4.4	4.8
	NEI-Other	2.2	1.1	0.0	0.5	0.6	1.0	0.8	0.8	0.5	1.0	1.5	0.9	1.9	2.5	3.4	3.4	6.2	5.2	7.5	6.0	3.1	4.1	2.4	0.9	0.6
	NEI-Ex-Soviet Union	2.1	0.5								0.0		0.4	1.0	0.3	1.3	1.1	1.2	1.9	3.9	2.9	2.9	2.2	2.4	2.2	1.0
	Other Fleets	1.3	0.8	0.3	0.5	0.9	0.7	0.7	1.2	2.0	2.2	2.6	2.5	2.6	4.8	4.2	1.7	2.0	1.6	1.7	1.3	1.6	0.9	0.9	0.7	2.6
	Total	24.8	8.9	0.6	4.0	7.2	10.6	13.4	15.1	12.0	12.7	15.6	11.3	16.0	18.9	28.4	24.5	34.0	28.3	40.7	29.9	23.7	29.0	22.9	22.6	25.7
Longline	Taiwan,China[7]	49.9	16.6	11.3	10.9	12.2	16.8	17.6	19.4	19.9	20.8	29.0	24.0	39.7	27.8	32.7	29.8	34.1	39.7	37.1	36.4	42.1	50.2	60.0	56.9	40.2
	Indonesia	15.9	5.5	1.9	2.4	2.4	0.7	2.4	3.2	4.5	4.5	4.5	7.6	7.9	10.8	12.2	23.2	27.9	26.1	30.5	20.9	21.1	26.3	11.8	10.9	9.3
	Japan	11.8	12.3	18.3	14.0	17.2	15.8	15.5	12.3	7.7	8.2	7.8	5.6	8.3	17.5	17.2	16.5	18.8	17.1	14.0	13.6	13.0	14.0	9.9	10.9	10.9
	China	5.5	0.8													0.2	0.5	1.7	2.3	2.4	2.8	3.1	2.8	4.6	8.3	8.9
	NEI-Deep-freezing	4.6	2.9			0.1	1.1	0.9	2.9	2.8	4.4	5.5	3.8	10.7	8.1	9.7	13.0	10.8	16.5	15.5	13.8	6.4	6.4	5.0	2.7	2.7
	Seychelles	3.9	0.4	0.0	0.1	0.1									0.0	0.0	0.1	0.0	0.1	0.1	0.5	1.0	2.2	3.7	7.0	5.5
	Korea, Republic of	1.6	8.2	17.4	11.7	12.8	11.9	14.4	17.1	12.2	10.7	2.3	4.8	5.3	8.5	6.4	11.3	10.6	3.4	1.4	3.4	1.5	0.2	1.2	2.5	2.6
	NEI-Fresh Tuna	0.8	1.0							1.9	2.6	2.3	2.6	2.9	4.6	3.8	4.3	5.3	4.7	4.8	4.6	0.2	0.4	0.5	1.2	1.7
	NEI-Indonesia Fresh Tuna		1.5				0.1		2.0	7.5	9.2	9.4	11.4	9.2	11.9	6.5	2.7	2.9	0.2	0.0						
	Other Fleets	2.5	0.7	0.5	0.6	0.0	0.4	0.3	0.3	0.1	0.0	0.1	0.3	1.5	1.4	1.2	0.2	0.2	1.9	2.8	2.4	1.9	2.1	3.0	2.1	3.6
	Total	96.5	49.8	49.5	39.7	44.9	46.7	51.2	57.1	56.7	60.5	60.8	60.2	85.4	90.6	89.8	101.5	112.4	112.1	108.6	98.4	90.3	104.6	99.8	102.5	85.4
All	Total	122.5	59.1	50.3	44.1	52.4	57.8	65.0	72.4	69.0	73.5	77.0	71.9	102.0	110.2	119.4	126.9	147.3	141.4	150.5	128.9	115.0	134.9	124.0	126.4	112.4

[7] includes catches for the fresh tuna longline fleet from 2001 onwards

Table 2. *2006 bigeye tuna stock assessment. Summary of results obtained by the ASPM stock assessment methods. B = Total biomass, SSB = spawning stock biomass. Brackets contain 90 % CI's.*

	ASPM Results
B_0	1,380,000 t
B_{2004}	720,000 t
B_{MSY}	
Ratio B_{2004} / B_0	0.52 (0.43-0.61)
Ratio B_{2004} / B_{MSY}	
SSB_0	1,150,000 t
SSB_{2004}	430,000 t
SSB_{MSY}	350,000 t
Ratio SSB_{2004} / SSB_{MSY}	1.34 (1.04-1.64)
Ratio SSB_{2004} / SSB_0	0.39 (0.31-0.47)
MSY	111,195 t (94,738-127,652)
C_{2004}	126,518 t
F_{2004}	0.29
F_{MSY}	0.30
Ratio F_{2004} / F_{MSY}	0.81 (0.54-1.08)

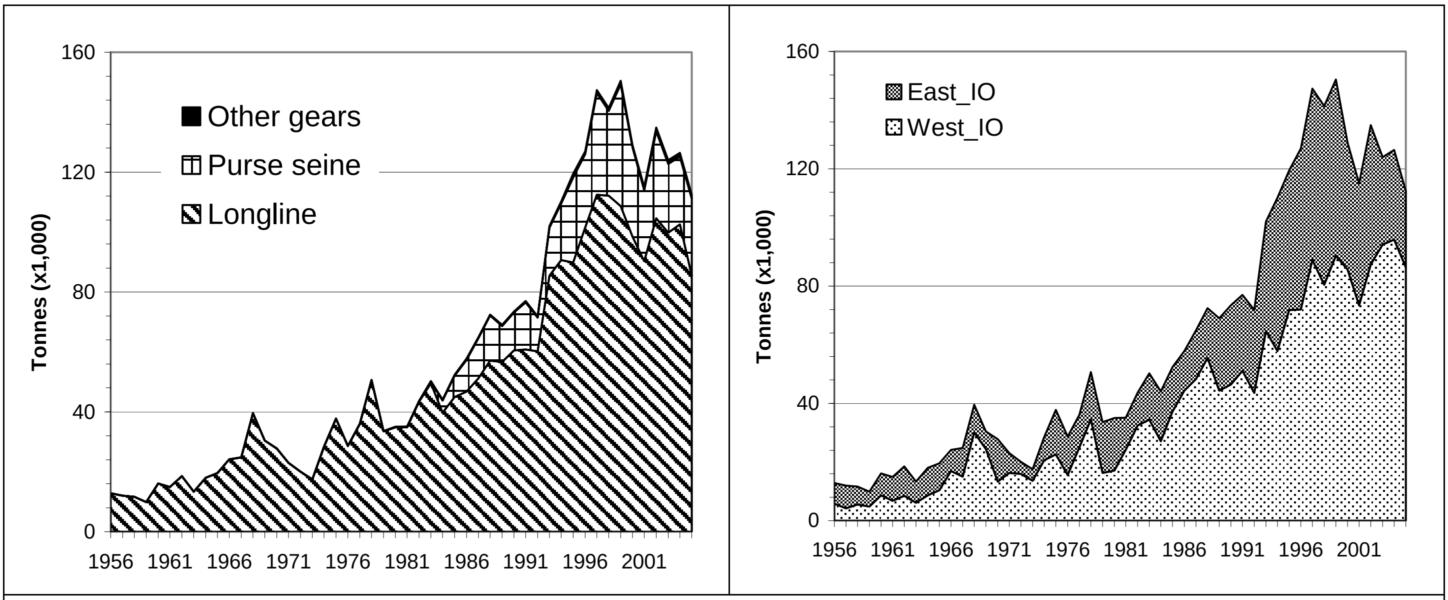


Figure 1. *Yearly catches (thousand of metric tonnes) of bigeye tuna by gear from 1956 to 2005 (left) and by area (Eastern and Western Indian Ocean, right).* *Data as of October 2006*

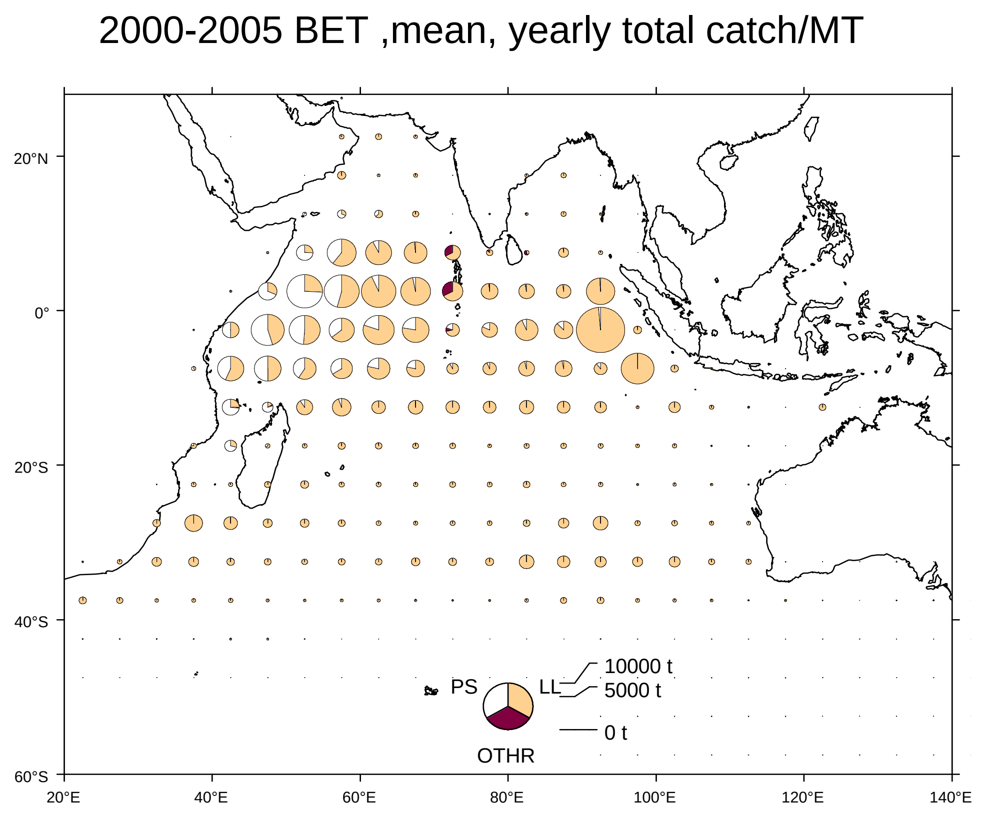


***Figure 2.** Mean of annual total catches of bigeye tuna (t) by longline and purse seine vessels operating in the Indian Ocean over the period 2000 to 2005.* *Data as of October 2006*

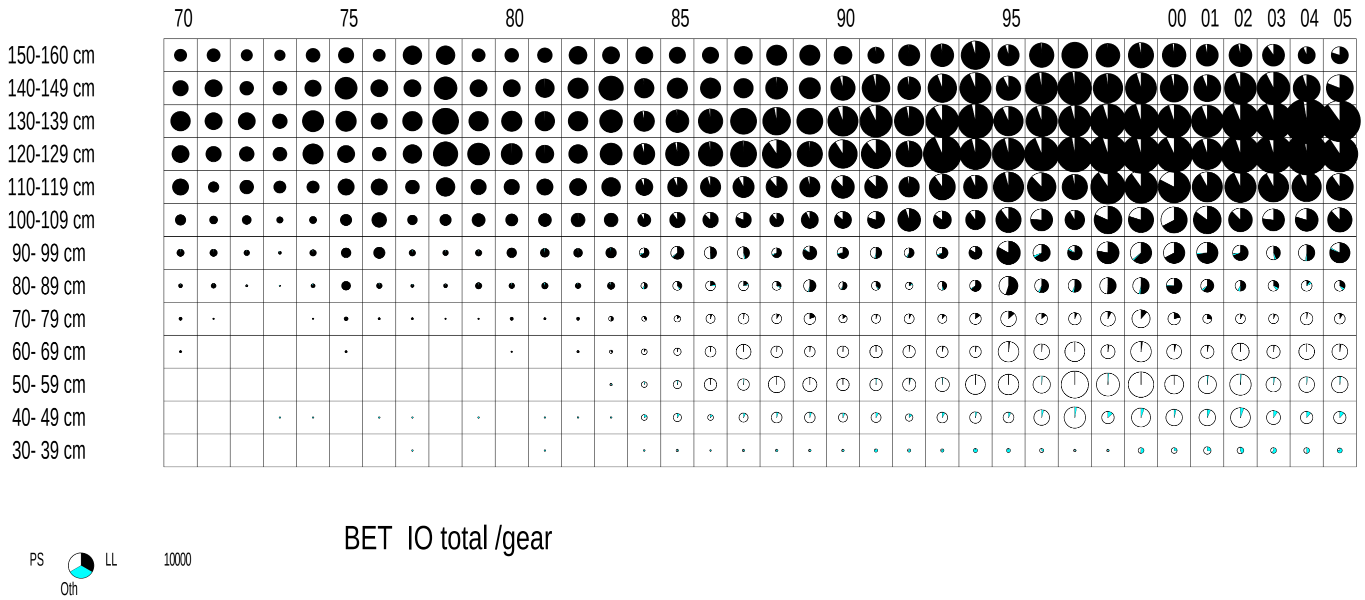


***Figure 3.** Mean catch at size of bigeye in purse seine (PS) and longline (LL) catches over the period 1996-2005*

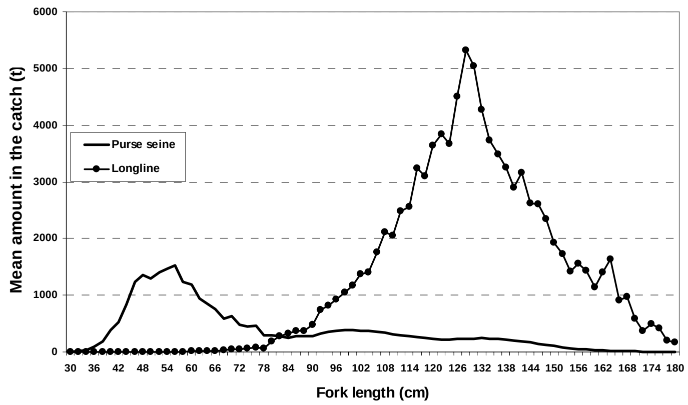


Figure 4. *Mean catch at size (weight) of bigeye measured from purse seine and longline catches from 1996-2005.*

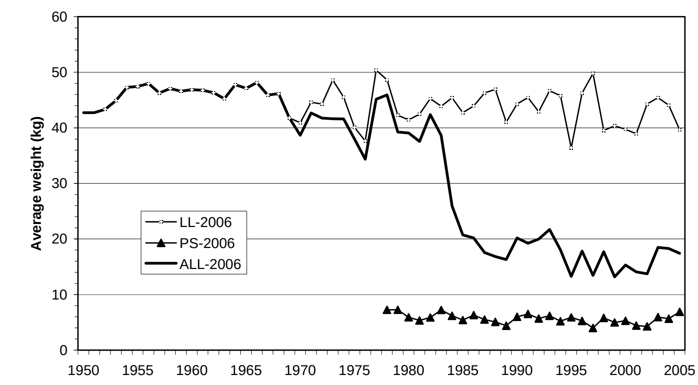


Figure 5. *Mean weight of bigeye measured from purse seine (PS) and longline (LL) catches over time.* *Data as of July 2006*

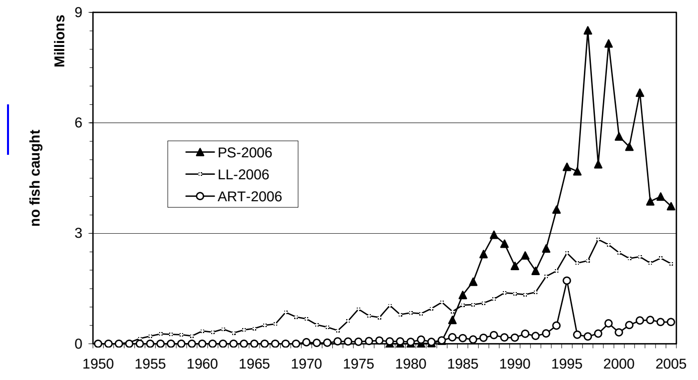


Figure 6. *Catch in numbers of bigeye tuna by gear (PS: purse seine; LL: longline).* *Data as of July 2006*

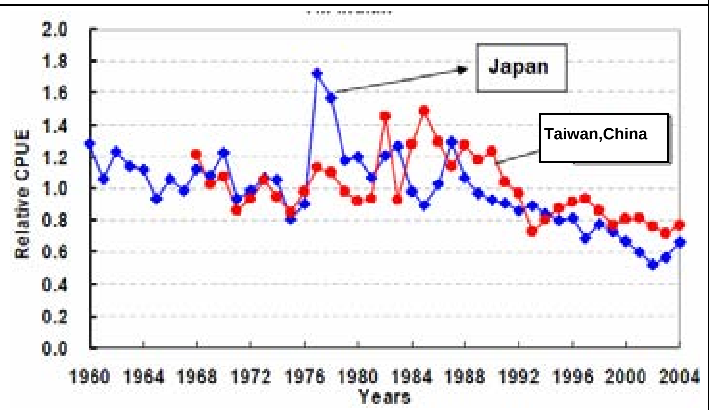


Figure 7. *Standardised CPUE indices for the Japanese and Taiwanese longline fleets in the Indian Ocean tropical waters*

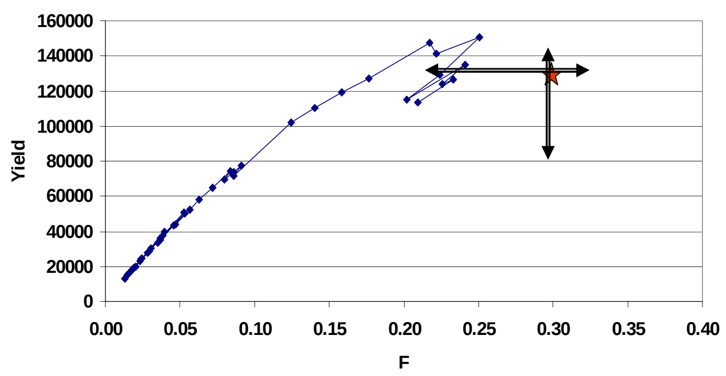


Figure 8. *2006 bigeye tuna stock assessment: Plot of annual bigeye tuna catches as a function of mean fishing mortality derived from the ASPIC model. The star represents MSY and the arrowed lines represent the associated uncertainty (source A. Fonteneau).*

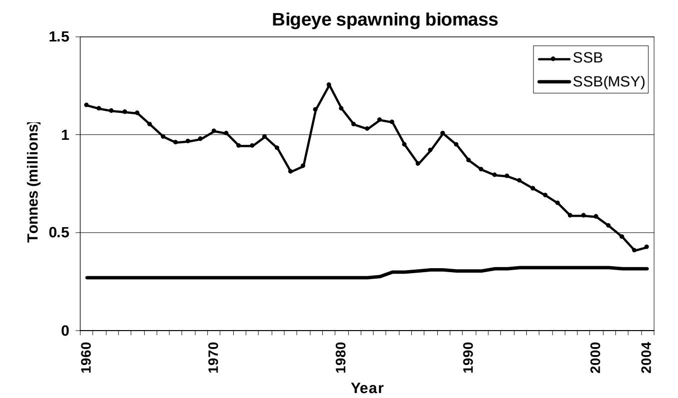


Figure 9. *2006 bigeye tuna stock assessment (ASPM): Spawning stock trajectories relating estimates of annual spawning stock size and the estimated maximum sustainable yield of the spawning stock biomass.*

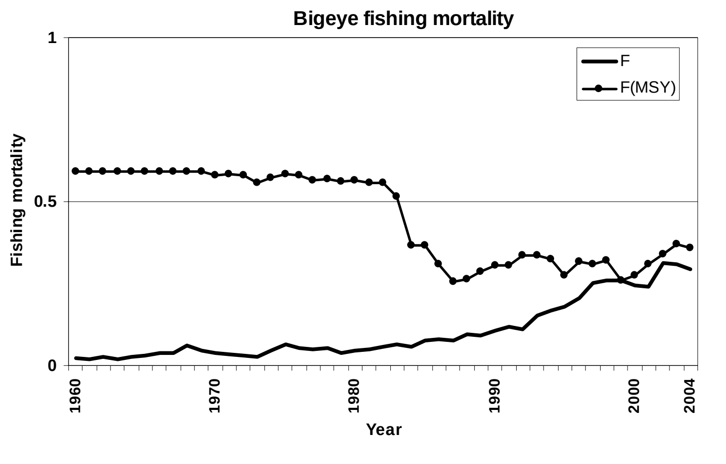


Figure 10. *2006 bigeye tuna stock assessment (ASPM): Fishing mortality trajectories relating estimates of annual fishing mortality and the estimated maximum sustainable level of fishing mortality.*

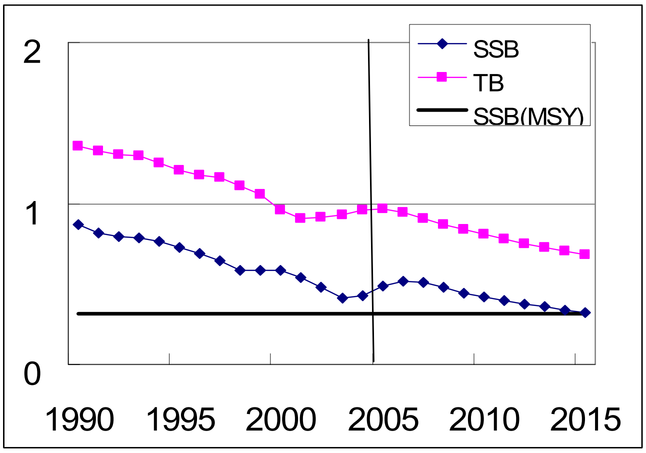
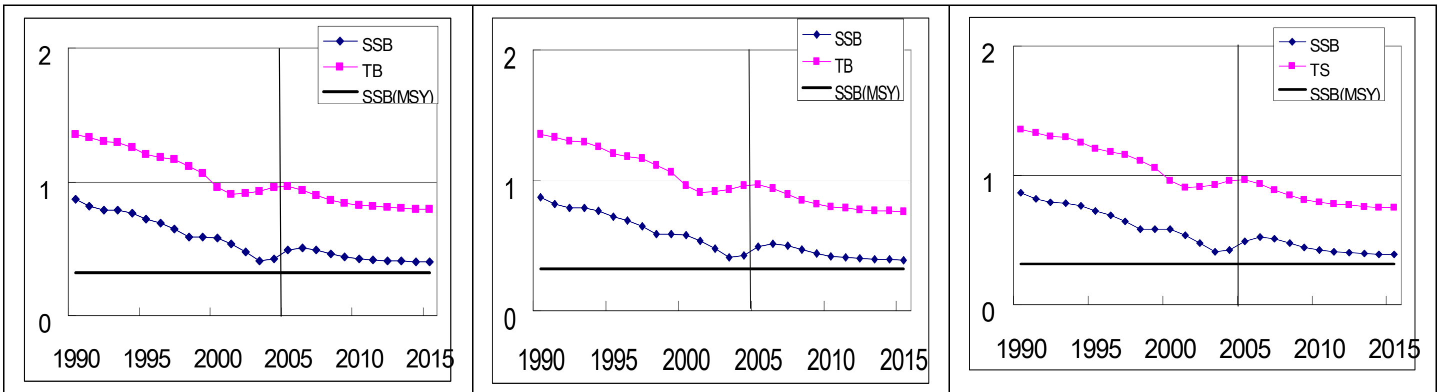


Figure 11. *2006 bigeye tuna stock assessment: Forward projections from the ASPM model illustrating trends in total biomass and spawning biomass for bigeye tuna in the Indian Ocean if catches were maintained at the 2004 level.*



(A) F (2004) = 0.293 | **(B) F (2000-2002) = 0.265** | **(C) F (1998-2001) = 0.251**

Figure 12. *2006 bigeye tuna stock assessment: Forward projections from the ASPM model illustrating trends in total biomass and spawning biomass for bigeye tuna in the Indian Ocean at various levels of fishing mortality (a) F in 2004 (b) F between 2000-02 (c) F between 1998 and 2001.*

Executive summary of the status of the skipjack tuna resource

(As adopted by the IOTC Scientific Committee 10 November 2006)

BIOLOGY

Skipjack tuna (*Katsuwonus pelamis*) is a cosmopolitan species found in the tropical and subtropical waters of the three oceans. It generally forms large schools, often in association with other tunas of similar size such as juveniles of yellowfin and bigeye.

Skipjack exhibits characteristics that result in a higher productivity when compared to other tuna species. This species has a short lifespan (probably up to 5 years) and is exploited during a short period (probably less than three years), a high fecundity, and spawns opportunistically throughout the year in the whole interquatorial Indian Ocean (north of 20°S, with surface temperature greater than 24°C) when conditions are favorable. The size at first maturity is about 41-43 cm for both males and females (and as such most of the skipjack taken by the fisheries are fish that have already reproduced).

Little is known about the growth of skipjack, and no new information or document on biology were presented at the working party. It is still a priority to gain more knowledge on the skipjack time-and-space variability in growth patterns.

In the absence of any stock structure information, a single Indian Ocean stock is assumed. However, skipjack appears to be less migratory than the other tunas. Given these biological characteristics and the relatively localised areas where fishing takes place (Figure 1), smaller management units for skipjack could be considered by managers.

Because of the above characteristics, skipjack tuna stocks are considered to be resilient and not prone to overfishing.

FISHERIES

Catches of skipjack increased slowly from the 1950s, reaching around 50,000 t at the end of the 1970s, mainly due to the activities of baitboats (or pole and line) and gillnets. The catches increased rapidly with the arrival of the purse seiners in the early 1980s, and skipjack became one of the most important tuna species in the Indian Ocean. Annual total catches reached around 400,000 t in the mid-1990's and have fluctuated between 500,000 – 580,000 t since 1999 (Figure 2 and Table 1). Preliminary data indicate that catches in 2005 may have been the highest reported in the history of the fishery (581,700 t).

It should be noted that an important amount of the skipjack catch (an average of 75,000 t since 2000) is estimated from data (mainly from some artisanal fisheries) which do not identify the species in the catch. Figure 3 illustrates the evolution of the importance of the catch which has to be dis-aggregated.

In recent years, the proportions of the catch taken by the industrial purse seine fishery and the various artisanal fisheries (baitboat, gillnets and others) have been fairly consistent, the majority of the catch originating from the western Indian Ocean (Figure 2). In general, there is low inter-annual variability in the catches taken in the Indian Ocean compared to those taken in other oceans.

The increase of skipjack catches by purse seiners is due to the development of a fishery in association with Fish Aggregating Devices (FADs). Currently, 80 % of the skipjack tuna caught by purse-seine is taken under FADs. Catch rates by purse seiners show an increasing trend in two of the three main fishing areas (Figure 4) possibly due to an increase in fishing power and to an increase in the number of FADs (and the technology associated with them) in the fishery.

The Maldivian fishery has effectively increased its fishing effort with the mechanisation of its pole and line fishery since 1974, and the use of anchored FADs since 1981. Skipjack represents some 75 % of its total catch, and catch rates have regularly increased since the beginning of the 1980s (Figure 5).

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

The average weight of skipjack caught in the Indian Ocean is 2.8 kg for purse-seine (2000-2005 average), 3.0 kg for the Maldivian baitboats and 4-5 kg for the gillnet (Figure 6). For all fisheries combined, it fluctuates between 3.0-3.5 kg; this is larger than in the Atlantic, but smaller than in the Pacific.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

During its last assessment in 2003, the WPTT analyzed the information available and considered that the uncertainties in the information were too large to conduct a complete assessment of the Indian Ocean skipjack tuna.

Fishery indicators

As an alternative, the WPTT decided to analyse various fishery indicators to gain a general understanding of the state of the stock. Several of these indicators were updated in 2006.

1. **Trends in catches**: The trend in catches indicate a large and continuous increase in the catches of skipjack tuna since the mid-1980's (Figure 2). This is mainly due to the expansion of the FAD-associated fishery in the western Indian Ocean. There is no sign that the rate of increase in the catches of skipjack is diminishing.
2. **Nominal CPUE Trends:** Figure 4 shows the catch and nominal CPUE trends of the purse seine fishery for three major skipjack fishing areas: East-Somalia, North-West Seychelles and Mozambique Channel. In the Somalia and North-West Seychelles areas, catches have been variable but generally increasing. In each of these areas, despite some inter annual variation, the current nominal CPUE's are around the same as those of the early 1990's. Since this is a period during which it is believed that effective purse-seine effort has increased substantially (increase of efficiency), it is likely that the true abundance in these areas has decreased. In itself, this is not unexpected given the large increase in catches over that period. However, as these areas may be source of skipjack recruitment to the Maldives artisanal fishery, there is a potential for interactions to occur between these fisheries.
3. **Average weight in the catch by fisheries:** The Working Party noted that the average weights of the skipjack taken from various areas and gears have remained relatively stable since 1991 (Figure 7). Figure 6 shows catches at size expressed as average weight from the major gears, purse seine, baitboat and gillnet and others, as well as the mean weight for the total catch. The purse seine and the baitboat fisheries take the greatest catch around 40-65 cm while catches taken from gillnet fisheries ranges from 70-80 cm.
4. **Number of 1 CWP squares visited or fished:** This indicator (Figure 8) reflects the spatial extension of a fishery. Trends observed in the number of CWP with effort or catch since 1991 suggest that the area exploited by the purse-seine fishery has changed little since 1991, apart in 1998 when a particularly strong El Niño episode resulted in a much wider spatial distribution of the fishery.

Length-based analyses

The WPTT did not develop a formal stock assessment for skipjack tuna. However, a length-based cohort analysis was carried during the meeting to analyze skipjack catches and length frequencies (Figure 9). In the 1980's, there was a marked increase of catches of smaller size fish (40-60 cm) due to the development of the purse seine fishery. The largest mode (60 cm+) reflects the artisanal fisheries (mainly the Maldives's pole-and-line one). The marked increase in the catch of large skipjack (60-70 cm) since 2000 is reflected for most gears by marked increase of the mean weight of their catches (Figure 6).

The patterns of mean fishing mortality by fish for four 5 years periods (Figure 10) illustrate the evolution of the fishery and highlight the increased mortality due to the purse seine and the artisanal fisheries in the recent period.

Interaction between skipjack fisheries and other species

Purse seiners catch 40-60 cm skipjack whereas artisanal fisheries catch 60-70 cm fish, thus the fishing pressure applied by purse seiners on smaller size skipjack is likely to affect the catches of larger sized skipjack by the artisanal fisheries. Furthermore, large numbers of juvenile bigeye and yellowfin tuna are caught in the course of purse-seine sets on FADs that target skipjack tuna. However, the fact that skipjack appears to be less migratory than the other tunas should also be considered.

Managers need to be aware that such interactions between fleets, gears and species have the potential to cause competition and conflict (e.g. the western Indian Ocean purse-seine fishery for small skipjack versus the Maldivian baitboat fishery for larger skipjack; the purse seine fishery for skipjack which catches juvenile bigeye versus the bigeye longline fishery; the purse seine catch of juvenile yellowfin on FADs versus their catch of large free school yellowfin) and affect the efficacy of management measures aimed at particular fleets or gears in isolation. These interactions have to be taken in account when management decisions are considered.

STOCK ASSESSMENT

No quantitative stock assessment is currently available for skipjack tuna in the Indian Ocean. The range of stock indicators available to the Scientific Committee do not signal that there are any problems in the fishery currently.

The SC also note that in most fisheries, declining catches combined with increasing effort are usually indicators that a stock is being exploited close or above its MSY. In the case of skipjack tuna, catches have continued to increase as effort increased. This is illustrated in the trend of yearly skipjack catches of the Indian Ocean using Relative Rate of Catch Increase (RRCI), a modified version of the Grainger and Garcia index (Figure 11). Furthermore, the majority of the catch comes from fish that are sexually mature (greater than 40 cm) and therefore likely to have already reproduced.

The SC noted that, although there might be no reason for immediate concern, it is clear that the catches cannot be increased at the current rate indefinitely. Therefore, it recommends that skipjack be monitored regularly.

MANAGEMENT ADVICE

The high productivity life history characteristics of skipjack tuna suggest this species is resilient and not prone to overfishing, and the stock status indicators indicate that there is no need for immediate concern about the status of skipjack tuna.

SKIPJACK TUNA SUMMARY

Maximum Sustainable Yield:	unknown
Preliminary catch in 2005 *(data as of October 2006)*	582,000 t
Catch in 2004	530,000 t
Mean catch over the last 5 years (2001-05)	544,000 t
Current Replacement Yield:	-
Relative Biomass (B_{cur}/B_{MSY}):	unknown
Relative Fishing Mortality (F_{cur}/F_{MSY}):	unknown

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

Table 1. *Best scientific estimates of the catches of skipjack tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1956-2005 (in thousands of tonnes).Data as of October 2006*

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Purse seine	France																										0.2	1.0
	NEI-Other																											
	Japan																						0.1	0.9	0.6	0.4	0.1	0.5
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.8	2.7
	Total																						0.1	0.9	0.6	1.4	2.0	4.2
Baitboat	Maldives	9.0	10.0	10.0	10.0	9.0	8.0	8.0	8.0	8.0	14.1	16.9	18.9	17.5	19.6	27.6	28.0	17.5	19.5	22.5	14.9	18.6	13.7	13.2	17.3	22.2	19.6	15.3
	Other Fleets	1.7	1.6	1.7	1.6	1.6	2.1	2.1	2.2	2.3	2.6	2.8	2.7	2.9	3.1	0.3	0.0	0.4	5.0	10.9	2.2	0.1	0.6	0.8	0.4	0.0	0.2	1.3
	Total	10.7	11.6	11.7	11.6	10.6	10.1	10.1	10.2	10.3	16.7	19.7	21.6	20.4	22.7	27.9	28.0	17.9	24.6	33.4	17.1	18.7	14.3	14.0	17.6	22.2	19.9	16.6
Longline	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gillnet	Sri Lanka	1.3	1.6	1.8	1.9	2.4	3.0	4.5	6.1	5.8	5.6	6.4	7.1	8.0	8.9	6.9	5.0	8.8	10.5	9.3	7.2	12.7	12.6	14.8	12.4	16.3	18.4	18.0
	Indonesia	1.1	1.1	1.1	1.1	1.1	1.4	1.4	1.5	1.6	1.7	1.9	1.8	1.9	2.1	3.8	4.0	6.3	6.9	9.0	16.5	20.9	28.4	22.1	26.8	35.9	40.8	41.0
	Pakistan	0.7	1.9	0.9	0.9	1.1	1.0	1.6	2.4	3.4	3.6	4.9	4.7	4.7	4.3	3.9	3.2	3.8	3.0	4.1	4.5	4.2	3.8	2.2	3.8	1.8	2.7	3.4
	Other Fleets	0.2	0.2	0.2	0.2	0.3	0.4	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.7	0.7	2.9	1.0	1.2	2.4	1.5	1.9	2.6	0.1	1.9	2.6
	Total	3.3	4.7	4.0	4.1	4.9	5.8	7.7	10.2	10.9	11.2	13.2	13.8	14.8	15.4	15.0	12.9	19.7	23.3	23.4	29.5	40.3	46.2	41.0	45.5	54.0	63.8	65.0
Line	Indonesia	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	1.1	1.2	1.7	1.9	2.6	5.1	6.5	1.1	0.9	1.4	1.7	2.5	3.6
	Other Fleets	0.4	0.4	0.4	0.5	0.6	0.7	1.0	1.3	1.2	1.2	1.4	1.5	1.8	1.9	3.1	2.7	3.0	3.5	3.4	3.4	4.6	4.1	4.1	3.8	4.6	5.0	3.2
	Total	0.6	0.6	0.6	0.7	0.8	0.9	1.2	1.5	1.5	1.5	1.7	1.9	2.1	2.3	4.2	3.9	4.7	5.4	6.0	8.5	11.1	5.3	5.0	5.2	6.3	7.5	6.8
All	Total	14.7	16.9	16.3	16.3	16.3	16.8	19.0	22.0	22.9	29.4	34.7	37.3	37.4	40.4	47.3	44.9	42.5	53.3	63.1	55.6	70.8	66.8	61.9	70.0	85.0	94.4	94.2

Gear	Fleet	Av 00/05	Av 56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Purse seine	Spain	81.3	24.8		6.4	18.6	19.1	27.9	39.7	63.9	47.9	41.8	46.7	51.3	61.6	69.6	66.3	62.9	58.6	74.3	79.4	68.5	91.3	88.0	64.4	94.3
	France	42.1	17.6	9.4	27.3	29.8	36.1	35.6	36.1	43.1	29.0	39.4	45.0	48.2	58.4	48.7	40.1	31.3	30.3	42.7	39.9	36.3	54.4	38.9	38.0	43.2
	Seychelles	33.8	4.3									1.8	0.6					4.9	10.7	15.8	11.6	26.2	29.9	36.8	30.0	46.0
	NEI-Ex-Soviet Union	18.6	4.3								0.7		10.1	8.7	8.2	18.4	14.7	11.2	10.2	17.3	19.8	21.1	21.0	24.7	17.8	8.5
	NEI-Other	17.6	7.5	0.4	8.2	8.4	6.4	4.8	7.0	7.9	11.0	10.8	10.8	17.4	24.5	22.3	18.4	24.3	31.2	33.4	40.8	26.5	31.9	20.6	4.7	4.0
	Iran, Islamic Republic	7.6	0.9														0.8	1.0	2.0	2.7	1.6	2.9	6.7	6.7	10.7	10.7
	Japan	2.0	3.5	0.6	0.7	0.3	0.6	0.9	2.3	3.4	10.9	15.9	31.7	31.4	20.1	16.1	7.0	6.7	5.7	4.6	2.3	1.8	1.9	2.4	1.5	2.6
	Other Fleets	3.1	2.3	1.5	3.1	3.2	4.4	9.9	7.8	8.3	8.8	13.1	6.4	7.1	6.3	3.9	1.9	3.0	1.2	2.4	1.4	6.4	1.3		0.0	8.0
	Total	206.2	65.2	11.8	45.7	60.4	66.6	79.0	92.8	126.7	108.2	122.8	151.4	163.9	179.2	178.9	149.2	145.4	150.0	193.2	196.9	189.6	238.6	218.3	167.1	217.3
Baitboat	Maldives	103.5	39.8	19.3	32.3	42.2	45.1	42.6	58.2	57.8	60.7	58.3	57.6	58.0	69.0	69.9	66.2	68.1	77.8	92.3	78.8	86.8	113.9	107.5	104.5	104.5
	Other Fleets	3.4	3.1	1.2	1.0	1.0	1.0	1.3	1.7	1.2	1.5	6.7	7.0	13.9	6.8	7.4	7.4	8.7	4.3	7.2	7.5	2.7	3.2	3.1	4.0	4.0
	Total	106.8	42.9	20.5	33.3	43.2	46.1	43.9	59.9	59.0	62.2	65.0	64.6	71.9	75.8	77.3	73.6	76.8	82.1	99.5	86.3	89.5	117.0	110.6	108.5	108.5
Longline	Total	0.3	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.7	0.5	0.5
Gillnet	Sri Lanka	70.6	23.3	16.3	13.3	14.9	14.6	15.3	15.9	17.3	20.5	23.1	27.0	31.5	38.8	40.6	47.3	56.1	56.9	72.5	73.2	68.4	74.2	70.1	70.1	70.1
	Indonesia	69.4	34.4	45.0	49.4	44.1	49.3	27.8	50.2	62.9	46.2	21.7	24.1	26.7	32.2	87.5	98.8	110.6	104.8	111.8	94.8	79.9	60.8	51.3	77.6	77.6
	Iran, Islamic Republic	37.9	5.1							0.3	0.8	1.1	4.3	4.4	7.4	1.1	2.5	8.3	4.7	13.9	18.5	23.2	23.1	36.0	53.6	53.6
	Pakistan	3.4	3.7	1.1	1.2	2.0	1.5	3.7	5.6	7.5	7.6	7.5	6.1	6.9	8.1	7.1	4.4	4.6	4.5	4.8	4.6	3.6	3.3	3.2	3.5	3.5
	Other Fleets	0.6	1.4	2.7	3.6	3.4	4.0	5.6	4.8	6.2	5.8	0.6	0.7	1.2	1.2	1.5	1.1	1.6	0.6	0.7	0.9	0.4	0.5	0.6	0.8	0.8
	Total	181.9	68.0	65.2	67.6	64.4	69.4	52.5	76.5	94.2	80.9	54.1	62.2	70.7	87.8	137.9	154.0	181.1	171.5	203.7	192.1	175.5	161.8	161.2	205.5	205.5
Line	Indonesia	33.6	8.7	3.6	2.7	5.2	1.3	23.0	5.9	4.0	4.8	34.6	25.9	44.9	52.2	0.9	3.4	0.7	0.4	0.0	19.2	29.4	33.2	43.0	31.2	31.2
	Other Fleets	6.3	3.4	3.2	3.1	3.1	3.3	3.2	3.4	5.7	6.2	6.3	4.8	4.6	4.5	4.7	4.4	4.8	4.5	3.5	3.9	4.0	4.7	3.9	9.5	9.5
	Total	39.9	12.1	6.8	5.9	8.3	4.5	26.2	9.3	9.6	11.0	40.8	30.6	49.5	56.6	5.6	7.8	5.4	4.9	3.5	23.1	33.4	37.9	47.0	40.7	40.7
All	Total	544.0	191.3	106.6	153.9	179.0	190.0	204.8	241.9	293.3	266.1	284.2	312.7	362.6	406.7	407.0	392.8	417.7	417.0	509.1	507.6	496.9	563.4	546.4	531.5	581.7

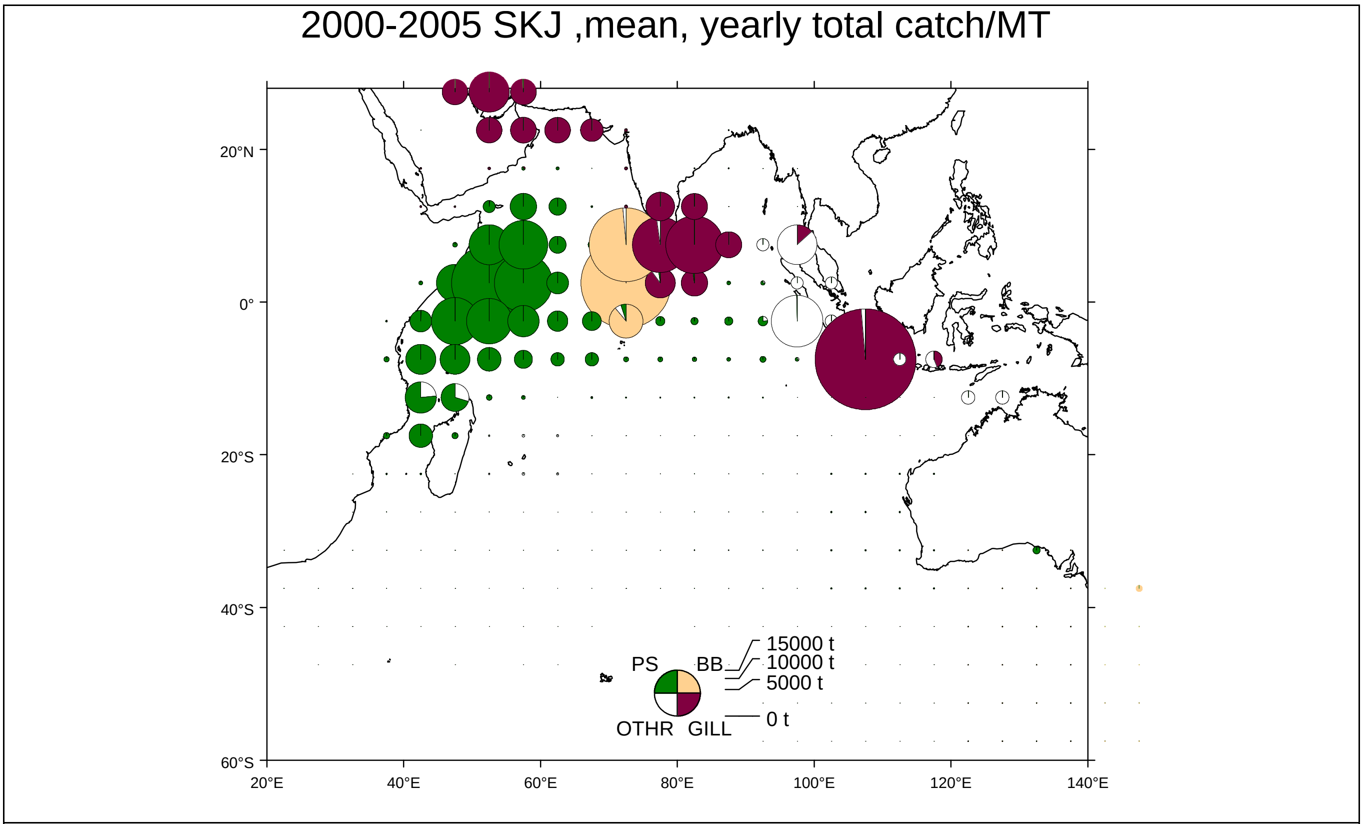


Figure 1.*: Mean spatial distribution of skipjack tuna catches in the Indian Ocean by gear type, 2000-2005. BB = bait boat (pole and line); GILL = gillnet; LL = longline; PS = purse seine.* *Data as of October 2006*

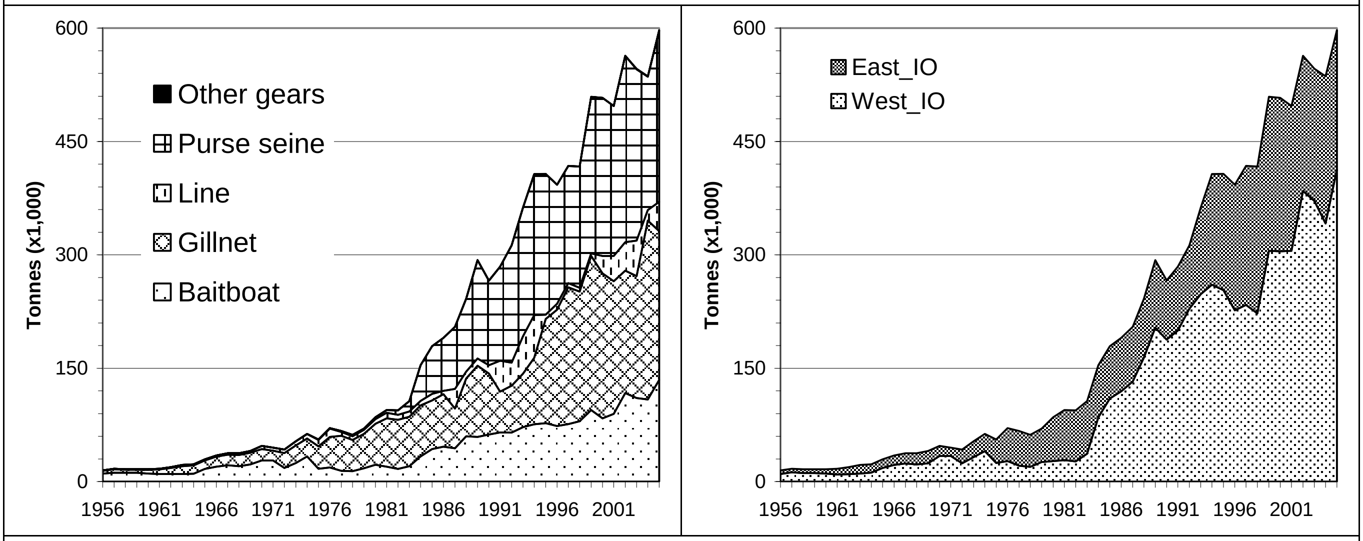


Figure 2. *Yearly catches (thousand of metric tonnes) of skipjack tuna by gear (left) and by area (Eastern and Western Indian Ocean, top right) from 1956 to 2005.* *Data as of October 2006*

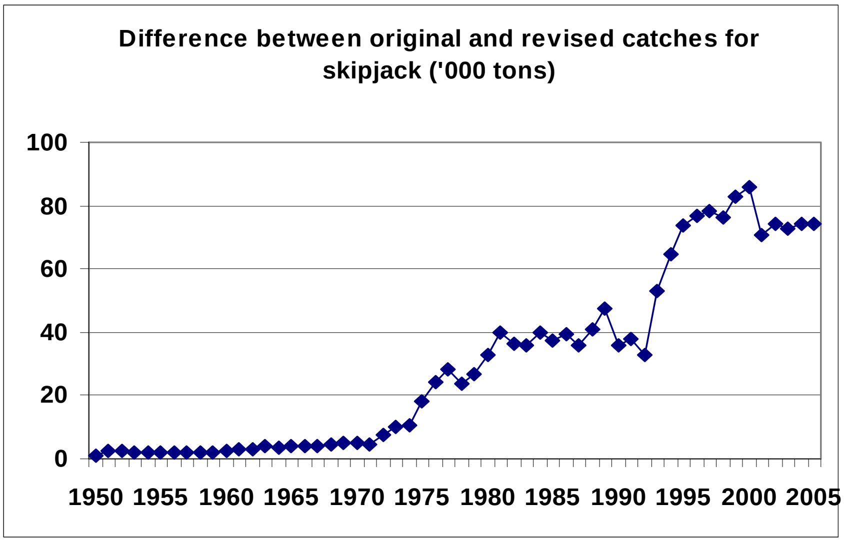


Figure 3. Total amount of the skipjack catches estimated from aggregated data

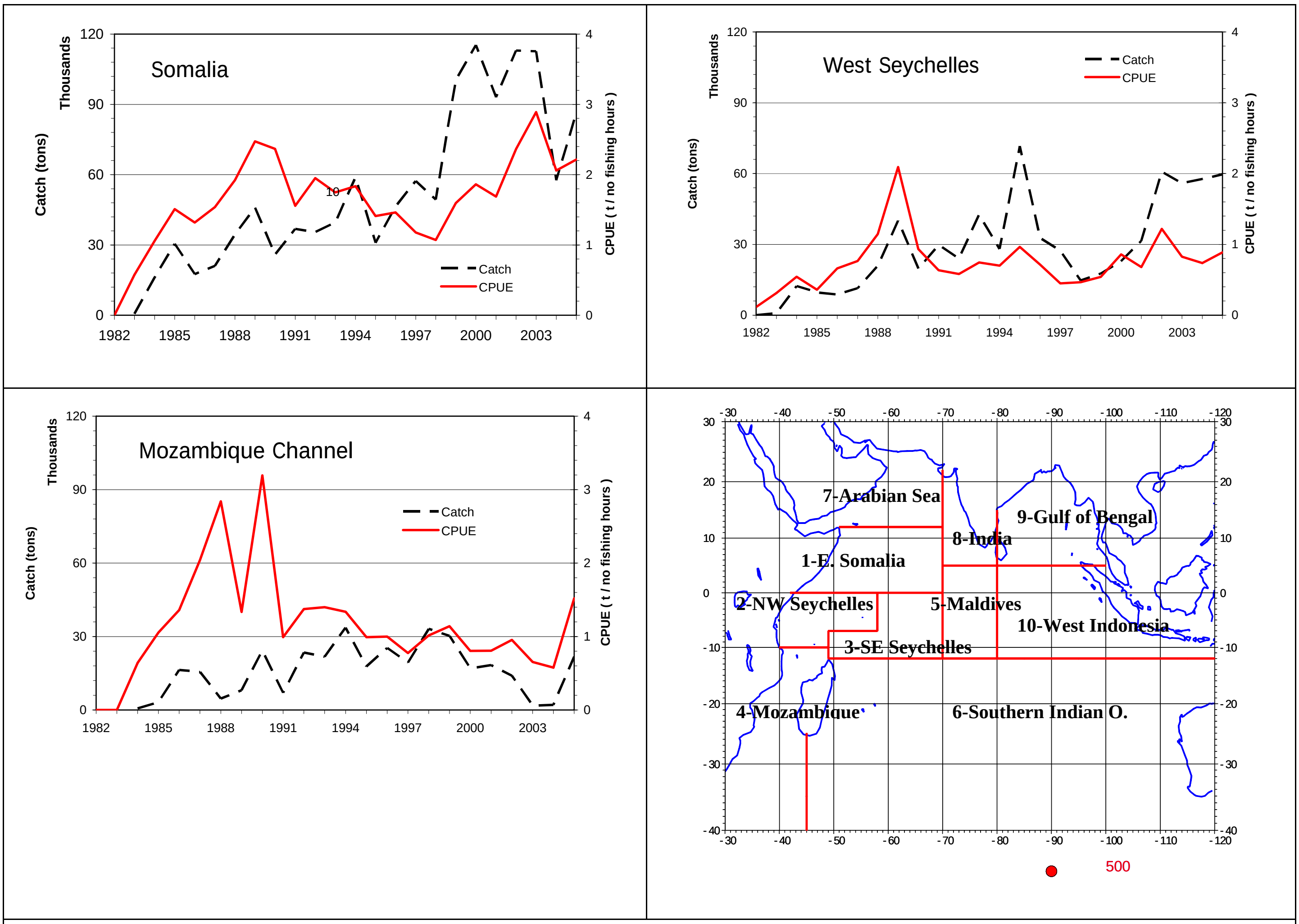


***Figure 4.**: Nominal CPUEs for three important purse seine fishing ground areas: East Somalia (top left); Mozambique Channel (top right) and North-West Seychelles (bottom left).*
Areas used for the calculation of the CPUE trends are represented (bottom right). Data as of July 2006

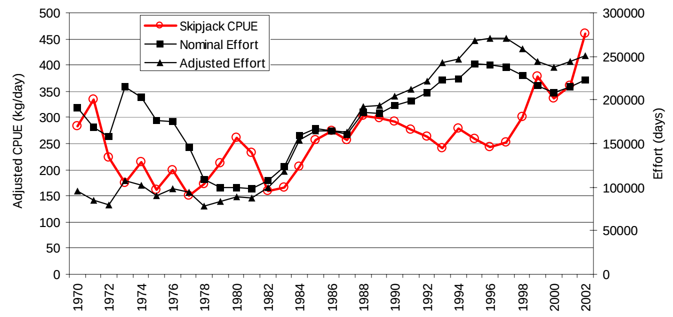


Figure 5. *Time series of CPUE, nominal and adjusted effort of the Maldivian baitboats fishery, 1970-2002 (from WPTT-03-23).*

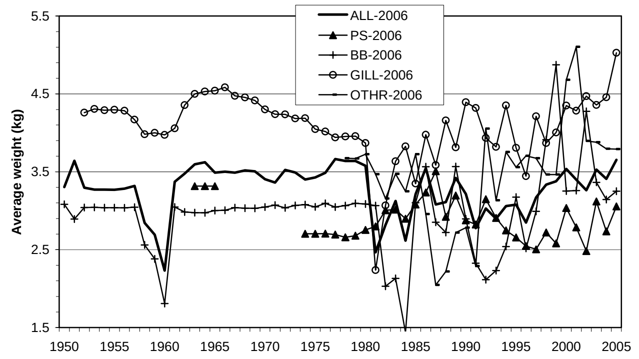


Figure 6. *Skipjack tuna average weight by main gear (from size-frequency data) and for the whole fishery (estimated from the total catch at size), 1950-2005. Data as of June 2006*

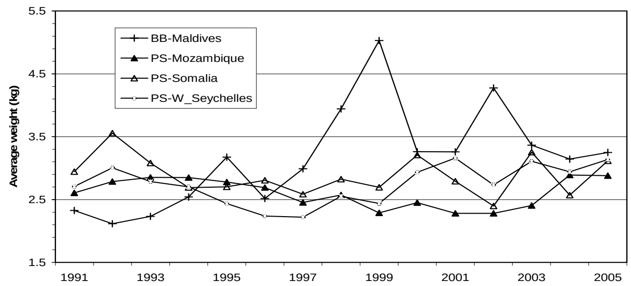


Figure 7. *Time series of average weight of skipjack caught by the purse seine and baitboat fisheries by major areas. (1991-2005). Data as of June 2006*

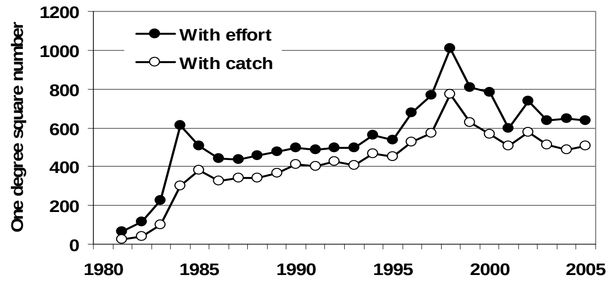


Figure 8. *Number of one degree CWP squares explored by the purse seine fishery, 1980-2005*

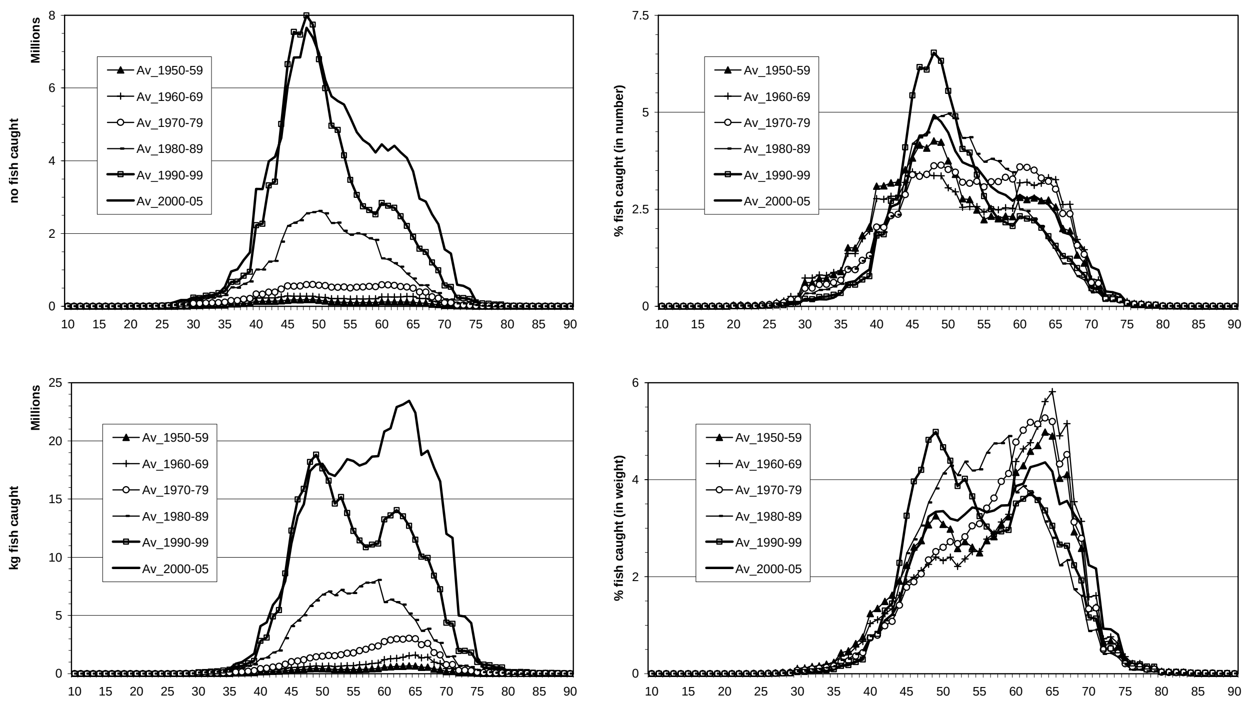
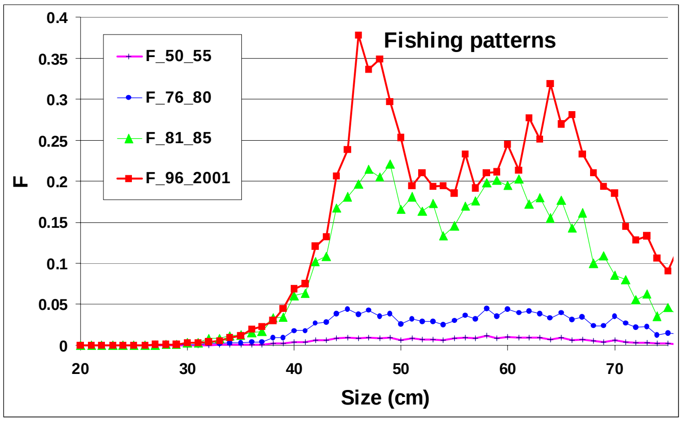


Figure 9. *Catch by size in numbers (top panels) and weight (bottom panels) for six ten-year mean periods: 1950-59, 1960-69, 1970-79, 1980-89, 1990-99 and 2000-2005. Left panels are actual numbers and right panels are in proportions. Note the two modes (40-50 and 55-65 cm) that appear in the yield frequencies but which are less visible in the number frequencies.*
Data as of June 2006



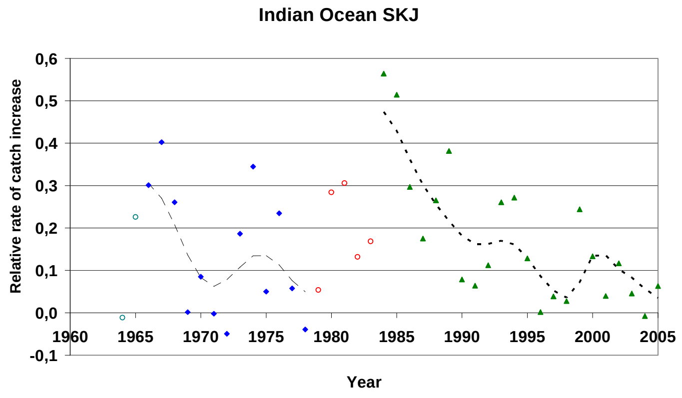


Figure 10. *Estimated mean fishing mortality by size for four periods: 1950-55, 1976-80, 1981-85, and 1996-2001.*	***Figure 11.*** *Relative Rate of Catch Increase (RRCI) for skipjack, 1960-200)*

Executive summary of the status of the yellowfin tuna resource

(As adopted by the IOTC Scientific Committee 10 November 2006)

BIOLOGY

Yellowfin tuna *(Thunnus albacares)* is a cosmopolitan species distributed mainly in the tropical and subtropical oceanic waters of the three major oceans, where it forms large schools. The sizes exploited in the Indian Ocean range from 30 cm to 180 cm fork length. Smaller fish (juveniles) form mixed schools with skipjack and juvenile bigeye tuna and are mainly limited to surface tropical waters, while larger fish are found in surface and sub-surface waters. Intermediate age yellowfin are seldom taken in the industrial fisheries, but are abundant in some artisanal fisheries, mainly in the Arabian Sea.

Stock structure is unclear, and a single stock with complete mixing is usually assumed for stock assessment purposes. Longline catch data indicates that yellowfin are distributed continuously throughout the entire tropical Indian Ocean, but some more detailed analysis of fisheries data suggests that the stock structure may be more complex and that mixing may be incomplete. A study of stock structure using DNA was unable to detect whether there were subpopulations of yellowfin tuna in the Indian Ocean.

Spawning occurs mainly from December to March in the equatorial area (0-10°S), with the main spawning grounds west of 75°E. Secondary spawning grounds exist off Sri Lanka and the Mozambique Channel and in the eastern Indian Ocean off Australia. Yellowfin size at first maturity has been estimated at around 100 cm, and recruitment occurs predominantly in July. Newly recruited fish are primarily caught by the purse seine fishery on floating objects. Males are predominant in the catches of larger fish at sizes than 150 cm (this is also the case in other oceans).

There are no direct estimates of natural mortality (M) for yellowfin in the Indian Ocean. In stock assessments, new estimates of M at length based on those from other oceans have been used. These were then converted to estimates of M at age using the two growth curves. This indicated a higher M on juvenile fish than for older fish.

There is little information on yellowfin movement patterns in the Indian Ocean, and what information there is comes from analysis of fishery data, which can produce biased results because of their uneven coverage. However, there is good evidence that medium sized yellowfin concentrate for feeding in the Arabian Sea. Feeding behaviour is largely opportunistic, with a variety of prey species being consumed, including large concentrations of crustacea that have occurred recently in the tropical areas and small mesopelagic fishes which are abundant in the Arabian Sea.

FISHERY

Catches by area, gear, country and year from 1956 to 2005 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 is shown in Figure 2. Most yellowfin tuna are caught in Indian Ocean north of 12°S and in the Mozambique Channel (north of 25°S).

Although some Japanese purse seiners have fished in the Indian Ocean since 1977, the purse seine fishery developed rapidly with the arrival of European vessels between 1982 and 1984. Since then, there has been an increasing number of yellowfin tuna caught although a larger proportion of the catches is made of adult fish, when compared to the case of the bigeye tuna purse-seine catch. Purse seiners typically take fish ranging from 40 to 140 cm fork length (Figure 3) and smaller fish are more common in the catches taken north of the equator (Figure 4). Catches of yellowfin increased rapidly to around 131,000 t in 1993. Subsequently, they fluctuated around that level, until 2003 and 2004 when they were substantially higher (227,000 t and 233,800 t, respectively). In recent years, catches appear to be higher in the first quarter of the year (Figure 5). The amount of effort exerted by the EU purse seine vessels (fishing for yellowfin and other tunas) varies seasonally and from year to year. Since 2000 between 800 and 1200 boat days per month were fished annually (Figure 6).

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

The longline fishery started in the beginning of the 1950's and expanded rapidly over the whole Indian Ocean. It catches mainly large fish, from 80 to 160 cm fork length (Figure 1c), although smaller fish in the size range 60 cm – 100 cm have been taken by longliners from Taiwan,China since 1989 in the Arabian Sea. The longline fishery targets several tuna species in different parts of the Indian Ocean, with yellowfin and bigeye being the main target species in tropical waters. The longline fishery can be subdivided into an industrial component (deep-freezing longliners operating on the high seas from Japan, Korea and Taiwan,China) and an artisanal component (fresh tuna longliners). The total longline catch of yellowfin reached a maximum in 1993 (196,000 t). Since then, catches have typically fluctuated between 80,000 t and 123,000 t.

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

Yellowfin catches in the Indian Ocean during 2003, 2004 and 2005 were much higher than in previous years, while bigeye catches remained at their average levels. Purse seiners currently take the bulk of the yellowfin catch — mostly from the western Indian Ocean. In 2003, 2004 and 2005, purse seine total catches were around 227,000 t and 234,000 t and 202,000 t, respectively — about 50% more than the previous largest purse seine catch, which was recorded in 1995. Similarly, artisanal yellowfin catches have been near their highest levels and longliners have reported higher than normal catches in the tropical western Indian Ocean during this period.

Yellowfin catches in number by gear (purse seine, longline and bait boat) are reported in Figure 7. Current estimates of annual mean weights of yellowfin caught by different gears and by the whole fishery are shown in Figure 8. After an initial decline, mean weights in the whole fishery remained quite stable from the 1970s to the early 1990s. Since 1993, mean weights in the catches in the industrial fisheries have declined. Prior to 2003, although total catch in biomass has been stable for several years, catches in numbers have continued to increase, as there has been more fishing effort directed towards smaller fish. As described above, this situation changed during 2003 and 2004; where most of the very large catches were obtained from fish of larger sizes.

AVAILABILITY OF INFORMATION FOR ASSESSMENT PURPOSES

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

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

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

The two standardized longline CPUE series showed similar trends, with an initial steep decline, over a period when catches were relatively low and stable, followed by stable standardized CPUEs since the late 1970s, a period during which catches have increased strongly following the development of the purse seine fishery (Figure 9). The observed pattern of standardised longline CPUEs does not correspond well with the expected response of CPUE to changes in catch and biomass, if standardized CPUE is directly proportional to the abundance of the part of the stock exploited by the gear concerned. There are several possible explanations for this, such as changes in catchability or behaviour, or the population existing in two fractions with differential availability to purse seine and longline gears, or a substantial decrease in the accumulated biomass in the oldest age groups in the early years. However, current analyses are unable to distinguish which, if any, of these explanations is correct.

STOCK ASSESSMENT

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

Although there were differences in the details of results from the different assessments, the overall picture they presented was consistent, particularly in terms of estimated trends in stock biomass and fishing mortality rates. Estimated trends in the fishing mortality rates are shown in Figure 10. Estimates of catchability using the PROCEAN and CATAGE methods show a strong increasing trend since the mid-1980s for both the longline fleets and the purse-seine fleets (Figure 11). The assessment runs considered at this meeting consistently indicated that fishing mortality rates between 1992 and 2002 have been close to or at levels of F corresponding to the Fmsy estimated by the most plausible ASPM assessment. Catches during this period were in the vicinity of, or possibly above, the MSY levels estimated by PROCEAN and the most plausible ASPM assessment. Estimated catches in 2003 and 2004 were well above those MSY levels, and projections carried out indicate that these are not sustainable unless supported by very high recruitments.

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

Since the early-1980s there has also been an increase in both purse seine fishing on floating objects and artisanal fisheries which has led to a rapid increase in the catch of juvenile yellowfin. The rapid expansion, particularly on juvenile fish, is cause for concern, since it displays all the symptoms of a potentially risky situation. The increases in catches in general has not been as a result of geographic expansion to previously unfished areas, but rather as a result of increased fishing pressure on existing fishing grounds.

EXCEPTIONAL CATCHES DURING 2003, 2004 AND 2005

Yellowfin catches in the Indian Ocean have been very high in recent years. The total catch in 2003 was 455,000 t, 507,000 t in 2004 and preliminary figures indicate that the total catch of yellowfin in 2005 was over 484,000 t. These catches represented more than a 30 % increase above the average annual catch taken in the previous five years (343,400 t), and were substantially greater than the previous high in 1993 (407,000 t). These anomalous catches occurred all over the western Indian Ocean, in particular in a small area off eastern Africa, although the anomaly extended over a much wider area, from the Arabian Sea to South Africa, in both industrial (purse seine on free-swimming schools and longline) and artisanal fisheries. The fish caught were of large sizes (100-150 cm FL).The Scientific Committee discussed two possible hypotheses explaining the observed high catches, noting that it is possible that a combination of factors was responsible for this event. There are two main categories of factors:

Increase in the biomass of the population:

According to this hypothesis, there may have been several large recruitments to the population in the late 1990’s or early 2000’s that could have been responsible for the large increase in yellowfin catches. In these years, environmental conditions favourable to good recruitment may have occurred in the Indian Ocean. But recruitment is not the only process by which the biomass could increase. Additional explanations could be reduced natural mortality during some critical life stage and/or increased growth rates related to favourable environmental conditions.

The Scientific Committee noted there is no evidence from existing data of unusually large numbers of small fish being caught in the surface fisheries in the early 2000’s. This could indicate that either the juveniles from these large cohorts were present, but outside the normal purse seine fishing grounds (e.g. in the eastern Indian Ocean), or that the recent cohorts were only at average levels.

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

It is also possible that during 2003, 2004 and 2005, the catchability of large yellowfin tuna had increased. Possible factors that could have caused this include aggregation of large yellowfin tuna over a relatively small area and/or depths that made it easier for purse seiners and longliners to catch them in large quantities and technological improvements on purse-seiners that could have the schools more vulnerable to fishing. No technological improvements have been reported for industrial longliners during this period.

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

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

By the end of 2002, most purse seine vessels had new sonar equipment installed. These devices potentially enable skippers to locate schools at distances up to 5 km, both night and day. This could make schools more vulnerable to fishing, and catches could be expected to increase. However, there is no indication of similar increases in efficiency in the Atlantic Ocean, where vessels were also fitted with the same equipment. In addition, higher catches also occurred in artisanal and longline fisheries for which there is no indication of recent technological advances.

The Scientific Committee agreed that it was most likely that the increased catches were due to a combination of these two sets of factors, increased recruitment in the early 2000s and increased catchability of large yellowfin tuna during 2003, 2004 and 2005. A full assessment of the event will be undertaken once full catch data for 2005 and 2006 are available.

MANAGEMENT ADVICE

While there was greater consistency in the 2005 assessment results than previously, the Scientific Committee emphasised that there remain considerable uncertainties in the assessments, as none as yet are able to fully explain the observed trends in standardized longline CPUEs over the duration of the fishery.

In interpreting the high catches of yellowfin 2003, 2004 and 2005, the Scientific Committee noted that if the hypothesis of one or two high recruitments entering the adult stock is correct, the increased catches from these year classes are unlikely to be detrimental to the stock, but these catches would not be sustainable in the longer term unless supported by continued high recruitments. On the other hand, there could be serious consequences if the hypothesis that there was an increased catchability during this time is correct. In this case, the very large catches would represent a much higher fishing mortality and certainly would not be sustainable. Furthermore, they could lead to a sudden decline of the existing adult biomass of yellowfin tuna, potentially reducing the stock to below MSY levels. If such is the case, management action might be needed to reduce catches and fishing mortality to below the levels prevailing in 1999 – 2002 to allow the stock to recover. If, as the Scientific Committee believes, the most likely cause of the exceptional catches is a combination of these factors, then some reduction of stock biomass is to be expected in the future. However, the extent of any such reduction will only become apparent in several years following detailed stock assessments.

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) The current fishing pressure on juvenile yellowfin by both purse seiners fishing on floating objects and artisanal fisheries is likely to be detrimental to the stock if it continues, as fish of these sizes are well below the optimum size for maximum yield per recruit estimated in 2002.

2) The Scientific Committee also noted that juvenile yellowfin tuna are caught in the purse-seine fishery that targets primarily skipjack tuna. Some measures to reduce the catches of juvenile yellowfin tuna in the FAD fishery will be accompanied by a decrease in the catches of skipjack tuna.

3) Fishing mortality rates between 1999 and 2002 were probably slightly below or around FMSY, and total catches during that period, at an average level of 347,000 t, were probably close to, or possibly above MSY. Total catches in 2003, 2004 and 2005 were substantially above MSY; see above for interpretation of the possible reasons for and possible effects of these catches.

In conclusion, the Scientific Committee recommended that any further increase in both effective fishing effort and catch above average levels in 1999 - 2002 should be avoided.

YELLOWFIN TUNA SUMMARY

Maximum Sustainable Yield:	Approximately 300,000 - 350,000 t
Preliminary catch in 2005 *(data as of October 2006)*	484,700 t
Catch in 2004	506,900 t
Mean catch over five years before 2003 (1998 – 2002)	343,400 t
Current Replacement Yield	-
Relative Biomass $B_{current}$/ B_{MSY}	
Relative Fishing Mortality $F_{current}/_{FMSY}$	

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

Table 1. *Best scientific estimates of the catches of yellowfin tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1956 to 2004.* *Data as of October 2006*

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Purse seine	France																										0.2	1.0
	Other Fleets								0.0	0.0	0.0									0.1	0.2	0.2	0.3	0.5	0.4	0.5	0.4	0.6
	Total								0.0	0.0	0.0									0.1	0.2	0.2	0.3	0.5	0.4	0.5	0.6	1.6
Baitboat	Maldives	2.0	2.0	2.0	2.0	1.0	1.5	1.5	1.5	1.5	1.0	1.5	1.7	1.7	1.8	2.3	1.4	2.5	6.9	5.0	4.6	5.2	4.9	3.8	4.4	4.4	5.6	4.5
	Other Fleets															0.0		0.1	0.6	1.2	0.2					1.8	0.5	0.3
	Total	2.0	2.0	2.0	2.0	1.0	1.5	1.5	1.5	1.5	1.0	1.5	1.7	1.7	1.8	2.3	1.4	2.6	7.4	6.2	4.8	5.2	4.9	3.8	4.4	6.1	6.1	4.9
Longline	Taiwan,China[8]	1.1	1.3	1.8	2.4	2.2	2.9	3.5	3.4	2.9	2.2	4.4	3.4	22.7	21.1	14.9	11.9	11.8	5.7	4.4	4.6	3.4	8.1	4.2	3.7	3.8	4.1	4.7
	Indonesia																		0.1	0.3	0.7	1.0	1.3	1.3	1.4	2.1	2.6	2.7
	Japan	59.5	31.9	22.6	22.2	36.1	32.7	44.2	22.0	22.2	24.9	40.8	30.2	48.3	23.1	10.3	13.4	7.9	3.9	4.9	6.4	2.8	2.1	4.6	3.3	3.2	4.9	7.3
	Korea, Republic of										0.1	0.1	0.4	5.3	9.1	5.2	7.4	10.3	10.8	13.2	13.4	13.7	33.1	26.6	18.0	13.2	12.4	19.4
	Other Fleets									0.3	0.5	0.5	0.1	2.4	0.6	1.9	1.6	1.5	1.2	0.7	0.2	1.1	0.9	0.2	0.4	0.5	0.4	0.4
	Total	60.6	33.1	24.5	24.6	38.3	35.6	47.7	25.4	25.3	27.7	45.7	34.0	78.6	54.0	32.4	34.4	31.5	21.7	23.5	25.4	21.9	45.4	37.0	26.9	22.8	24.4	34.5
Gillnet	Sri Lanka	0.9	1.0	1.1	1.2	1.5	1.8	2.7	3.6	3.5	3.3	3.7	4.1	4.6	5.1	4.0	2.9	4.4	5.4	4.8	3.8	7.0	6.4	6.9	7.6	8.3	9.6	9.5
	Oman	0.5	0.5	0.5	0.7	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.9	2.9	3.4	3.8	4.0	4.4	4.1	5.0	4.8	3.5
	Pakistan	0.5	1.4	0.7	0.7	0.9	0.8	1.2	1.8	2.5	2.7	3.6	3.5	3.5	3.2	2.9	2.4	2.8	2.2	3.0	3.3	3.1	2.8	1.6	2.8	1.3	2.0	2.5
	Indonesia	0.4	0.4	0.4	0.4	0.4	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.6	0.6	1.1	1.1	1.0	1.0	1.5	3.1	4.1	4.6	4.2	2.3	3.0
	Other Fleets	0.4	0.3	0.3	0.3	0.6	0.8	0.3	0.5	0.4	0.4	0.3	0.4	0.4	0.4	0.7	1.4	1.4	5.7	1.9	2.3	4.5	2.8	3.7	5.0	3.6	0.6	1.1
	Total	2.7	3.7	3.1	3.3	3.9	4.4	5.3	7.0	7.5	7.7	8.9	9.5	10.0	10.2	8.9	8.0	10.5	15.3	13.5	13.9	19.9	19.1	20.7	24.1	22.5	19.3	19.6
Line	Yemen	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.7	0.8	0.9	1.0	1.0	1.0	1.1	0.8	0.8
	Comoros															0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
	Maldives															0.3	0.2	0.2	0.3	0.3	0.3	0.5	0.4	0.5	0.7	0.7	0.7	0.3
	Other Fleets	0.4	0.4	0.4	0.5	0.5	0.6	0.8	1.0	1.0	1.0	1.1	1.3	1.5	1.6	1.2	1.3	1.6	1.8	1.8	1.6	2.4	4.8	3.4	2.9	7.5	3.8	4.4
	Total	0.6	0.6	0.7	0.7	0.7	0.8	1.1	1.3	1.2	1.2	1.3	1.5	1.7	1.8	1.8	1.8	2.2	2.5	2.9	2.9	3.9	6.3	5.1	4.7	9.4	5.5	5.6
All	Total	65.9	39.4	30.2	30.6	43.9	42.4	55.5	35.2	35.5	37.6	57.5	46.8	92.1	67.8	45.4	45.5	46.8	46.9	46.2	47.1	51.2	76.1	67.1	60.5	61.3	55.9	66.2

[8] includes catches for the fresh tuna longline fleet from 2001 onwards

Gear	Fleet	Av01/05	Av56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Purse seine	Spain	67.7	20.8		11.5	18.4	20.0	26.3	44.9	41.1	43.7	44.0	37.8	47.8	43.1	65.1	59.4	61.0	38.6	51.9	49.4	47.7	53.4	79.0	80.8	77.5
	France	50.9	18.6	10.5	36.7	39.1	43.3	46.8	59.9	38.4	45.3	38.1	45.3	39.5	35.8	39.6	35.6	31.2	22.4	30.8	37.7	34.1	36.4	63.3	63.5	57.2
	Seychelles	29.6	3.6									0.4	0.2					2.8	7.4	9.8	11.6	12.9	16.6	33.3	48.8	36.5
	NEI-Other	15.5	6.4	0.7	8.4	9.4	6.3	5.2	7.9	4.5	11.9	11.9	8.1	15.5	19.7	19.3	16.7	21.9	20.3	25.8	27.1	19.4	19.1	24.5	10.1	4.4
	NEI-Ex-Soviet Union	10.4	2.7								0.8		5.2	8.7	5.8	14.6	11.7	9.8	5.3	11.8	10.9	9.8	6.8	15.1	13.8	6.3
	Iran, Islamic Republic	8.3	1.3										2.1	3.4	2.7	4.3	1.6	1.9	3.3	2.5	2.2	2.2	5.0	8.3	13.1	13.1
	Other Fleets	5.2	3.3	2.1	2.3	2.6	4.6	6.4	6.7	6.7	8.0	11.8	15.3	16.1	10.3	9.5	7.8	6.8	6.3	5.6	5.0	6.9	5.0	4.0	3.6	6.4
	Total	187.6	56.8	13.2	58.9	69.5	74.3	84.7	119.5	90.7	109.7	106.2	114.0	131.0	117.5	152.5	132.9	135.5	103.6	138.2	143.9	133.0	142.2	227.4	233.8	201.5
Baitboat	Maldives	14.6	6.2	7.7	8.2	6.9	6.2	7.4	5.9	5.5	4.9	7.0	8.0	9.3	12.4	11.8	11.5	12.2	13.0	12.6	10.0	11.1	16.3	16.1	14.4	15.0
	Other Fleets	0.5	0.3	0.1	0.2	0.4	0.2	0.3	0.2	0.2	0.3	0.4	0.5	0.5	0.4	0.4	0.5	0.5	0.4	0.5	0.6	0.5	0.6	0.6	0.4	0.4
	Total	15.1	6.5	7.8	8.4	7.3	6.4	7.7	6.1	5.8	5.2	7.5	8.5	9.8	12.8	12.2	12.0	12.7	13.4	13.1	10.6	11.6	16.9	16.7	14.9	15.4
Longline	Taiwan,China	41.4	16.8	5.6	5.8	7.3	16.2	22.3	22.7	22.4	31.6	30.7	56.0	88.2	34.1	23.1	27.9	18.4	23.4	17.7	17.4	26.9	33.2	29.7	49.8	67.6
	Indonesia	20.5	7.3	0.8	0.8	0.8	0.7	1.3	2.3	3.8	4.6	5.5	9.3	10.8	14.8	16.7	31.8	38.2	35.7	41.7	29.6	28.4	24.2	20.2	16.5	13.0
	Japan	15.7	15.8	7.8	7.9	9.5	10.7	8.3	9.3	4.6	6.3	4.4	5.7	5.7	9.7	8.0	12.8	15.6	16.8	14.7	15.5	13.9	14.4	17.9	16.2	16.2
	NEI-Deep-freezing	2.9	2.5			0.1	1.1	1.2	3.4	3.2	6.7	5.9	8.9	23.8	9.9	6.9	12.1	5.9	9.8	7.4	6.6	3.3	4.2	2.8	2.2	2.2
	Korea, Republic of	2.3	7.1	16.2	10.2	12.5	15.5	13.2	14.1	8.7	7.5	3.2	4.4	4.3	4.0	2.7	4.0	4.2	2.6	1.0	2.0	1.5	0.3	2.1	4.1	3.5
	NEI-Fresh Tuna	1.2	4.1							11.9	16.6	14.4	16.7	16.5	23.7	17.1	17.7	21.2	16.6	14.8	13.3	0.5	0.5	0.9	1.7	2.4
	NEI-Indonesia Fresh Tuna		2.0				0.1		2.7	10.3	12.6	12.9	15.6	12.6	16.3	8.9	3.7	4.0	0.3	0.0						
	Other Fleets	9.3	3.0	0.7	0.7	0.3	1.1	0.7	0.5	0.5	0.1	1.9	20.1	33.7	8.2	4.2	3.8	1.9	2.6	4.6	4.6	4.6	3.8	7.3	12.3	18.4
	Total	93.4	58.6	31.1	25.5	30.5	45.3	47.0	55.0	65.3	86.1	78.8	136.7	195.7	120.7	87.6	113.7	109.3	107.8	101.9	89.0	79.2	80.6	80.9	102.8	123.3
Gillnet	Sri Lanka	31.6	11.5	9.0	6.4	6.9	7.1	7.4	7.7	8.3	9.6	11.6	13.9	16.6	21.5	18.9	23.7	29.5	29.2	37.0	33.7	28.1	30.3	33.8	33.8	32.3
	Iran, Islamic Republic	29.2	6.5							1.0	2.3	3.2	12.1	13.3	19.5	22.5	28.5	20.0	18.0	24.3	13.5	18.0	19.0	29.5	39.7	39.7
	Oman	12.5	5.9	1.6	4.6	2.3	2.5	5.9	15.6	16.2	14.4	9.0	13.5	11.5	19.2	21.4	11.6	9.9	11.3	7.4	7.1	6.3	5.3	10.3	24.6	15.9
	Pakistan	3.5	2.9	0.8	0.9	1.5	2.6	2.4	3.9	8.6	3.3	4.9	3.9	2.6	2.4	2.1	3.3	3.9	3.9	9.4	5.3	4.0	3.3	3.5	3.3	3.3
	Indonesia	3.3	2.3	3.0	3.1	4.2	6.0	2.7	4.1	3.0	2.1	0.9	0.9	0.9	1.3	5.1	5.2	5.5	5.3	5.8	4.7	2.9	2.9	2.2	5.2	3.2
	Other Fleets	1.0	1.2	0.4	0.7	1.2	0.7	0.8	0.5	0.8	1.0	0.9	1.0	0.9	0.9	0.9	0.9	1.0	0.9	1.0	1.1	1.0	1.0	1.1	0.9	0.9
	Total	81.0	30.3	14.9	15.6	16.0	18.9	19.3	31.8	37.9	32.7	30.6	45.3	45.8	64.8	70.9	73.2	69.9	68.6	84.9	65.4	60.3	61.7	80.3	107.4	95.2
Line	Yemen	28.8	6.6	1.5	2.3	3.1	3.9	4.6	5.4	6.2	6.9	7.7	8.5	7.6	8.3	13.2	15.0	17.0	19.1	21.1	23.1	25.2	27.2	29.2	31.3	31.3
	Comoros	5.9	1.9	0.2	0.2	0.2	0.2	0.2	0.2	3.7	3.7	3.7	5.0	5.0	5.9	5.9	5.8	5.6	5.6	5.4	5.9	5.4	5.8	6.1	6.2	6.2
	Maldives	4.3	0.7	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.6	0.7	1.6	2.5	4.2	2.5	6.8	5.5
	Other Fleets	6.9	3.6	3.4	2.8	4.7	3.4	5.3	4.0	2.9	4.0	12.6	10.0	12.0	11.4	2.9	3.3	2.7	2.2	2.3	4.6	5.6	7.5	11.5	3.6	6.2
	Total	46.0	12.8	5.4	5.6	8.2	7.6	10.4	9.9	13.0	14.8	24.2	23.7	24.9	25.8	22.2	24.4	25.6	27.4	29.6	35.2	38.8	44.8	49.4	47.8	49.2
All	Total	423.1	164.9	72.4	113.9	131.5	152.4	169.1	222.2	212.7	248.5	247.2	328.3	407.1	341.6	345.4	356.1	352.9	320.8	367.7	344.2	322.8	346.2	454.8	506.9	484.7

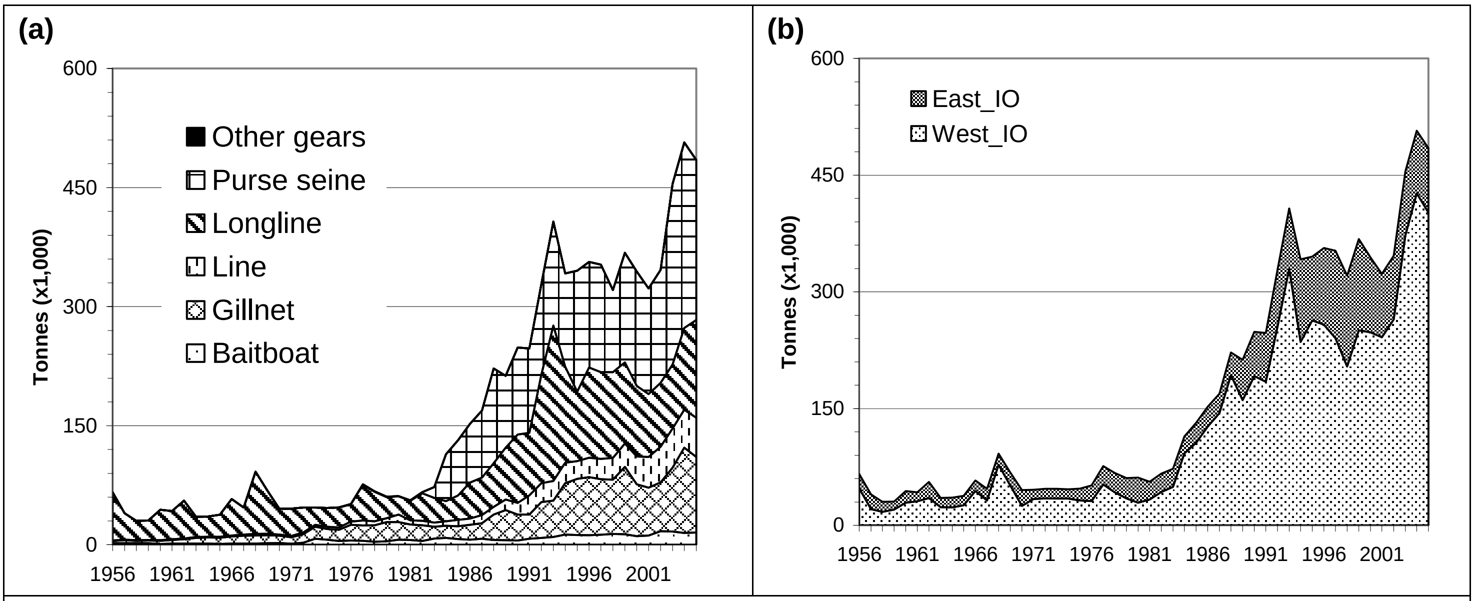


Figure 1. *Yearly catches (tonnes x 1000) of yellowfin by (a) gear and (b) area from 1956 to 2005.*

Data as of October 2006

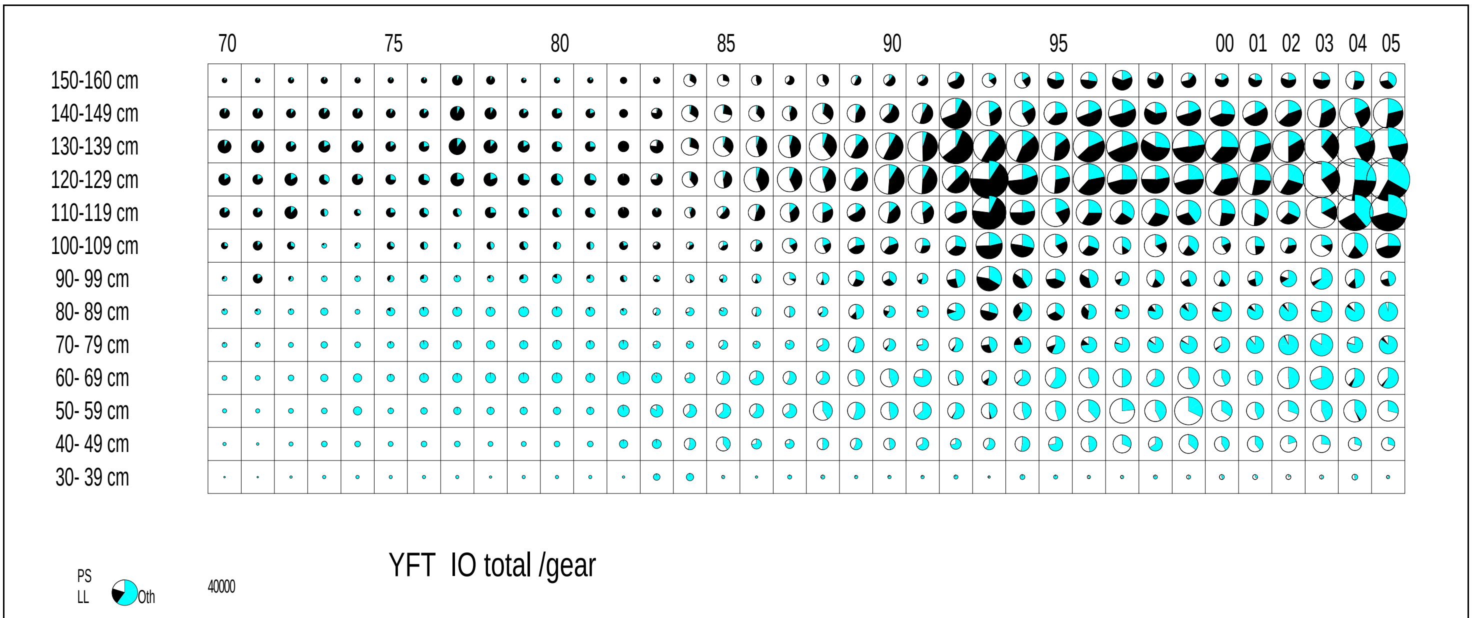


Figure 3. *Yellowfin tuna**:** total catches at size in the Indian Ocean by gear from 1970 to 2005*

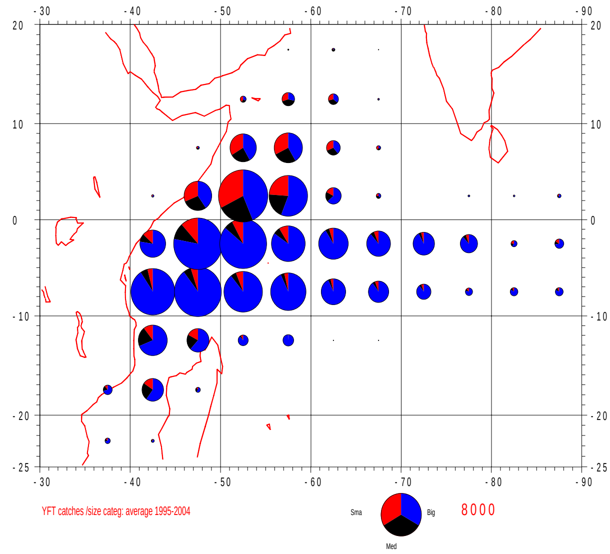


***Figure 4.** Yellowfin tuna: location of catches of small (<3 kg) medium (3-10 kg) and large (>10 kg) sized fish taken by purse seiners from 1995 to 2004. Legend pie represents 8000 t.*

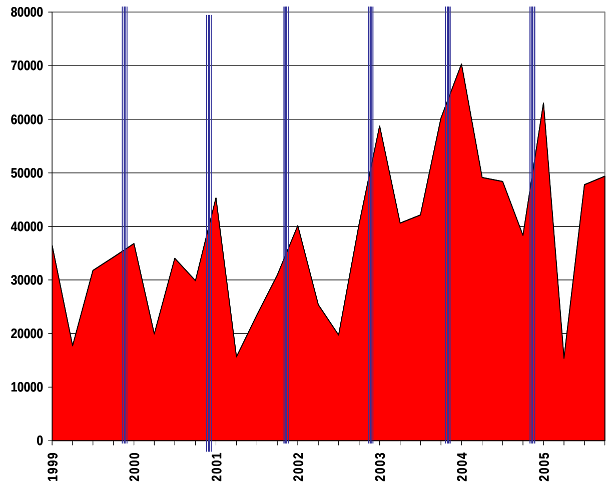


***Figure 5.** Yellowfin tuna: quarterly catches by purse seiners in the Indian Oceans over the period 1999 to 2005*

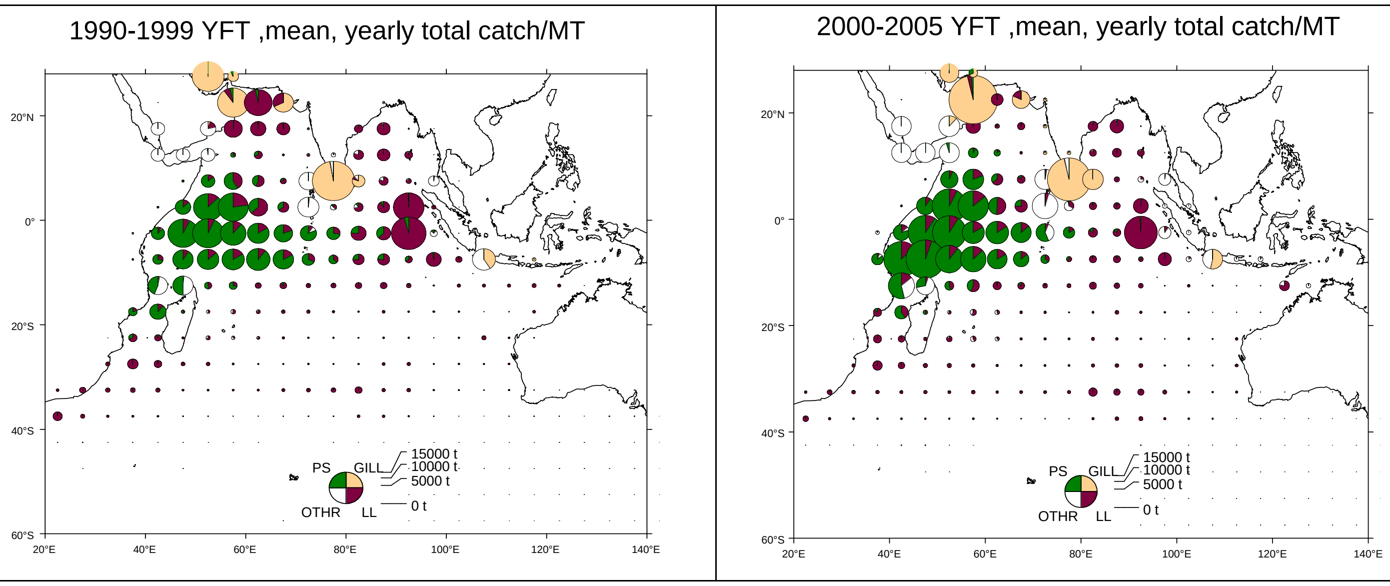
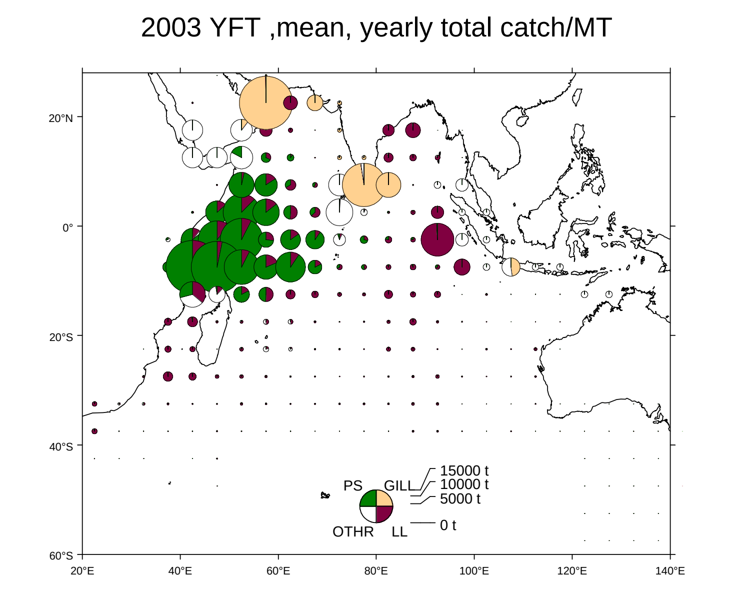
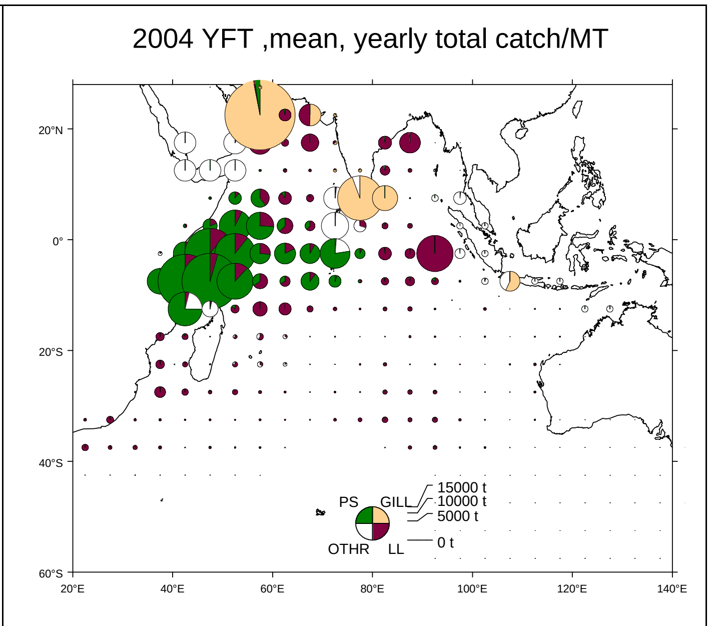


***Figure 2a.** Location and size of yellowfin tuna catches in the Indian Ocean by gear type. GILL = gillnet, LL = longline, PS = purse seine. Data as of October 2006*





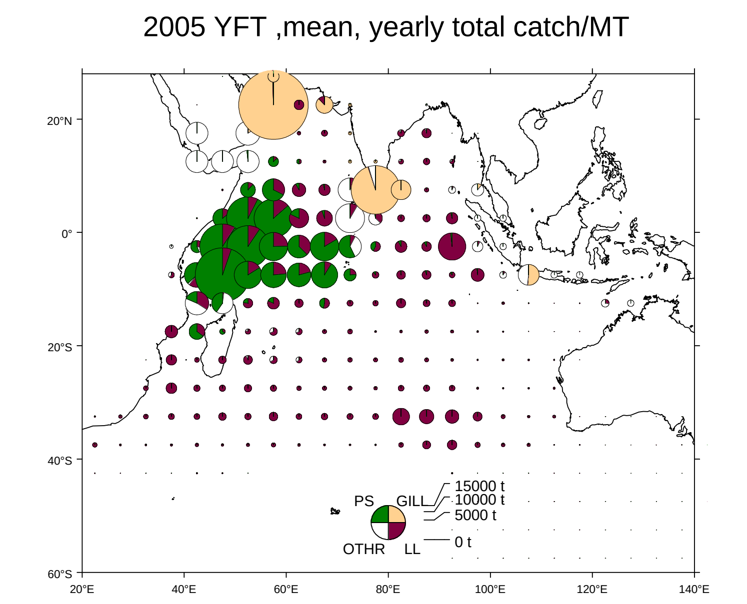


Figure 2b. *Location and size of yellowfin tuna catches in the Indian Ocean by gear type for 2003, 2004 and 2005 when extraordinarily large catches were taken. GILL = gillnet, LL = longline, PS = purse seine.*

Data as of October 2006

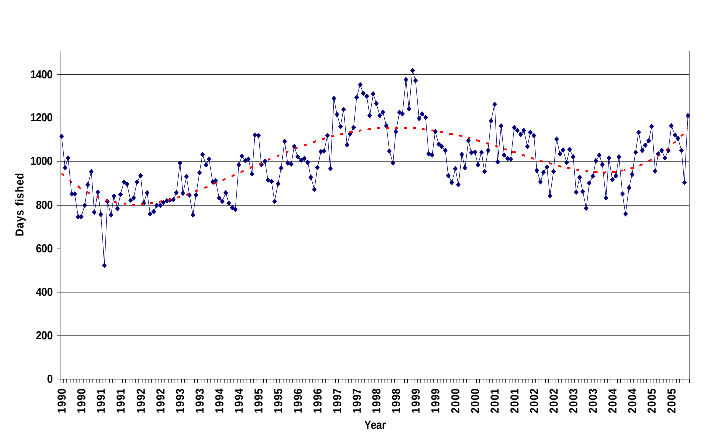


Figure 6. *Amount of effort (boat days per month) exerted by the EU purse seine fleet in the Indian Ocean since.*

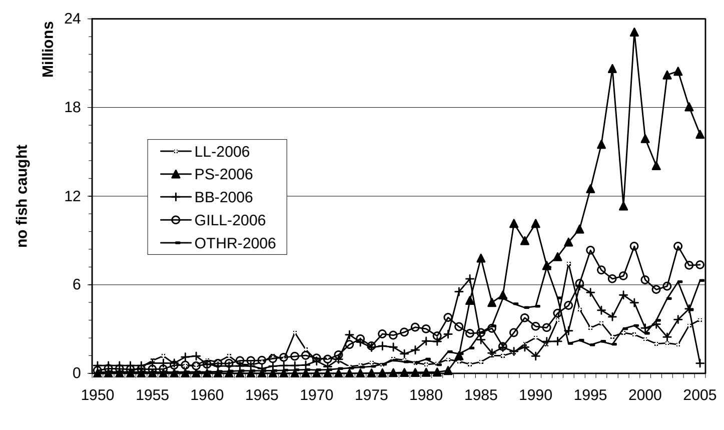


Figure 7. *Numbers of yellowfin caught by gear-type.*

Data as of July 2006

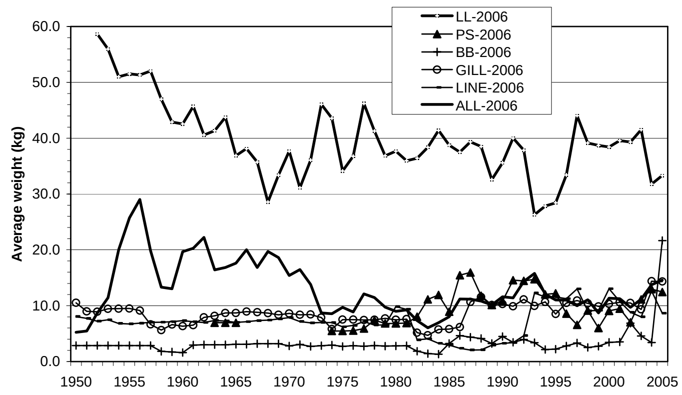


Figure 8. *Mean weight (kg) of yellowfin individuals in the catch by gear and for all gear-types (estimated from the total catch at size). PS: purse seine, BB: bait boat, LL: longline, GIL: gillnet, OTH: other.* *Data as of July 2006*

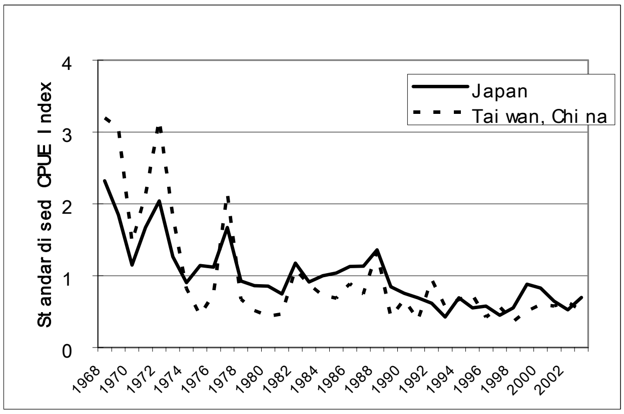


Figure 9. *Yearly standardised CPUE indices for yellowfin tuna based on the Japanese and Taiwan,China longline catch rates in the Indian Ocean.*

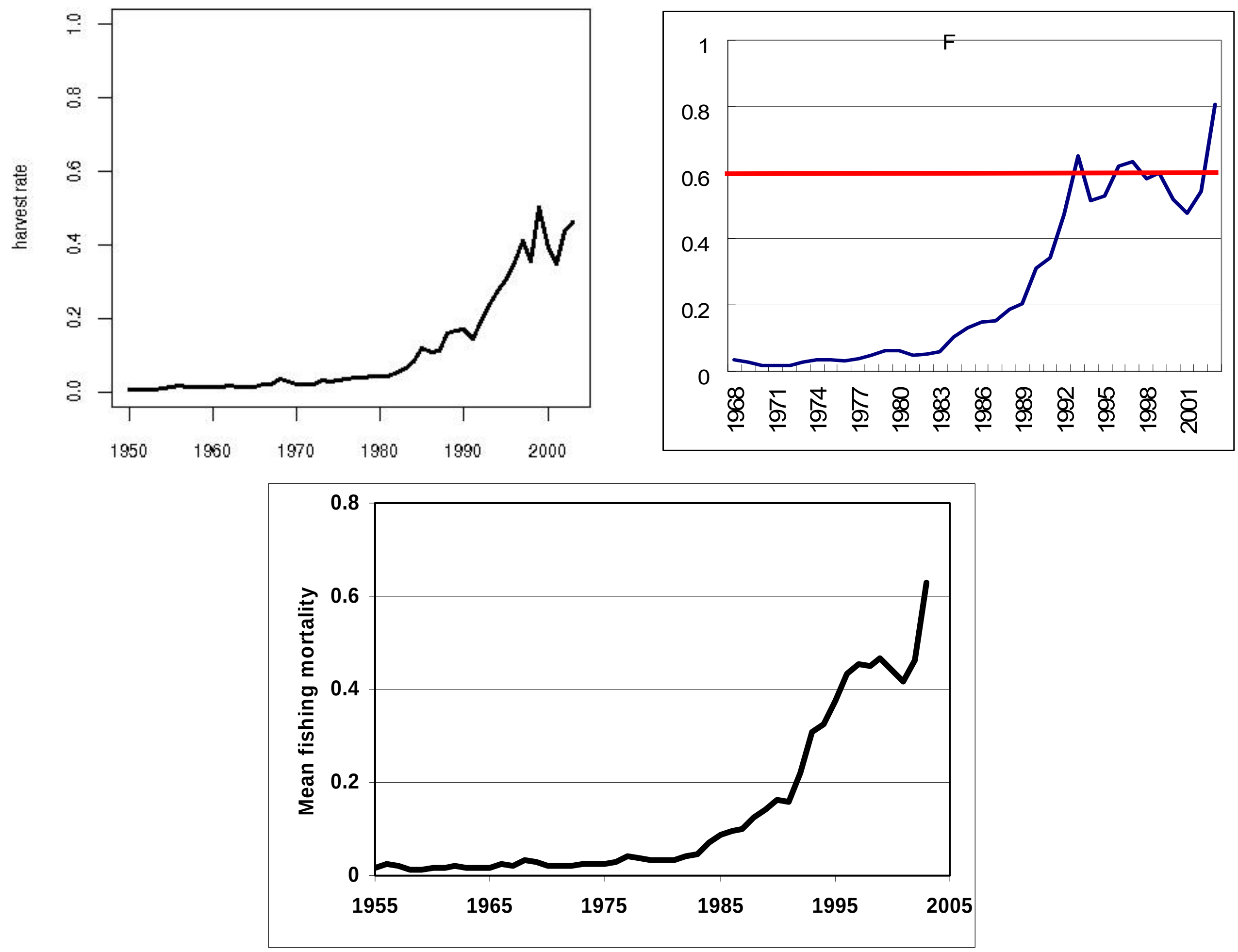


Figure 10. *Yellowfin fishing mortality rate trends from each of the models in 2005. Bayesian (top left), ASPM (top right) and CATAGE (bottom).*

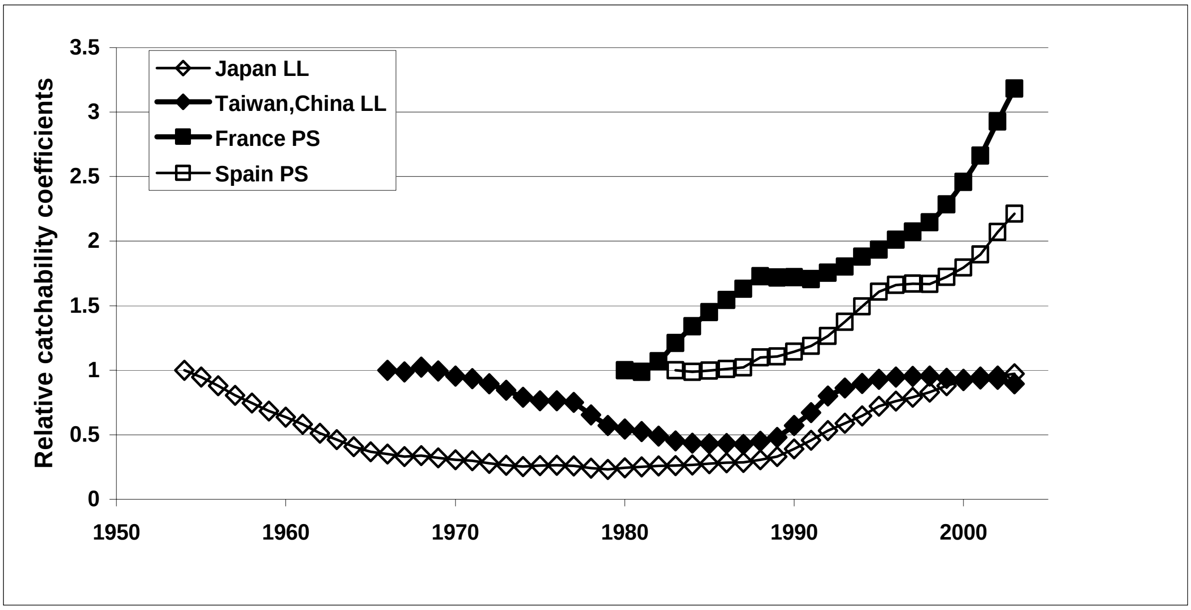


Figure 11. *Mean yearly relative catchability coefficients estimated from CATAGE for Japanese longline (LL), Taiwan,China longline, French purse seine (PS) and Spanish purse seine.*

Executive summary of the status of the Indian Ocean swordfish resource

(As adopted by the IOTC Scientific Committee 10 November 2006)

BIOLOGY

Swordfish (*Xiphius gladius*) is a large oceanic apex predator that inhabits all the world's oceans and in the Indian Ocean ranges from the northern coastal state coastal waters to 50°S. Swordfish is known to undertake extensive diel vertical migrations, from surface waters during the night to depths of 1000m during the day, in association with movements of the deep scattering layer and cephalopods, their preferred prey. By contrast with tunas, swordfish is not a gregarious species, although densities increase in areas of oceanic fronts and seamounts.

Genetic studies of the stock structure of swordfish in the Indian Ocean have failed to reveal spatial heterogeneity, and for the purposes of stock assessments one pan-ocean stock has been assumed. However, spatial heterogeneity in stock indicators (CPUE trends), indicate the potential for localised depletion of swordfish in the Indian Ocean.

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

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

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

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

FISHERIES

Swordfish are taken as a target or by-catch of longline fisheries throughout the Indian Ocean (Figure 1) and is likely to be a component of the "unidentified Billfish" catch by Sri Lankan gill net fisheries in the central northern Indian Ocean

Exploitation of swordfish in the Indian Ocean was first recorded by the Japanese in the early 1950's as a by-catch in their tuna longline fisheries. Over the next thirty years, catches in the Indian Ocean increased slowly as the level of coastal state and distant water fishing nation longline effort targeted at tunas increased. In the 1990's, exploitation of swordfish, especially in the western Indian Ocean, increased markedly, peaking in 1998 at around 35,000 t (Figure 2, Table 1). By 2002, twenty countries were reporting catches of swordfish (Figure 3, Table 1). The annual total catch has averaged 31,400 t in recent years (2000-2004) and in 2004 was 31,000 t. The highest catches are taken in the south west Indian Ocean; however, in recent years the fishery has been extending eastward (Figure 4).

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

During the 1990's a number of coastal and island states, notably Australia, La Reunion/France, Seychelles and South Africa have developed longline fisheries targeting swordfish, using monofilament gear and light sticks set at night. This gear achieves significantly higher catch rates than traditional Japanese and Taiwanese longlines. As a result, coastal and island fisheries have rapidly expanded to take over 10,000 t of swordfish per annum in the late 1990's.

STOCK STATUS

While the 2006 stock assessments (IOTC-2006-WPB-R) represent a major advance in the assessment of Indian Ocean swordfish the results should be considered preliminary and as such (and as in previous years) the Scientific

Committee has considered a range of information (e.g. indicators of abundance and stock status such as trends in CPUE and size composition) to formulate its technical advice in 2006.

The standardised CPUE of swordfish for the Japanese fleet for all areas of the Indian Ocean combined showed a variable but continuous decline over time (Figure 5). However, this result appears to be driven by the declining trend in the areas north of the equator (areas 3 and 4 combined – see Figure 5) as the CPUE trend from the areas south of the equator (areas 6, 7 and 8 combined – see Figure 5) appears to have stabilised in recent years. Catch rates following 1990 are markedly lower than those prior to this time (particularly in southern areas) and this may be due to an apparent regime shift in fishing practices after 1990 (Figure 6). This marked decrease in CPUE also follows substantial increases in catches throughout the 1990's, particularly in the western Indian Ocean (Figure 2). The apparent fidelity of swordfish to particular areas is a matter for concern as this can lead to localised depletion. In previous years, localised depletion was inferred on the basis of decreasing CPUEs following fine scale analyses of the catch effort data. While no fine scale analyses of CPUE were carried out in 2006, localised depletion may still be occurring in some areas. Localised depletion has occurred in other parts of the world where swordfish have been heavily targeted.

The annual average sizes of swordfish in the respective Indian Ocean fisheries are variable but show no trend Figure 7). While there are no clear signals of declines in the size-based indices, these indices should be carefully monitored. It was noted that since females mature at a relatively large size, a reduction in the biomass of large animals could potentially have a strong effect on the spawning biomass.

Notwithstanding the uncertainties in the 2006 assessments using surplus production models, the overall results were consistent, particularly in terms of the current levels of fishing mortality and stock biomass levels (Figure 8). Stock biomass decreased markedly from the early 1990's corresponding to a sharp increase in fishing mortality. Based on the point estimates and confidence limits, on balance the assessment model results (excluding the high productivity scenario which was considered to be the least plausible) indicate that the fishing mortality has exceed the MSY level in recent years although the stock does not appear to be in an overfished state. The current catch level (around 31,500 t) is above the MSY and probably not sustainable.

MANAGEMENT ADVICE

On the basis of the 2006 assessments and stock indicators the SC concluded that the level of catch in 2004 (about 32,000 t) is above the MSY and unlikely to be sustainable. Furthermore, while the assessments indicated that the stock i.e. for the Indian Ocean overall is probably not currently overfished, catch rate data from the southwest Indian Ocean suggest that overfishing of swordfish may be occurring in localised areas, in particular in the southwest Indian Ocean. Notwithstanding this, the reductions in catch rates have not been accompanied by reductions in average size of the fish in the catch, as has been the case in other oceans. The SC expressed concern regarding the very rapid increase in effort targeting swordfish in other areas of the Indian Ocean and the relatively large incidental catch of swordfish in fisheries targeting bigeye. These increases in effort exploiting swordfish have continued since 2000.

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

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

SWORDFISH SUMMARY

Maximum Sustainable Yield:	estimates range between 23,540 t and 27,000 t.
Preliminary catch in 2005 *(data as of October 2006)*	26,200 t
Catch in 2004	31,700 t
Mean catch over the last 5 years (2001-05)	30,200 t
Current Replacement Yield	-
Relative Biomass (B_{2004}/B_{MSY})	estimates range between 1.17 – 1.60
Relative Fishing Mortality (F_{2004}/F_{MSY})	estimates range between 0.74 – 1.29

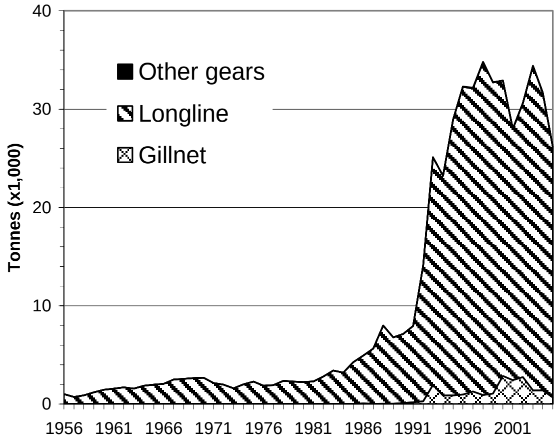
Note: This Executive Summary has been updated to take account of recent catch data. The management advice, and stock assessment results are based on data up to the end of 2004.

Table 1*. Best scientific estimates of the catches of swordfish (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1955-2004 (in thousands of tonnes). Data as of October 2006*

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Longline	Taiwan,China	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.5	0.5	0.3	0.3	0.2	0.6	0.8	1.2	0.9	0.9	0.6	1.0	0.9	0.9	0.9	0.6	1.1	1.3	1.1	1.5
	Indonesia																			0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
	Japan	0.9	0.6	0.7	0.9	1.2	1.3	1.4	1.1	1.3	1.5	1.7	2.2	1.7	1.6	1.2	1.1	0.9	0.8	0.8	0.8	0.4	0.3	0.9	0.6	0.6	0.8	1.0
	Korea, Republic of										0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.3	0.5	0.6	0.7	0.8	0.6	0.3	0.4	0.3
	Other Fleets									0.1	0.2	0.0	0.0	0.1	0.0	0.1					0.0		0.0	0.0	0.0	0.0	0.0	0.0
	Total	1.0	0.7	0.9	1.2	1.4	1.6	1.7	1.6	1.9	2.0	2.0	2.5	2.6	2.6	2.7	2.1	2.0	1.6	2.0	2.3	1.9	1.9	2.4	2.3	2.2	2.3	2.8
Other gears	Total															0.0		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0		
All	Total	1.0	0.7	0.9	1.2	1.4	1.6	1.7	1.6	1.9	2.0	2.0	2.5	2.6	2.6	2.7	2.1	2.0	1.6	2.0	2.3	1.9	1.9	2.4	2.3	2.3	2.3	2.8

Gear	Fleet	Av01/05	Av56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Longline	Taiwan,China[9]	12.1	4.9	1.9	1.7	2.0	3.2	3.8	5.4	4.1	3.8	4.7	9.0	15.3	12.5	18.3	17.6	17.2	16.8	14.7	15.2	12.9	13.5	14.4	12.3	7.5
	Spain	3.8	0.5											0.2	0.7	0.0	0.0	0.5	1.4	2.0	1.0	1.9	3.5	4.3	4.7	4.7
	NEI-Deep-freezing	2.6	1.3			0.0	0.2	0.2	0.8	0.6	0.8	0.9	1.4	4.2	3.6	5.4	7.7	5.5	7.0	6.2	5.8	2.2	2.4	2.4	3.0	3.0
	Indonesia	1.8	0.3	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.5	0.5	1.0	1.2	1.1	1.3	0.7	0.6	1.3	2.6	2.5	1.8
	Australia	1.3	0.2							0.0		0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.3	1.4	1.8	2.9	1.3	1.8	0.4	0.3
	Japan	1.2	1.3	1.2	1.3	2.2	1.3	1.4	1.5	1.0	1.0	0.9	1.7	1.4	2.6	1.7	2.1	2.8	2.2	1.5	1.6	1.2	1.3	1.1	1.3	1.3
	France-Reunion	1.1	0.3									0.0	0.1	0.3	0.7	0.8	1.3	1.6	2.1	1.9	1.7	1.6	0.8	0.8	0.9	1.2
	Seychelles	1.0	0.1													0.0	0.1	0.2	0.2	0.3	0.5	0.7	0.6	1.4	1.4	1.1
	Portugal	0.8	0.1																0.1	0.2	0.2	0.6	0.8	0.9	0.9	1.1
	China	0.6	0.1													0.1	0.2	0.3	0.1	0.4	0.4	0.3	0.4	0.8	0.7	0.6
	South Africa	0.5	0.1															0.0	0.4	0.1	0.0	0.3	0.9	0.8	0.2	0.2
	Guinea	0.5	0.0																			0.0	0.5	0.5	0.5	0.8
	Mauritius	0.5	0.0													0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.7	0.7
	Korea, Republic of	0.1	0.2	0.3	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.2	0.1	0.0	0.1	0.0	0.0	0.1	0.3	0.3
	NEI-Fresh Tuna	0.1	0.2							0.5	0.7	0.6	0.7	0.7	1.1	0.9	0.9	1.1	1.0	0.9	0.9	0.0	0.0	0.1	0.2	0.1
	Other Fleets	0.4	0.2	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.4	0.4	0.5	0.4	0.5	0.3	0.2	0.2	0.9	0.7	0.2	0.2	0.3	0.6	0.3	0.8
	Total	28.4	9.8	3.4	3.2	4.2	4.9	5.6	7.9	6.7	7.0	7.8	13.8	23.1	22.3	28.1	31.3	30.8	33.9	31.6	30.1	25.5	27.9	33.0	30.3	25.5
Gillnet	Sri Lanka	1.7	0.4				0.0	0.0	0.0	0.0	0.1	0.2	0.3	1.9	0.9	0.9	1.0	1.3	0.9	1.1	2.8	2.4	2.7	1.4	1.4	0.7
	Other Fleets		0.0				0.0																			
	Total	1.7	0.4				0.1	0.0	0.0	0.0	0.1	0.2	0.3	1.9	0.9	0.9	1.0	1.3	0.9	1.1	2.8	2.4	2.7	1.4	1.4	0.7
All	Total	30.2	10.2	3.4	3.2	4.2	4.9	5.6	8.0	6.8	7.1	7.9	14.1	25.1	23.2	29.0	32.3	32.2	34.8	32.7	32.9	28.0	30.6	34.4	31.7	26.2

[9] includes catches for the fresh tuna longline fleet from 2001 onwards



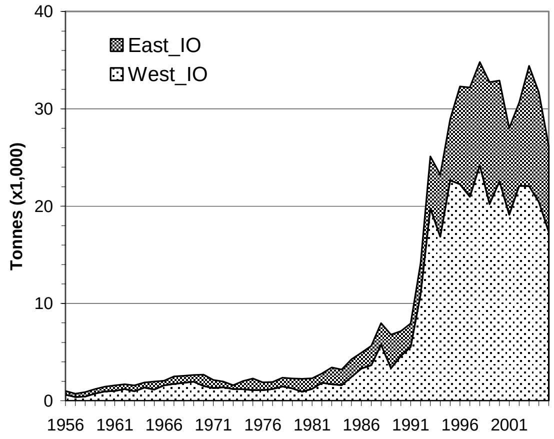
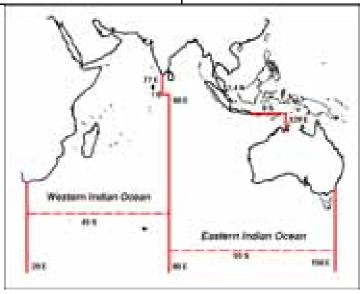


Figure 1. *Catches of Swordfish per gear and year recorded in the IOTC Database (1956-2005).*
Data as of October 2006

Figure 2. *Trends of the swordfish catches in the western and the eastern area of the Indian Ocean from 1956 – 2005.*
Data as of October 2006



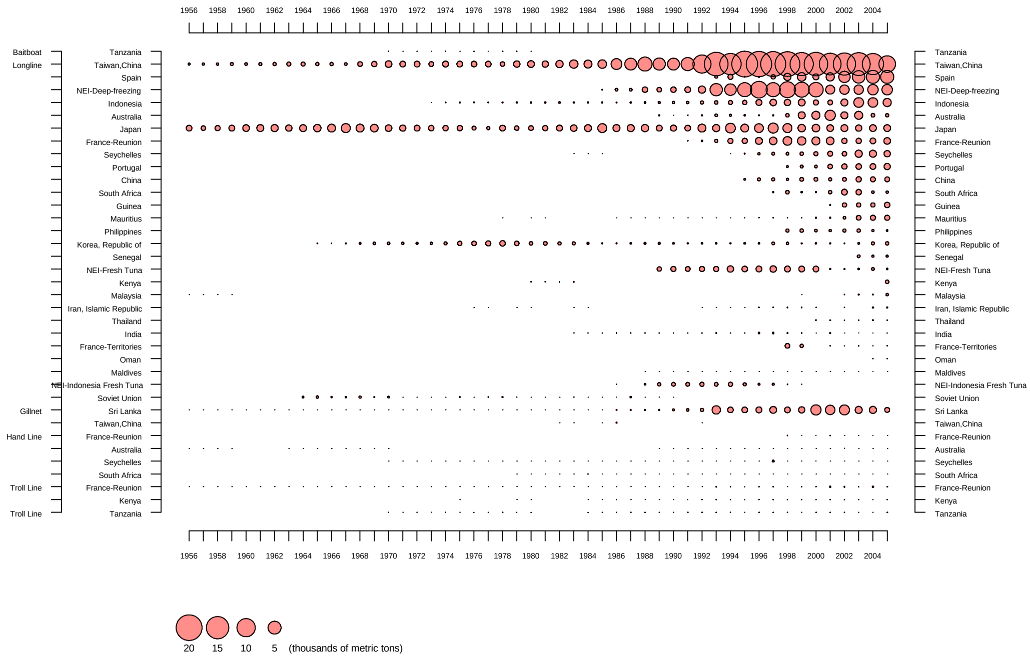
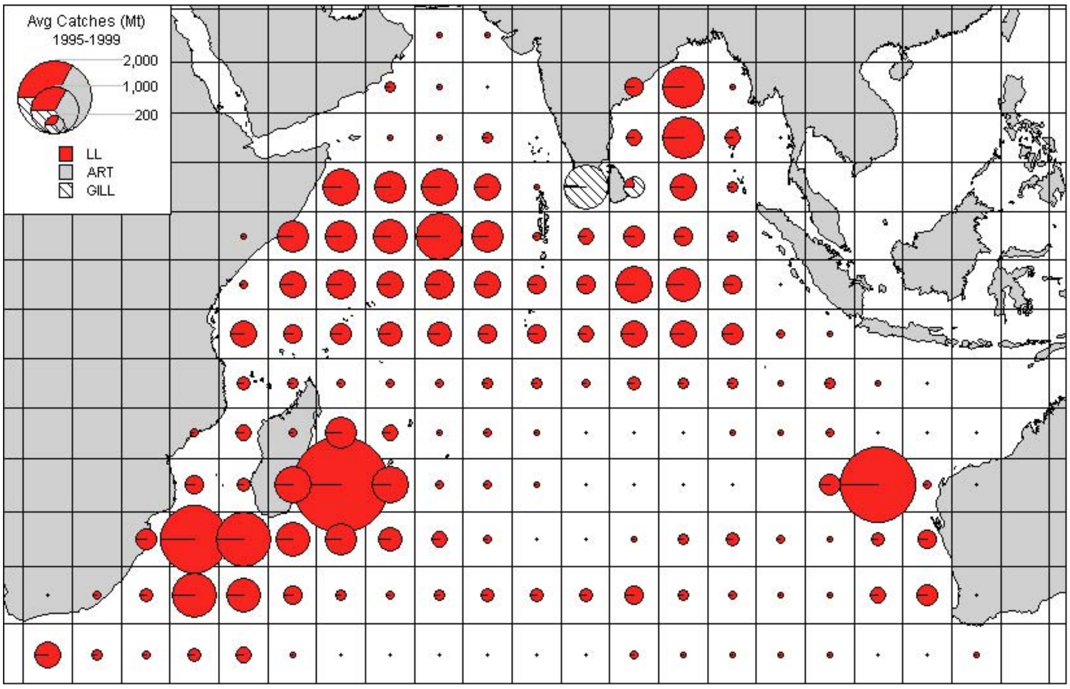


Figure 3. *Catches of swordfish in the Indian Ocean for the period 1956-2005, in thousands of metric tons by gear and country/fleet.* *Data as of October 2006*

1995-1999



2000-2004

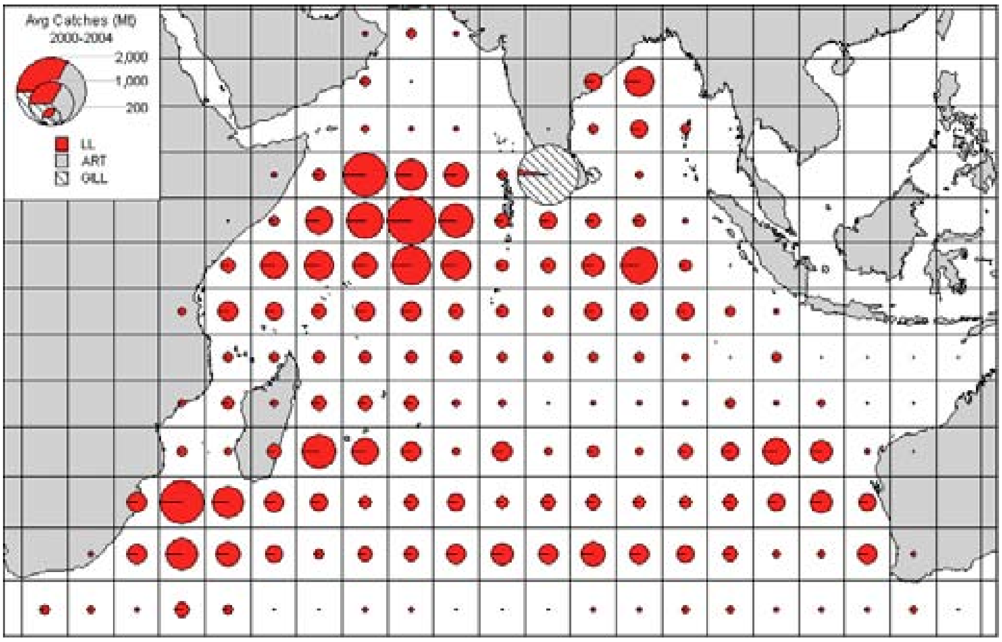


Figure 4. *Mean annual catches of swordfish (t) for the periods 1995 to 1999 and 2000 to 2004 for longline, gillnet and other fisheries in the Indian Ocean.*

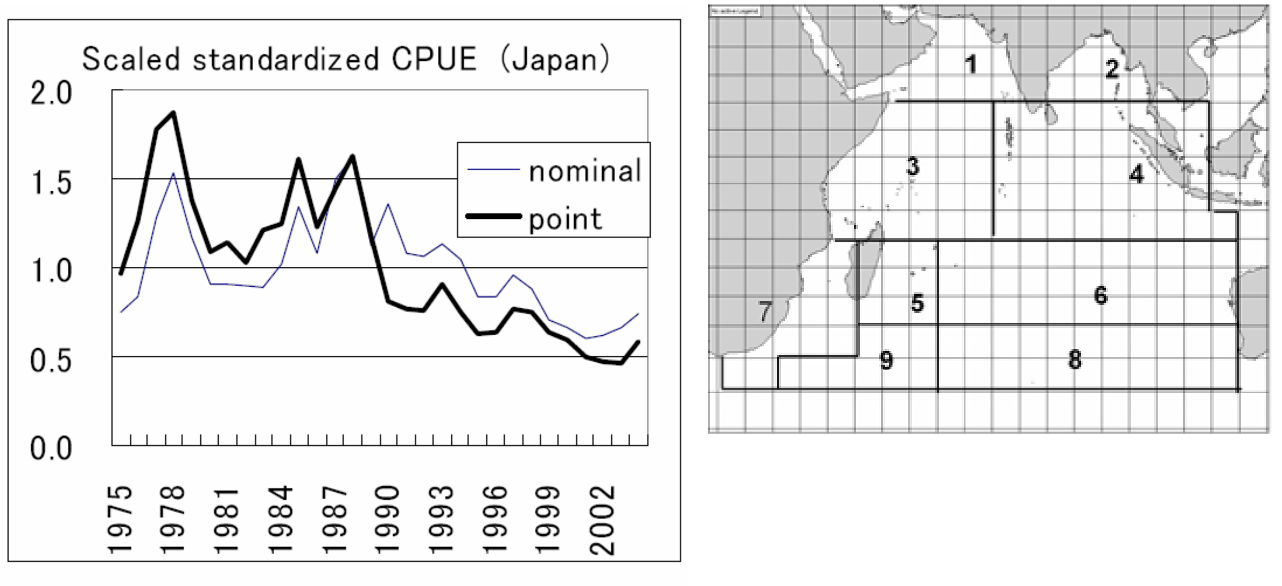


Figure 5. *Catch per unit effort indices (nominal and standardised) for swordfish caught by the Japanese fleet in the Indian Ocean (average set to 1). Insert (top right): Areas used in the standardisation of catch rates.*

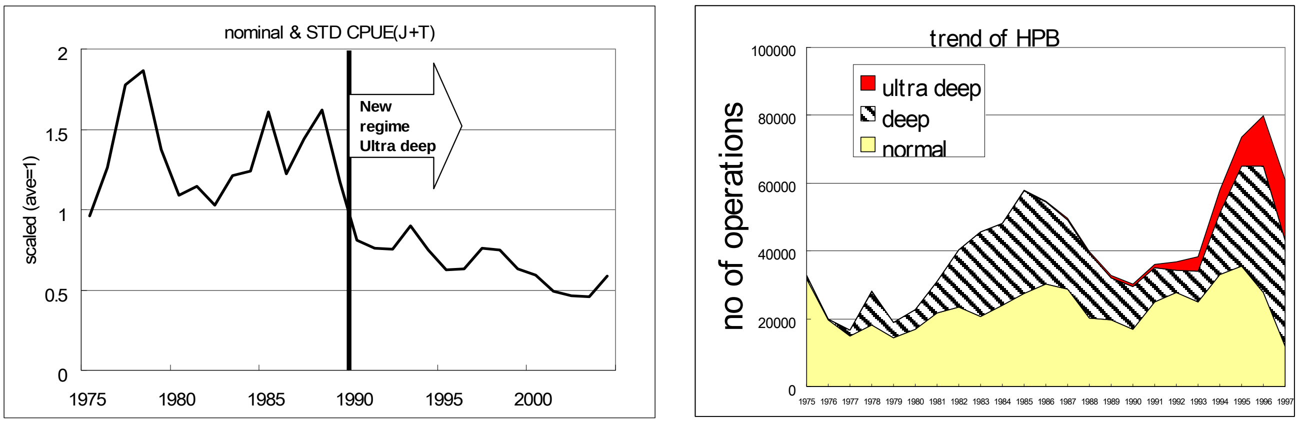


Figure 6. *Indications of a possible regime shift in catch rates related to changes in the setting practices of Japanese longliners over time. Nominal catch rates (left)umber of operations performed using normal, deep and ultra-deep longline sets (right).*

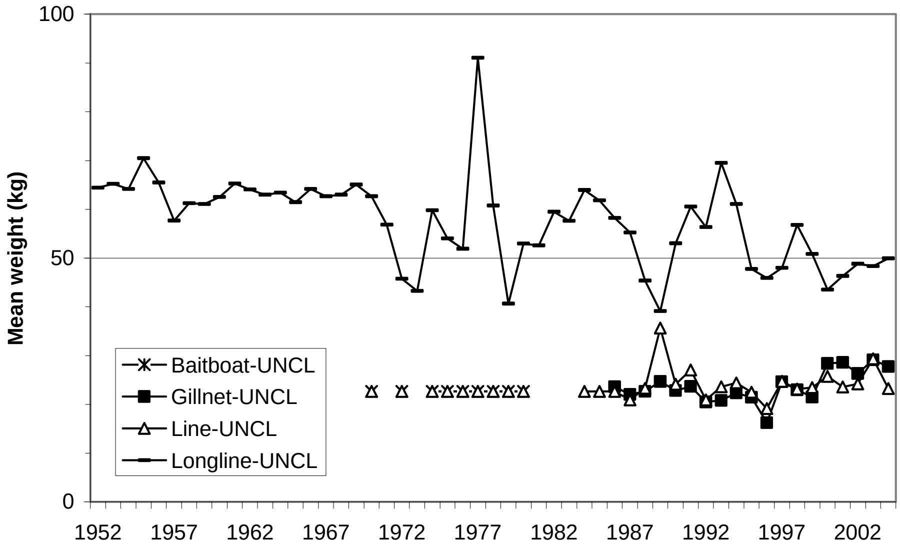
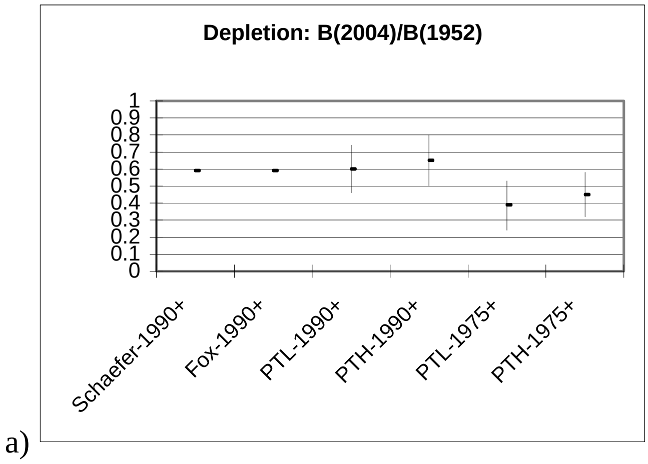
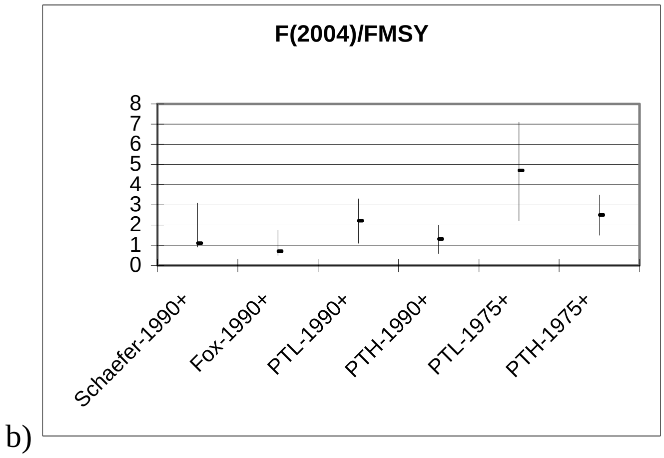


Figure 7. *Trends in average size of swordfish in Indian Ocean fisheries.*





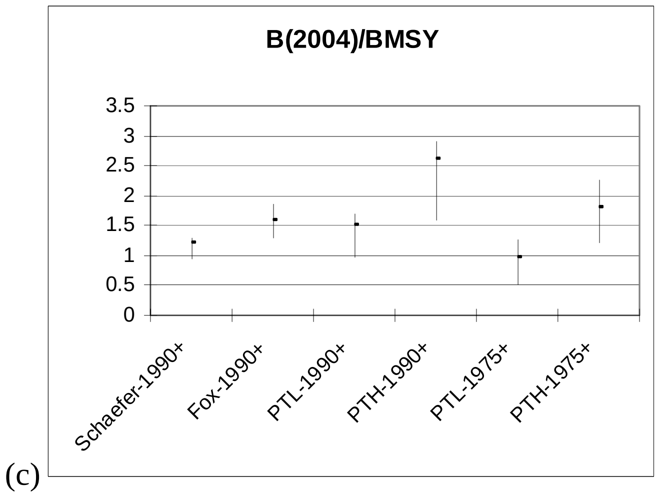


Figure 8. *2006 Indian Ocean swordfish stock assessment results. Stock status estimates from the six successful production model fits. (a) Current biomass levels as a proportion of the biomass in 1952 (when the stock was considered to be at carrying capacity i.e. at equilibrium in an unfished state (b) Current fishing mortality relative to the level of fishing mortality at MSY (c) current biomass relative to the estimated biomass at MSY. Confidence limits are 80% for the Fox and Schaefer models (Confidence limit estimates are not available for the depletion estimates) and 95% for the Pella-Tomlinson models.*

Executive summary of the status of the bullet tuna resource

(As adopted by the IOTC Scientific Committee 10 November 2006)

BIOLOGY

Bullet tuna (*Auxis rochei*) is an oceanic species found in the equatorial areas of the major oceans. It is a highly migratory species with a strong schooling behaviour. Adults are principally caught in coastal waters and around islands that have oceanic salinities.

Adults can grow to 50 cm fork length. Bullet tuna mature at around two years old — about 35 cm (FL). It is a multiple spawner with fecundity ranging between 31,000 and 103,000 eggs per spawning (according to the size of the fish). Larval studies indicate that bullet tuna spawn throughout its range.

Bullet tuna feed on small fishes, particularly anchovies, crustaceans (commonly crab and stomatopod larvae) and squid. Cannibalism is common. Because of their high abundance, bullet tuna are considered to be an important prey for a range of species, especially the commercial tunas.

No information is available on the stock structure of bullet tuna in Indian Ocean.

FISHERIES

Bullet tuna is caught mainly by gillnet and line across the broader Indian Ocean area (Figure 1). This species is also an important catch for artisanal purse seiners. The catch estimates for bullet tuna were derived from very small amounts of information and are therefore highly uncertain[10] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. Estimated catches of bullet tuna reached around 1,000 t in the early 1990's and peaked at 2,600 t in 2000. Current catches are around 1,600 t. In 2005, the countries attributed with the highest catches of bullet tuna were India (962 t or 68 % of the total catch), Indonesia (233 t, 17 %) and Sri Lanka (206 t, 14.5 %) (Table 1).

Two countries reported catches of bullet tuna in the IOTC region in year 2005. Catches for other countries known to catch bullet tuna are estimated by the Secretariat according to the species composition per gear declared during the previous year or by the major fishing countries of the region (Figure 3).

The fisheries in the Indian Ocean mainly catch bullet tuna ranging between 15 and 25 cm.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is no information on the stock structure of bullet tuna in the Indian Ocean.

There is some age and the growth information available for bullet tuna in the Indian Ocean.

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for bullet tuna are highly uncertain. Catches fluctuate from year to year but have been steadily increasing since the early 1980's.
2. **Nominal CPUE Trends:** data not available to the Secretariat.
3. **Average weight in the catch by fisheries:** data not available to the Secretariat.
4. **Number of squares fished:** data not available to the Secretariat.

STOCK ASSESSMENT

While some localised, sub-regional assessments may have been undertaken, no quantitative stock assessment has been undertaken by the IOTC Working Party on Neritics.

[10] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of unreporting fisheries for which catches had to be estimated.

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for bullet tuna in the Indian Ocean, therefore the stock status is uncertain.

The SC notes the catches of bullet tuna are typically variable but relatively low compared to the other neritic species. The reasons for this are not clear: it may be problem related to reporting, or it may be a normal fluctuation in the fishery. Bullet tuna is a relatively productive species with high fecundity and rapid growth and this makes it relatively resilient and less prone to overfishing. Nevertheless, bullet tuna appears to be an important prey species for other pelagic species including the commercial tunas, therefore it should be reviewed at the first meeting of the IOTC Working Party on NeriticTunas.

BULLET TUNA SUMMARY

Maximum Sustainable Yield:	-
Preliminary catch in 2005 *(data as of October 2006)*	1,400 t
Catch in 2004	1,500 t
Mean catch over the last 5 years (2001-05)	1,600 t
Current Replacement Yield:	-
Relative Biomass ($B_{current}/B_{MSY}$):	-
Relative Fishing Mortality ($F_{current}/F_{MSY}$):	-

Table 1. *Best scientific estimates of the catches of bullet tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1956-2006 (in thousands of tonnes).*
Data as of October 2006

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Gillnet	India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
	Indonesia																0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Line	India																										0.1	0.1
	Indonesia																0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Other gears	India																					0.0	0.0	0.0	0.0		0.0	0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total								0.0	0.0	0.0											0.0	0.0	0.0	0.0		0.0	0.0
All	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.2	0.3

Gear	Fleet	Av01/05	Av56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Gillnet	Sri Lanka	0.3	0.2				0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.5	0.5	0.8	1.2	1.1	0.3	1.5	0.4	0.4	0.3	0.3	0.2
	India	0.3	0.1	0.1	0.0	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.2	0.1	0.2	0.1	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.3	0.3
	Indonesia	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.9	0.3	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.3	0.4	0.4	0.4	0.9	0.9	1.3	1.6	1.6	0.8	2.0	0.9	1.0	0.9	0.8	0.7
Line	India	0.6	0.2	0.1	0.1	0.1	0.4	0.2	0.3	0.3	0.3	0.3	0.4	0.2	0.5	0.3	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.8	0.5	0.5
	Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.6	0.2	0.1	0.1	0.2	0.4	0.2	0.3	0.3	0.3	0.3	0.4	0.3	0.5	0.3	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.8	0.5	0.5
Other gears	India	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.2
	Total	0.2	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.2
All	Total	1.6	0.6	0.3	0.2	0.3	0.7	0.4	0.6	0.7	0.7	0.8	1.0	0.7	1.5	1.2	2.0	2.2	2.2	1.4	2.6	1.6	1.7	2.0	1.5	1.4

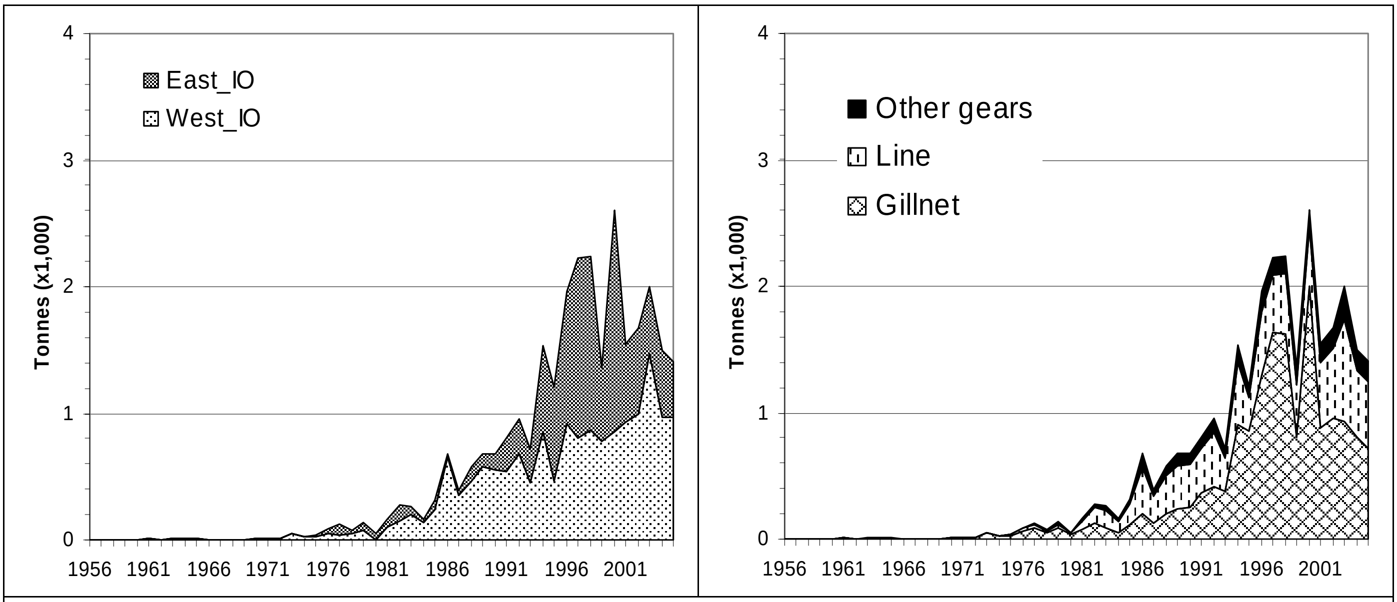


Figure 1. *Bullet tuna: annual catches from 1956 to 2005 by area (left) and gear (right).* Data as per October 2006

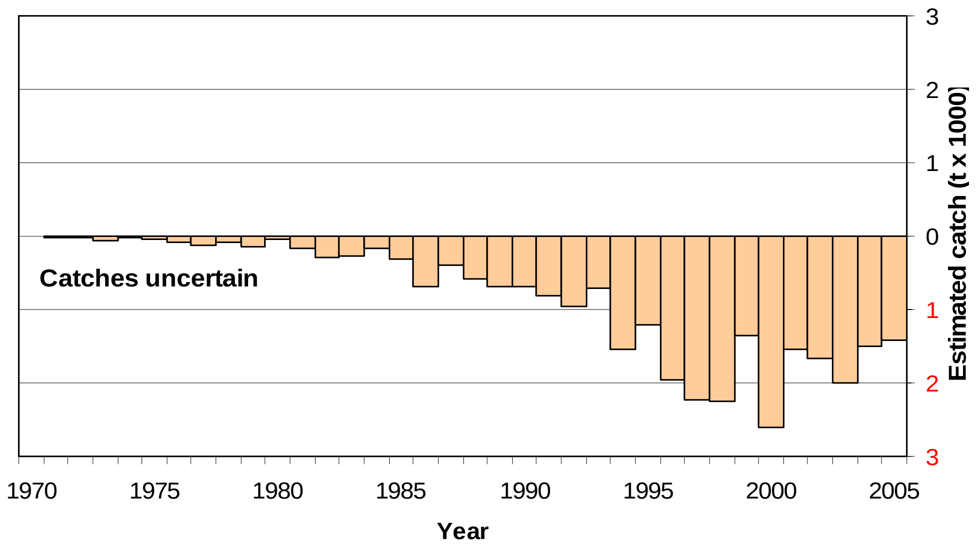


Figure 2. *Bullet tuna: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text.* Data as of October 2006

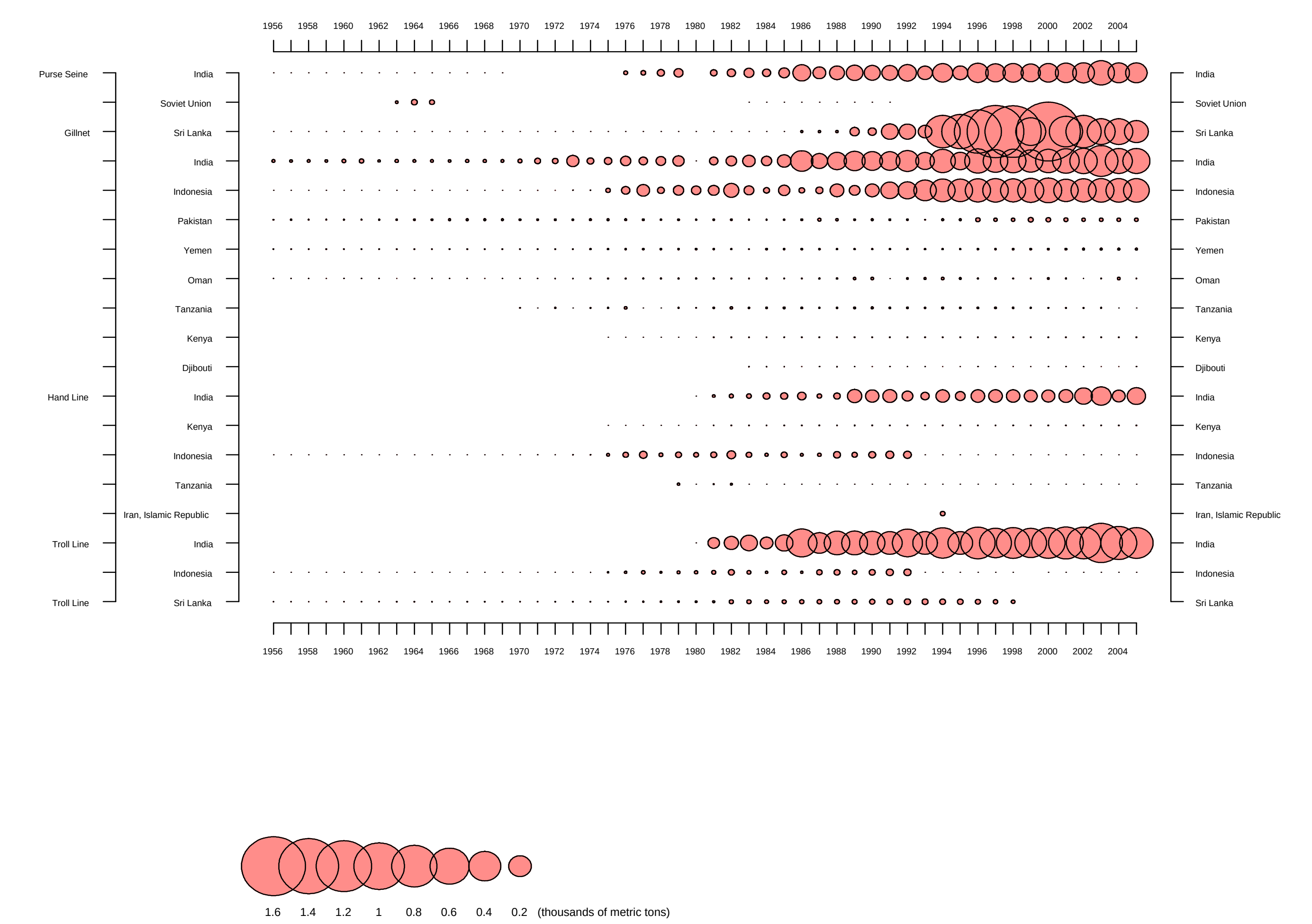


Figure 3. *Bullet tuna: catches by gear and main fleets for the period 1956-2006 (in thousands of tonnes).* Data as of October 2006

Executive summary of the status of the frigate tuna resource

(As adopted by the IOTC Scientific Committee 10 November 2006)

BIOLOGY

Frigate tuna (*Auxis thazard*) is a highly migratory species found in both coastal and oceanic waters. It is highly gregarious and often schools with other Scombrids.

In other oceans, frigate tuna grows to around 65 cm fork length but the largest size reported for the Indian Ocean is 58 cm (off Sri Lanka).

Size at first maturity is between 29 cm and 35 cm fork length depending on location. In the southern Indian Ocean, the spawning season extends from August to April whereas north of the equator it is from January to April. Fecundity ranges between 200,000 and 1.06 million eggs per spawning (depending on size).

Frigate tuna feeds on small fish, squids and planktonic crustaceans (e.g. decapods and stomatopods). Because of their high abundance, frigate tuna are considered to be an important prey for a range of species, especially the commercial tunas.

No information is available on the stock structure of frigate tuna in Indian Ocean.

FISHERIES

Frigate tuna is taken from across the Indian Ocean area using gillnets, bait boats and lines (Figure 1). This species is also an important catch for Industrial purse seiners. The catch estimates for frigate tuna were derived from very small amounts of information and are therefore highly uncertain[11] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. Estimated catches have increased steadily since the late 1970's, reaching around 10,000 t in the early 1980's and over 30,000 t by the mid-1990's. Current catches are around 32,000 t. In 2005, the countries attributed with the highest catches were India (13,208 t or 40.2% of the total catch), Indonesia (8,543 t, 26 %), Maldives (5,001 t, 15.2 %) and Sri Lanka (2,296 t, 7 %) (Table 1).

In 2005, seven countries reported catches of frigate tuna in the IOTC region. Catches for other countries known to catch frigate tuna are estimated by the Secretariat according to the species composition per gear declared during the previous year or by the major fishing countries of the region (Figure 3).

The size frigate tuna taken by the Indian Ocean fisheries typically ranges between 25 and 40 cm depending on the type of gear used, season and location.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is no information on the stock structure of frigate tuna in the Indian Ocean.

Age and growth, fecundity estimates and size at first maturity information is available for frigate tuna in the Indian Ocean.

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for frigate tuna are highly uncertain. Catches fluctuate from year to year but have been steadily increasing since the mid 1950's.
2. **Nominal CPUE Trends:** data not available to the Secretariat.
3. **Average weight in the catch by fisheries:** data not available to the Secretariat.
4. **Number of squares fished:** data not available to the Secretariat.

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[11] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of unreporting fisheries for which catches had to be estimated.

STOCK ASSESSMENT

While some localised, sub-regional assessments have been undertaken by national scientists, no quantitative stock assessment has been undertaken by the IOTC Working Party on Neritics.

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for the frigate tuna in the Indian Ocean, therefore the stock status is uncertain. This species is a relatively productive species with high fecundity and rapid growth and this makes it relatively resilient and not prone to overfishing. Nevertheless, frigate tuna appears to be an important prey species for other pelagic species including the commercial tunas, therefore it should be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

FRIGATE TUNA SUMMARY

Maximum Sustainable Yield:	-
Preliminary catch in 2005 *(data as of October 2006)*	32,900 t
Catch in 2004	31,900 t
Mean catch over the last 5 years (2001-05)	31,800 t
Current Replacement Yield:	-
Relative Biomass ($B_{current}/B_{MSY}$):	-
Relative Fishing Mortality ($F_{current}/F_{MSY}$):	-

Table 1. *Best scientific estimates of the catches of frigate tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1956-2006 (in thousands of tonnes).*

(Data as of October 2006)

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Baitboat	Maldives	1.8	0.9	0.9	0.9	0.9	1.4	1.4	1.4	1.4	2.3	2.8	2.8	2.8	2.8	1.7	1.7	1.8	3.9	3.5	2.3	1.5	1.8	0.9	0.9	0.8	0.8	1.2
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	Total	1.8	0.9	0.9	0.9	0.9	1.4	1.4	1.4	1.4	2.3	2.8	2.8	2.8	2.8	1.7	1.7	1.8	3.9	3.5	2.4	1.5	1.8	0.9	0.9	0.8	0.8	1.2
Gillnet	Indonesia																0.0	0.0	0.0	0.0	0.3	0.9	2.1	0.6	1.4	1.2	1.5	3.0
	India	0.2	0.1	0.1	0.1	0.2	0.3	0.1	0.2	0.3	0.2	0.1	0.2	0.1	0.1	0.2	0.4	0.5	2.7	0.7	0.9	1.4	1.0	1.4	1.8		0.7	1.1
	Oman	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	United Arab Emirates																			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2
	Total	0.2	0.2	0.2	0.2	0.3	0.4	0.1	0.3	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.5	0.7	2.8	1.0	1.6	2.8	3.5	2.5	3.7	1.6	2.8	5.4
Line	India																										0.3	0.5
	Maldives	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.1
	Sri Lanka	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	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	0.1	0.2	0.7
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.1	0.2	0.2	0.3	0.5
	Total	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.2	0.4	0.6	0.3	0.5	0.5	0.9	1.9
Other gears	Thailand															0.2	0.5	0.4	0.7	0.5	1.2	0.8	0.7	0.9	0.1	0.0	0.1	1.3
	India																					0.0	0.0	0.1	0.2		0.1	0.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1
	Total								0.0	0.1	0.0					0.3	0.6	0.5	0.7	0.6	1.3	0.9	0.8	1.1	0.3	0.2	0.2	1.5
All	Total	2.2	1.2	1.2	1.2	1.3	1.9	1.7	1.8	1.9	2.8	3.2	3.3	3.3	3.2	2.5	2.9	3.1	7.5	5.3	5.5	5.6	6.6	4.8	5.4	3.1	4.8	10.0

Gear	Fleet	Av01/05	Av56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Baitboat	Maldives	3.9	2.3	2.0	1.7	1.3	0.8	1.0	1.4	1.9	3.0	2.3	3.1	5.0	3.8	3.7	6.1	2.3	3.8	3.1	3.7	3.7	3.9	4.1	3.3	4.6
	Other Fleets	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	3.9	2.3	2.0	1.8	1.3	0.9	1.0	1.5	2.0	3.1	2.4	3.2	5.0	3.8	3.7	6.1	2.3	3.8	3.1	3.7	3.7	3.9	4.1	3.3	4.6
Gillnet	Indonesia	8.3	2.8	1.2	0.5	1.7	0.4	0.7	2.5	1.5	2.5	4.2	4.5	6.6	8.0	7.8	8.3	8.5	8.2	8.9	9.4	7.7	8.3	8.5	8.5	8.5
	India	8.0	2.6	1.5	1.0	1.7	4.8	2.5	3.4	4.2	4.0	3.9	4.9	3.3	6.1	3.4	6.6	5.8	6.3	5.7	6.2	6.8	7.2	10.1	8.0	8.0
	Sri Lanka	1.7	0.6				0.0	0.0	0.0	0.3	0.3	0.2	0.4	1.2	1.7	1.7	2.7	3.9	3.8	1.8	1.4	1.5	1.7	1.9	1.9	1.4
	Iran, Islamic Republic	1.0	0.3				0.3	0.4	0.3	0.2	0.1	0.5	0.3	0.4	0.2	4.4	0.7	0.6	0.5	0.6	0.8	0.6	0.6	1.1	1.5	1.5
	Oman	0.3	0.2	0.1	0.2	0.1	0.1	0.3	0.5	0.9	0.6	0.1	0.2	0.4	0.5	0.8	0.6	0.9	0.6	0.6	0.5	0.6	0.2	0.1	0.3	0.2
	United Arab Emirates	0.3	0.2	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.5	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.3	0.3	0.2	0.2
	Other Fleets	0.2	0.1	0.1	0.3	0.2	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.3	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2
	Total	19.8	6.9	3.4	2.4	4.2	6.3	4.6	7.6	7.8	8.2	9.6	11.1	12.5	17.3	18.8	19.8	20.4	20.2	18.4	18.9	17.8	18.5	22.3	20.6	20.0
Line	India	4.2	1.2	0.8	0.5	0.9	2.4	1.3	1.7	2.1	2.0	2.0	2.5	1.7	3.1	1.7	3.4	3.0	3.2	2.9	3.1	3.4	3.7	4.9	4.4	4.4
	Maldives	0.3	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.5	0.3	0.3	0.4	0.2	0.4	0.3	0.3	0.3	0.3	0.2	0.3	0.4
	Sri Lanka	0.0	0.3	0.7	0.5	0.6	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.1	1.1	1.0	0.8	0.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Fleets	0.0	0.1	0.3	0.1	0.3	0.1	0.2	0.5	0.3	0.5	0.6	0.6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
	Total	4.5	1.8	1.9	1.4	2.1	3.4	2.4	3.1	3.5	3.7	3.9	4.6	3.4	4.5	3.1	4.7	3.9	4.1	3.2	3.5	3.8	4.0	5.2	4.7	4.8
Other gears	Thailand	1.0	0.7	0.5	0.6	1.7	0.8	7.5	1.4	1.1	0.9	0.9	1.2	1.2	0.9	1.4	1.1	1.1	1.1	0.4	1.0	1.0	0.8	1.1	1.1	1.1
	Sri Lanka	0.9	0.2					0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.6	0.6	0.7	0.8	1.0	1.0	0.9	1.0	0.9	0.9	0.9
	India	0.9	0.3	0.2	0.1	0.2	0.6	0.3	0.4	0.5	0.5	0.5	0.6	0.4	0.7	0.4	0.8	0.7	0.8	0.7	0.8	0.8	0.9	1.3	0.8	0.8
	Other Fleets	0.6	0.2	0.2	0.2	0.3	0.3	0.3	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	1.2	0.2	0.0	0.0	0.9	0.5	1.1	0.4	0.4	0.6
	Total	3.5	1.4	0.8	1.0	2.2	1.7	8.1	1.9	1.9	1.6	1.7	2.2	1.9	2.1	2.4	3.8	2.7	2.6	2.1	3.7	3.3	3.7	3.7	3.3	3.5
All	Total	31.8	12.5	8.2	6.5	9.8	12.3	16.1	14.1	15.2	16.6	17.5	21.0	##	27.7	28.0	34.4	29.4	30.7	26.8	29.7	28.6	30.1	35.3	31.9	32.9

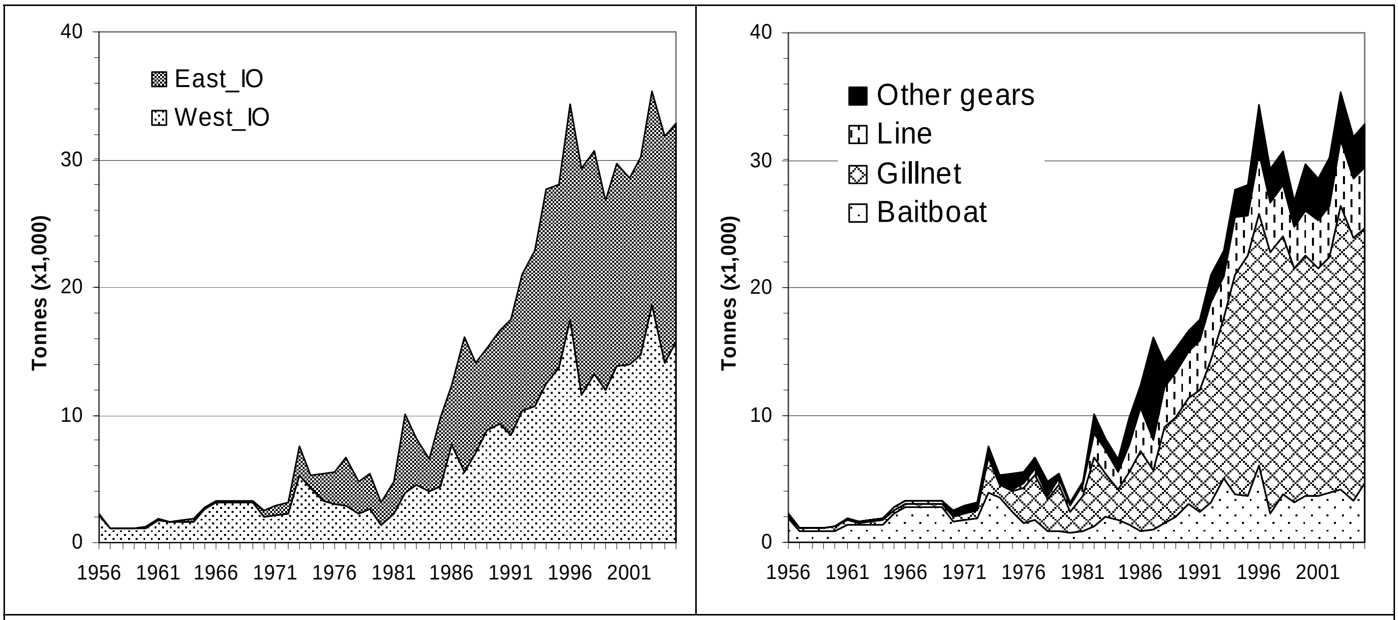

***Figure 1**. Frigate tuna: annual catches from 1956 to 2005 by area (left) and gear (right).* *Data as per October 2006*

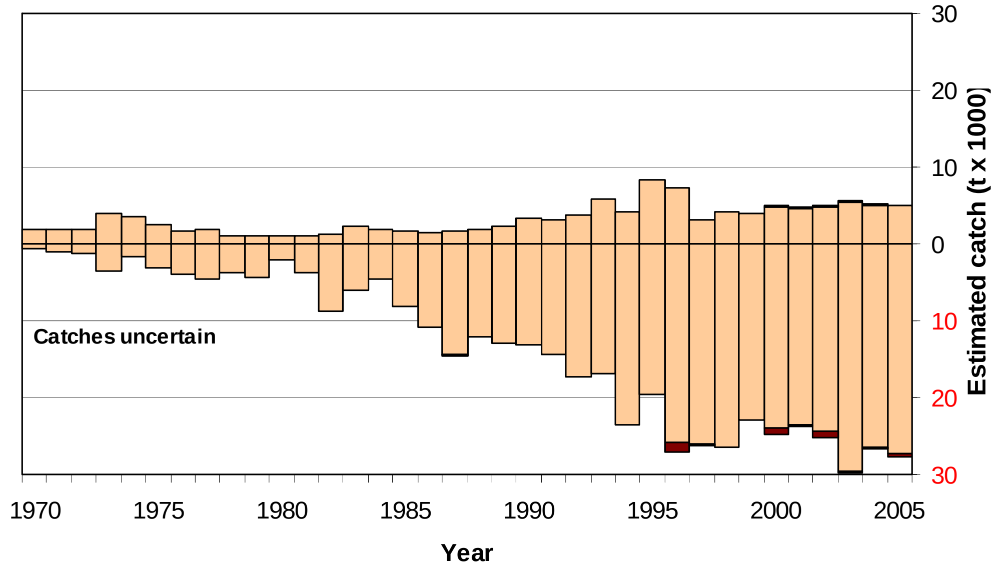

***Figure 2**. Frigate tuna: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text. Dark sections represent estimates of catches by industrial fleets.* *Data as of October 2006*

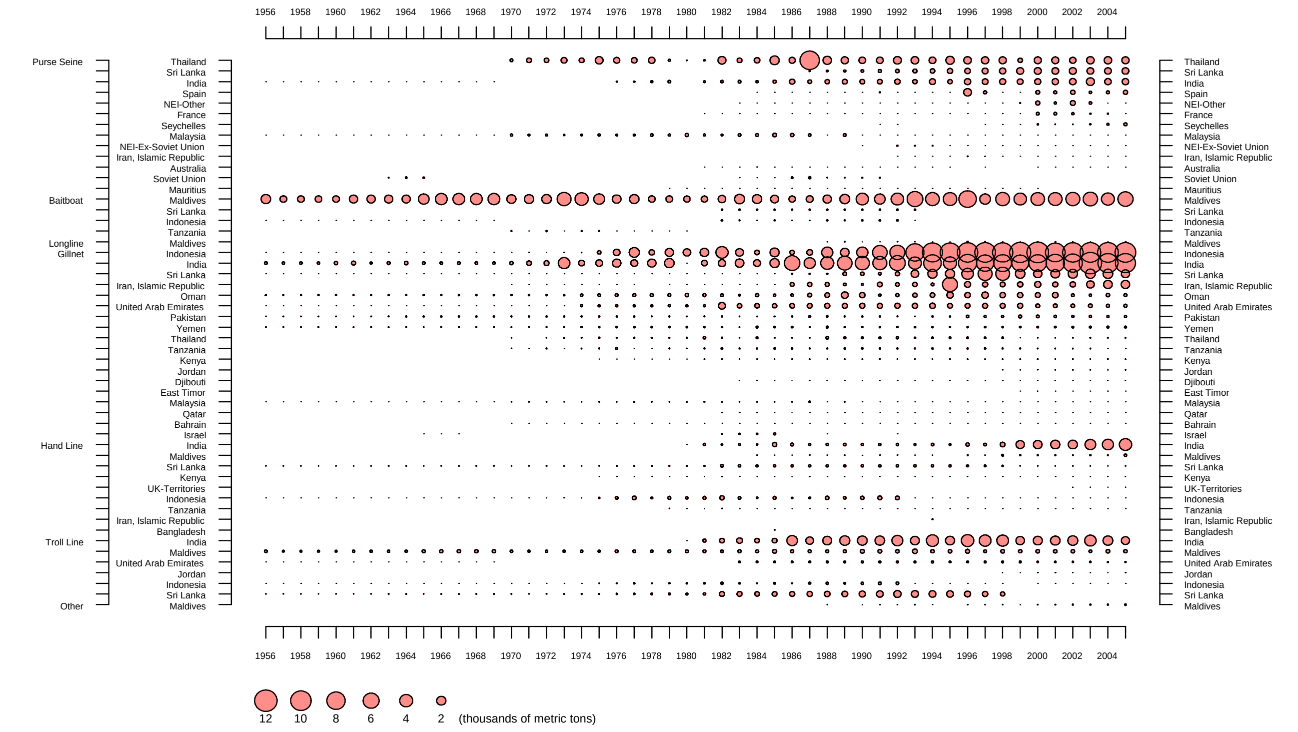

Figure 3. *Frigate tuna: catches by gear and main fleets for the period 1956-2005.(Data as per October 2006)*

Executive summary of the status of the Indo-Pacific king mackerel resource

As adopted by the IOTC Scientific Committee 10 November 2006

BIOLOGY

The Indo-Pacific king mackerel (*Scomberomorus guttatus*) is a migratory species that forms small schools and inhabits coastal waters, sometimes entering estuarine areas. It is found in waters from the Persian Gulf, India and Sri Lanka, Southeast Asia, as far north as the Sea of Japan.

Adults can reach a maximum length of 76 cm fork length. Maturity is reached at around 48-52 cm total length (TL) or 1-2 years old in southern India, and about 40 cm (TL) in Thailand. Based on the occurrence of ripe females and the size of maturing eggs, spawning probably occurs from April to July in southern India and in May in Thailand waters. Fecundity increases with age in the Indian waters, ranging from around 400,000 eggs at age 2 years to over one million eggs at age 4 years.

The Indo-Pacific king mackerel feeds mainly on small schooling fishes (e.g. sardines and anchovies), squids and crustaceans.

No information is available on the stock structure of Indo-Pacific king mackerel stock structure in Indian Ocean.

FISHERIES

The Indo-Pacific king mackerel is mostly caught by gillnet fisheries in the Indian Ocean (Figure 1), in particular artisanal fleets from India and more recently Indonesia (Table 1). The catch estimates for Indo-Pacific king mackerel were derived from very small amounts of information and are therefore highly uncertain[12] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. Estimated catches have increased steadily since the mid 1960's, reaching around 10,000 t in the early 1970's and over 30,000 t by 1989. Current catches are around 33,000 t. In 2005, the countries attributed with the highest catches were Indonesia (14,250 t, or 42.3% of the estimated total catch), India (13,116 t, 38.9 %) and Iran (4,279 t, 12.7 %) (Table 1).

In 2005, seven countries reported catches of Indo-Pacific king mackerel in the IOTC region. Catches for other countries known to catch this species are estimated by the Secretariat according to the species composition per gear declared during the previous year or by the major fishing countries of the region (Figure 3).

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is no information on the stock structure of Indo-Pacific king mackerel in the Indian Ocean.

Age and growth, fecundity estimates and size at first maturity information is available for Indo-Pacific king mackerel in the Indian Ocean.

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for Indo-Pacific king mackerel are highly uncertain. Catches fluctuate from year to year but have been steadily increasing since the mid 1960's.
2. **Nominal CPUE Trends:** data not available to the Secretariat.
3. **Average weight in the catch by fisheries:** data not available to the Secretariat.
4. **Number of squares fished:** data not available to the Secretariat.

STOCK ASSESSMENT

No quantitative stock assessment has been undertaken by the IOTC Working Party on Neritics.

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[12] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of unreporting fisheries for which catches had to be estimated.

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for the Indo-Pacific king mackerel in the Indian Ocean, therefore the stock status is uncertain. This species is a relatively productive species with high fecundity and rapid growth and this makes it relatively resilient and not prone to overfishing.

The SC recommends Indo-Pacific king mackerel be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

INDO-PACIFIC KING MACKEREL SUMMARY

Maximum Sustainable Yield:	-
Preliminary catch in 2005 *(data as of October 2006)*	33,700 t
Catch in 2004	33,700 t
Mean catch over the last 5 years (2001-05)	33,000 t
Current Replacement Yield:	-
Relative Biomass ($B_{current}/B_{MSY}$):	-
Relative Fishing Mortality ($F_{current}/F_{MSY}$):	-

Table 1. *Best scientific estimates of the catches of Indo-Pacific king mackerel (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1956-2005 (in thousands of tonnes). Data as of October 2006*

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Gillnet	India	4.0	3.0	2.7	2.3	3.2	4.4	3.4	3.2	4.5	3.5	3.7	3.7	4.2	3.8	4.1	5.0	6.6	3.4	7.7	6.7	7.2	5.7	5.2	8.0	8.5	13.0	13.2
	Indonesia	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	0.9	0.3	0.4	0.5	0.5	0.6	0.9	0.4	0.3	0.3	0.4	0.4	0.5	0.9
	Iran, Islamic Republic																											1.4
	Malaysia	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1								1.2	1.3	1.5	1.2	1.4	1.7
	Saudi Arabia																										0.0	0.0
	Thailand															0.0		0.0	0.2	0.1	0.1	0.2	0.5	0.3	0.6	0.4	0.6	0.2
	Yemen	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.5	0.5	0.6	0.6	0.7	0.6	0.7	0.6	0.5
	Pakistan	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.4	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.1	0.4	0.4
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	Total	4.8	3.9	3.6	3.1	4.0	5.2	4.4	4.2	5.7	4.7	5.2	5.1	5.6	5.2	4.8	5.8	7.6	4.5	9.1	8.4	8.7	8.7	8.1	11.6	11.3	16.5	18.3
Line	Other Fleets	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2
	Total	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Other gears	Thailand															0.1	0.2	0.1	0.0	0.0	0.0	0.3	0.1	0.1	0.0	0.2	0.2	0.5
	India	0.0	0.0	0.0	0.0	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	0.2		0.4	0.5
	Other Fleets	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.5	0.6	0.7	0.6	0.6	0.6	0.8	1.1	0.7	0.4	0.6	0.6	0.9	1.1	0.9	0.6	0.6	0.0	0.2
	Total	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.5	0.6	0.7	0.6	0.6	0.6	0.9	1.3	0.8	0.5	0.6	0.6	1.2	1.2	1.1	0.7	0.7	0.6	1.2
All	Total	4.9	4.0	3.6	3.2	4.3	5.6	4.7	4.6	6.3	5.5	6.0	5.8	6.4	6.0	5.8	7.2	8.6	5.1	9.9	9.2	10.1	10.0	9.3	12.4	12.3	17.2	19.8

Gear	Fleet	Av01/05	Av56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Gillnet	India	13.2	9.5	12.8	19.0	16.5	8.9	11.9	14.1	16.8	12.4	18.3	15.9	19.3	14.9	15.6	11.5	13.1	20.6	12.6	12.5	13.6	14.9	13.9	11.8	11.8
	Indonesia	12.3	4.0	0.9	0.7	1.2	1.4	1.6	9.3	11.6	5.4	4.7	1.9	8.9	5.7	10.6	13.8	11.9	11.8	11.2	11.7	13.2	9.5	10.5	14.3	14.3
	Iran, Islamic Republic	3.8	1.2	1.6	0.9	0.5	0.5	0.7	0.7	1.7	2.3	2.5	2.2	1.6	1.6	5.4	4.3	2.3	3.9	3.5	4.1	2.5	4.0	3.7	4.3	4.3
	Malaysia	0.6	0.6	1.4	0.9	1.1	1.5	1.6	1.4	1.0	1.1	1.2	1.5	1.2	1.2	0.8	0.9	1.0	1.3	0.3	0.4	0.4	0.7	0.7	0.6	0.4
	Saudi Arabia	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.4
	Thailand	0.3	0.2	0.1	0.1	0.3	0.2	0.4	0.4	0.3	0.3	0.3	0.4	0.5	0.3	0.6	0.4	0.4	0.4	0.7	0.2	0.3	0.4	0.4	0.2	0.3
	Yemen	0.3	0.4	0.1	0.8	0.6	0.7	0.6	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3
	Pakistan	0.2	0.2	0.4	0.3	0.4	0.5	0.6	0.6	0.0	0.1	0.9	0.0					0.1	0.1	0.4	0.3	0.2	0.2	0.2	0.2	0.2
	Other Fleets	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.0	0.1	0.2	0.1	0.2	0.2	0.3	0.2	0.3	0.3	0.2	0.2	0.1	0.1	0.1
	Total	31.2	16.4	17.4	22.8	20.6	13.7	17.5	26.9	31.9	22.2	28.3	22.5	32.2	24.4	33.7	31.6	29.7	39.0	29.6	30.2	31.0	30.7	30.2	32.0	31.9
Line	India	1.3	0.4									1.7	1.4	1.8	1.4	1.4	1.1	1.2	1.9	1.1	1.1	1.2	1.4	1.3	1.3	1.3
	Other Fleets	0.1	0.1	0.2	0.2	0.2	0.1	0.3	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1
	Total	1.3	0.5	0.2	0.2	0.2	0.1	0.3	0.0	0.1	0.1	1.7	1.5	1.8	1.5	1.4	1.1	1.2	1.9	1.2	1.2	1.3	1.4	1.3	1.3	1.4
Other gears	Thailand	0.2	0.3	0.5	0.3	0.3	0.5	0.5	0.3	0.6	0.7	0.7	0.9	0.9	0.7	1.1	0.9	0.8	0.8	0.8	0.2	0.1	0.3	0.3	0.2	0.3
	India	0.1	0.2	0.9	0.7	0.7	0.8	0.7	1.1	1.4	0.8	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
	Other Fleets	0.1	0.3	0.1	0.1	0.0	0.2	0.2	0.0	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	0.1	0.1
	Total	0.4	0.8	1.5	1.1	1.1	1.5	1.4	1.4	2.0	1.6	0.9	1.1	1.1	0.9	1.2	1.0	1.0	1.0	1.0	0.4	0.3	0.5	0.6	0.4	0.4
All	Total	33.0	17.7	19.2	24.0	21.9	15.3	19.2	28.4	34.0	23.9	31.0	25.2	35.1	26.7	36.4	33.7	31.9	41.9	31.7	31.8	32.6	32.6	32.1	33.7	33.7

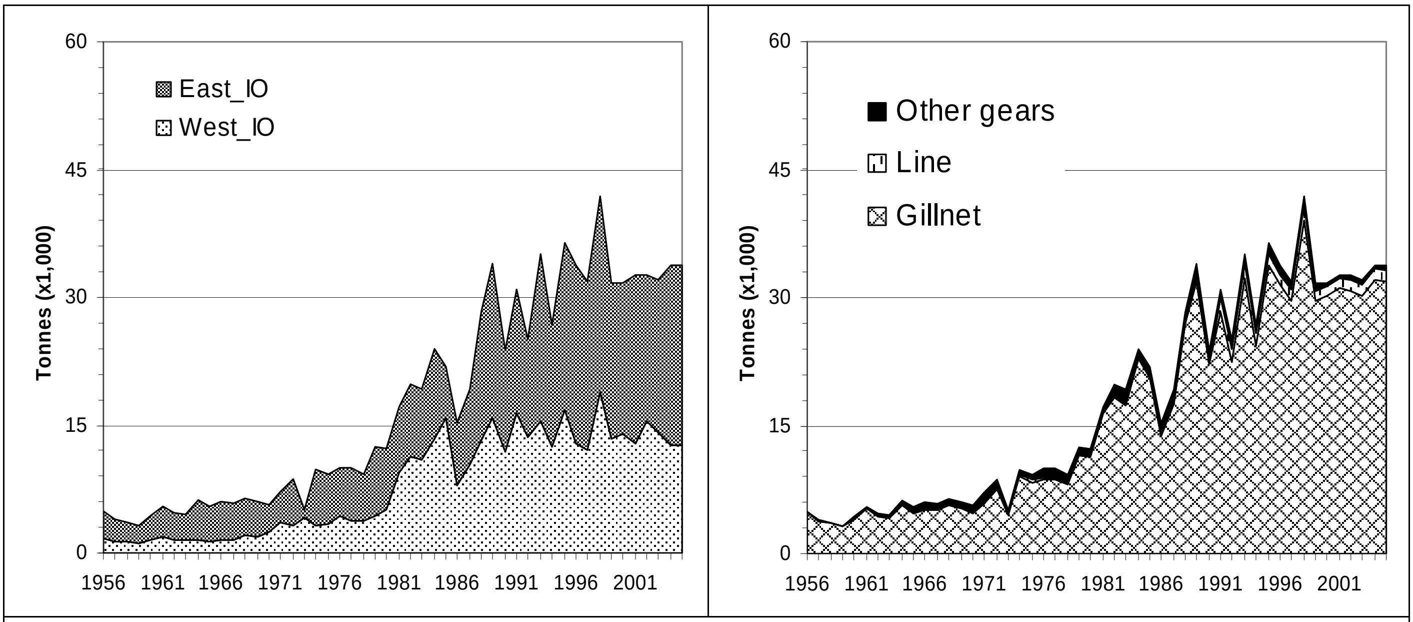

***Figure 1**. Indo-Pacific king mackerel: annual catches from 1956 to 2005 by area (left) and gear (right).* *Data as of October 2006*

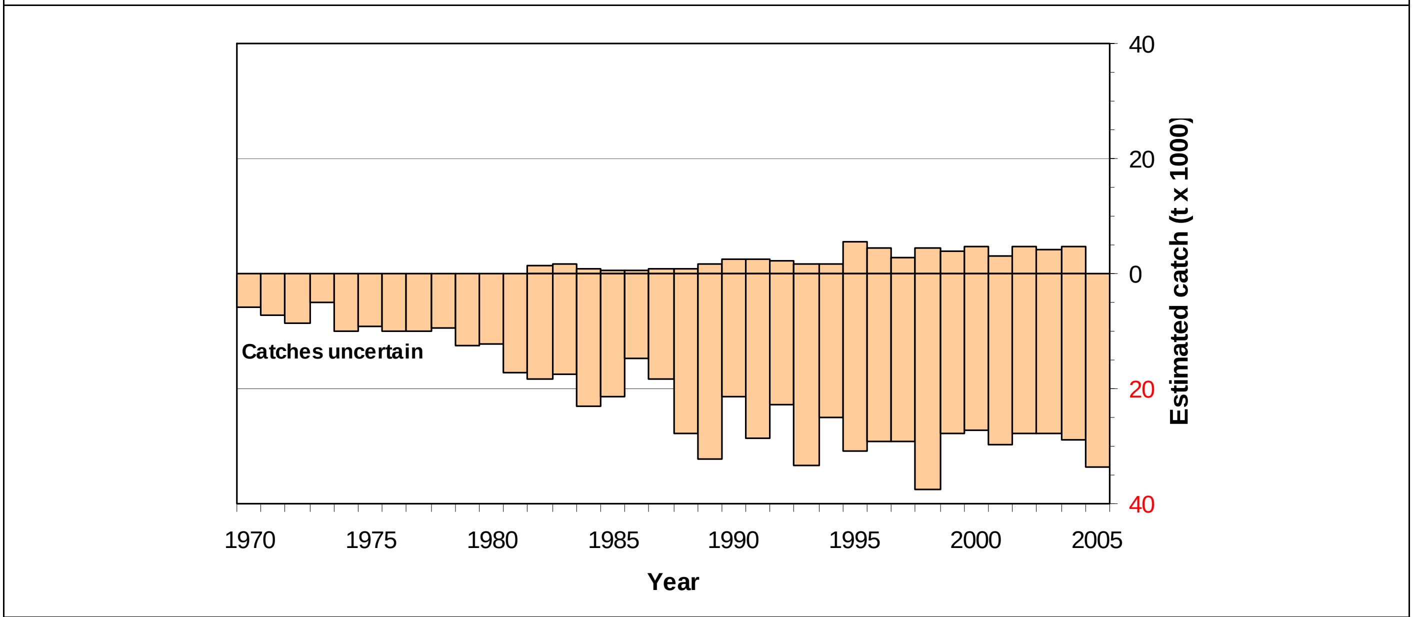

***Figure 2**. Indo-Pacific king mackerel: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text.* *Data as of October 2006*

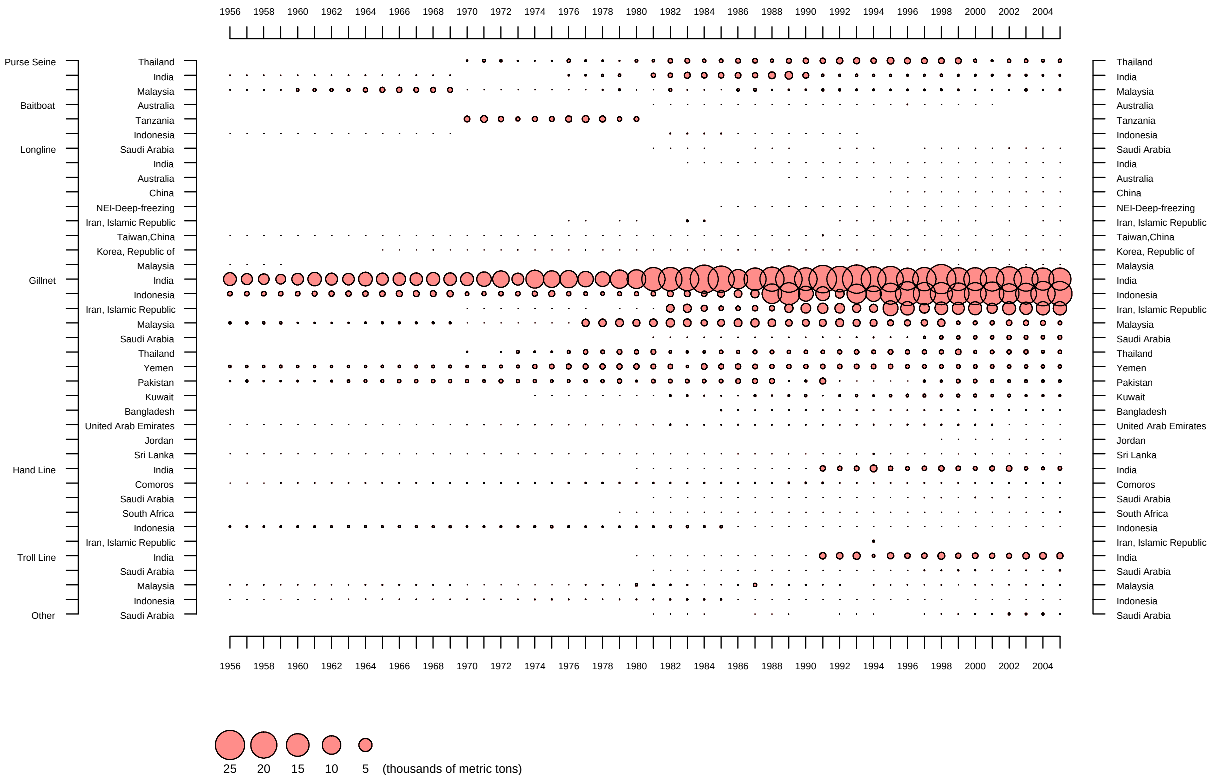

Figure 3. *Indo-Pacific king mackerel: estimated catches by gear and main fleets for the period 1956-2005 (in thousands of tonnes).* *Data as of October 2006*

Executive summary of the status of the kawakawa resource

(As adopted by the IOTC Scientific Committee 10 November 2006)

BIOLOGY

Kawakawa (*Euthynnus affinis*) lives in open waters close to the shoreline and prefers waters temperatures ranging from 18° to 29°C. Kawakawa form schools by size with other species sometimes containing over 5,000 individuals. Kawakawa are often found with yellowfin, skipjack and frigate tunas. Kawakawa are typically found in surface waters, however, they may range to depths of over 400 m (they have been reported under a fish-aggregating device employed in 400 m), possibly to feed.

Kawakawa grow a length of 100 cm FL and can weigh up to 14 kg but the more common size is around 60 cm. Juveniles grow rapidly reaching lengths between 50 and 65 cm by three years of age.

On the Natal coast in South Africa, sexual maturity is attained at 45-50 cm and spawning occurs mostly during summer. A 1.4 kg female (48 cm FL) may spawn approximately 0.21 million eggs per batch (corresponding to about 0.79 million eggs per season).

Kawakawa larvae are patchy but widely distributed and can generally be found close to land masses. Large changes in apparent abundance are linked to changes in ocean conditions. This species is a highly opportunistic predator feeding on small fishes, especially on clupeoids and atherinids; also squids, crustaceans and zooplankton.

No information is available on stock structure of kawakawa in Indian Ocean.

FISHERIES

Kawawkawa is caught mainly by gillnets and purse seiners (Table 1 and Figure 1) and may be an important by-catch of the industrial purse seiners. The catch estimates for kawakawa were derived from very small amounts of information and are therefore highly uncertain[13] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. Annual estimates of catch kawakawa increased markedly from around 10,000 t in the late 1970’s to reach the 50,000 t mark in 1990. Catches peaked at over 70, 000 t in 2002 and 2003 but have since declined. In 2005, the catch was 59,000 t.

In 2005, twenty countries reported catches of kawakawa in the IOTC area. Catches for other countries known to catch kawakawa are estimated by the Secretariat according to the species composition per gear declared during the previous year or by the major fishing countries of the region. The largest component of the catches in 2005 was taken by India (30 %), Iran (20 %), Malaysia (13 %), Thailand (11 %), Yemen (5 %) and Oman (5 %) (Figure 3).

A high percentage of the kawakawa captured by Thai purse seiners in the Andaman sea is comprised of fish 8 to 42 cm long.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is no information on the stock structure of kawakawa in the Indian Ocean.

Numerous studies have been undertaken to investigate the age and the growth of kawakawa. These include various studies based on age and length distributions using various body parts (e.g. vertebrae, dorsal spines, and otoliths). Fecundity of kawakawa has also been studied in Indian Ocean.

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for kawakawa are highly uncertain. The trend in catches indicates a large and continuous increase in the catches from the mid-1980’s to 2002 (Figure 1). The estimated catches decreased over the period 2002-2005.

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[13] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of unreporting fisheries for which catches had to be estimated.

2. **Nominal CPUE Trends:** data not available to the Secretariat.
3. **Average weight in the catch by fisheries:** data not available to the Secretariat.
4. **Number of squares fished:** data not available to the Secretariat.

STOCK ASSESSMENT

While some localised, sub-regional assessments may have been undertaken, no quantitative stock assessment has been undertaken by the IOTC Working Party on Neritics.

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for kawakawa in the Indian Ocean, therefore the stock status is uncertain.

The SC notes the decline in the catches since 2002. However, the reasons for this are not clear: it may be problem related to reporting, or it may be a normal fluctuation in the fishery — a similar decline occurred in the early 1990's. Nevertheless, the SC recommends that this species be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

KAWAKAWA SUMMARY

Maximum Sustainable Yield:	-
Preliminary catch in 2005 *(data as of October 2006)*	58,800 t
Catch in 2004	58,900 t
Mean catch over the last 5 years (2001-05)	64,608 t
Current Replacement Yield:	-
Relative Biomass ($B_{current}/B_{MSY}$):	-
Relative Fishing Mortality ($F_{current}/F_{MSY}$):	-

Table 1. *Best scientific estimates of the catches of kawakawa (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1956-2005 (in thousands of tonnes). Data as of October 2006.*

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Purse seine	Malaysia	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.5	0.4	0.3	1.2	0.9	1.0	0.5	0.8	1.3	0.8	0.9	1.7	1.1	2.6	1.1	0.9
	Thailand															0.1	0.4	0.4	0.6	0.5	1.1	0.7	0.6	0.8	0.1	0.0	0.0	1.2
	India																					0.1	0.1	0.2	0.4		0.6	0.6
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	1.0	0.6	0.4	0.5	0.4	0.3	1.4	1.3	1.4	1.1	1.2	2.4	1.6	1.6	2.7	1.5	2.6	1.7	2.6
Gillnet	India	0.6	0.4	0.5	0.4	0.8	1.2	0.3	0.7	0.7	0.5	0.5	0.6	0.6	0.5	0.9	1.7	1.8	8.7	2.5	3.2	5.3	3.6	5.0	6.7		11.1	11.4
	Iran, Islamic Republic															0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3		0.2	0.2	0.4	0.7
	Yemen	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.4	0.5	0.6	0.6	0.7	0.6	1.8	1.0	0.9
	Oman	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.7	0.8	0.9	1.0	1.1	1.0	1.2	1.1	0.8
	Pakistan	0.3	0.7	0.3	0.3	0.4	0.4	0.6	0.9	1.2	1.3	1.8	1.8	1.8	1.6	1.4	1.2	1.4	1.1	1.5	1.7	1.6	1.4	0.8	1.4	0.7	1.0	1.3
	United Arab Emirates															0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2.0
	Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.6	0.3	0.5	0.5	0.6	0.3
	Other Fleets	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	0.0	0.2	0.1	0.2	0.1	0.2	0.3	0.5	0.3	0.1	0.2	0.2	0.7	0.6
	Total	1.4	1.7	1.4	1.4	1.8	2.1	1.5	2.1	2.6	2.5	2.9	3.1	3.1	2.8	3.3	3.8	4.4	11.0	5.6	6.9	9.7	7.9	8.1	10.6	4.8	16.0	18.0
Line	Indonesia	0.0	0.0	0.0	0.0	0.0	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	0.3	0.3					0.0	0.2
	Maldives												0.3	0.3	0.4	0.4	0.3	0.4	0.6	0.5	0.3	0.9	0.9	0.7	0.6	0.9	1.0	1.2
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.3	0.3	0.4	0.3	0.3	0.2	0.3	0.4	0.6	0.5	1.0
	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.4	0.8	0.6	0.7	1.0	1.0	0.9	1.5	1.1	1.0	1.0	1.4	1.6	2.4
Other gears	Maldives												0.2	0.2	0.2	0.3	0.2	0.3	0.6	0.4	0.2	0.2	0.2	0.2	0.2	0.3	0.5	1.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.3	0.2	0.3	0.6	0.4	0.2	0.2	0.2	0.2	0.2	0.3	0.5	1.0
All	**Total**	**1.5**	**1.8**	**1.5**	**1.6**	**2.0**	**2.3**	**1.7**	**2.4**	**3.6**	**3.2**	**3.3**	**4.1**	**4.0**	**3.7**	**5.7**	**5.9**	**6.7**	**13.7**	**8.3**	**10.3**	**12.9**	**10.8**	**12.1**	**13.3**	**9.1**	**19.8**	**24.1**

Gear	Fleet	Av01/05	Av56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Purse seine	Malaysia	8.2	2.4	1.5	1.7	2.6	2.2	1.4	1.9	2.1	3.1	3.4	5.5	3.4	1.9	2.4	4.0	4.2	6.1	5.4	6.9	6.0	10.1	8.7	8.5	7.8
	Thailand	6.3	2.4	0.4	0.6	1.5	0.7	4.5	2.2	2.2	4.5	7.0	7.7	7.2	5.7	8.6	7.0	6.6	6.5	2.6	6.3	6.2	4.9	7.0	7.0	6.5
	India	1.3	0.7	0.9	0.7	0.8	2.2	1.0	1.4	2.6	2.9	1.2	1.5	1.2	0.9	1.1	1.0	1.3	1.2	1.6	1.6	1.4	1.6	1.7	1.0	1.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	15.9	5.5	2.8	3.0	4.9	5.1	6.9	5.4	6.9	10.5	11.6	14.7	11.8	8.5	12.1	12.1	12.2	13.9	9.6	14.9	13.6	16.7	17.5	16.6	15.3
Gillnet	India	15.4	8.5	8.6	11.1	15.8	16.0	12.9	13.9	23.7	29.9	13.8	17.4	13.8	9.7	12.1	11.1	15.3	14.1	17.8	18.5	15.8	18.3	18.0	12.4	12.4
	Iran, Islamic Republic	13.2	2.7	2.5	3.9	1.7	1.9	0.6	2.2	0.8	0.7	0.7	0.7	0.5	2.1	3.9	5.7	7.8	7.9	10.9	13.5	12.5	16.4	14.1	11.6	11.6
	Yemen	2.8	1.1	0.8	1.2	2.1	1.5	1.4	1.7	1.3	1.6	1.7	1.7	0.6	1.2	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.1
	Oman	2.2	1.1	0.4	1.1	1.0	1.1	2.6	3.5	2.0	2.1	1.1	1.6	0.9	1.4	2.2	2.4	2.5	1.8	1.5	1.7	2.0	1.5	2.9	2.5	2.2
	Pakistan	2.0	1.5	0.4	0.5	0.8	1.6	2.0	4.1	1.4	2.1	1.9	1.5	1.5	1.7	1.4	2.9	2.8	2.9	3.4	3.0	2.2	1.6	1.8	2.1	2.1
	Sri Lanka	1.4	0.4				0.0	0.0	0.0	0.2	0.1	0.1	0.2	0.1	1.1	1.2	1.5	2.2	2.2	1.4	1.4	2.3	2.6	0.7	0.7	0.5
	United Arab Emirates	0.7	0.8	0.9	0.9	0.8	1.2	1.8	1.9	2.0	2.1	2.0	2.1	1.2	2.3	2.1	2.1	2.2	2.2	2.2	0.7	0.9	0.7	0.7	0.6	0.6
	Indonesia	0.7	0.3	0.3	0.3	0.3	0.3	0.1	0.3	0.4	0.3	0.2	0.2	0.3	0.3	0.9	0.9	0.9	0.9	1.0	0.9	0.6	0.6	0.5	0.9	0.7
	Other Fleets	1.0	0.5	0.2	0.4	0.3	0.3	0.6	0.7	0.5	0.7	0.9	1.0	0.7	0.7	0.9	1.1	1.6	1.8	0.8	0.8	0.6	0.8	1.7	1.0	0.7
	Total	39.3	16.8	14.1	19.4	22.9	23.9	22.0	28.4	32.4	39.6	22.3	26.4	19.5	20.7	26.0	29.1	37.0	35.7	41.3	42.8	39.4	45.1	43.3	35.0	33.9
Line	India	4.9	1.4									4.3	5.5	4.3	3.0	3.8	3.5	4.8	4.4	5.6	5.8	4.9	5.7	5.4	4.2	4.2
	Indonesia	1.4	0.3	0.2	0.1	0.1	0.0	1.4	0.2	0.2	0.2	0.4	0.4	1.5	2.2	0.0	0.1	0.0	0.0	0.0	1.2	1.8	1.6	1.4	0.2	1.9
	Maldives	0.5	0.6	1.3	0.7	1.4	0.7	0.9	0.6	0.8	1.0	0.8	1.2	1.9	0.9	1.0	1.2	0.6	1.4	0.5	0.5	0.4	0.4	0.5	0.5	0.6
	Other Fleets	0.6	0.6	1.0	1.1	0.9	1.0	2.6	1.2	1.2	1.2	1.5	1.6	1.3	1.5	1.4	1.3	1.3	1.1	0.9	0.5	0.7	0.5	0.7	0.6	0.6
	Total	7.4	2.9	2.4	2.0	2.4	1.7	4.9	2.0	2.1	2.5	7.1	8.6	9.1	7.7	6.2	6.0	6.7	6.9	6.9	8.0	7.8	8.3	8.0	5.4	7.3
Other gears	Maldives	1.9	0.7	1.1	0.8	1.0	0.6	0.5	0.6	0.6	1.0	0.8	1.3	1.7	1.7	1.7	2.6	1.5	2.2	1.2	1.4	1.7	1.8	1.9	1.8	2.1
	Other Fleets	0.1	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1
	Total	2.0	0.8	1.3	1.0	1.0	0.6	0.5	0.6	0.6	1.0	0.8	1.3	1.7	1.7	1.7	2.6	1.5	2.2	1.3	1.4	1.8	1.9	2.0	1.9	2.3
All	**Total**	**64.6**	**26.0**	**20.6**	**25.4**	**31.2**	**31.3**	**34.3**	**36.4**	**42.0**	**53.6**	**41.9**	**51.0**	**42.1**	**38.7**	**46.0**	**49.8**	**57.3**	**58.7**	**59.1**	**67.1**	**62.7**	**71.9**	**70.8**	**58.9**	**58.8**

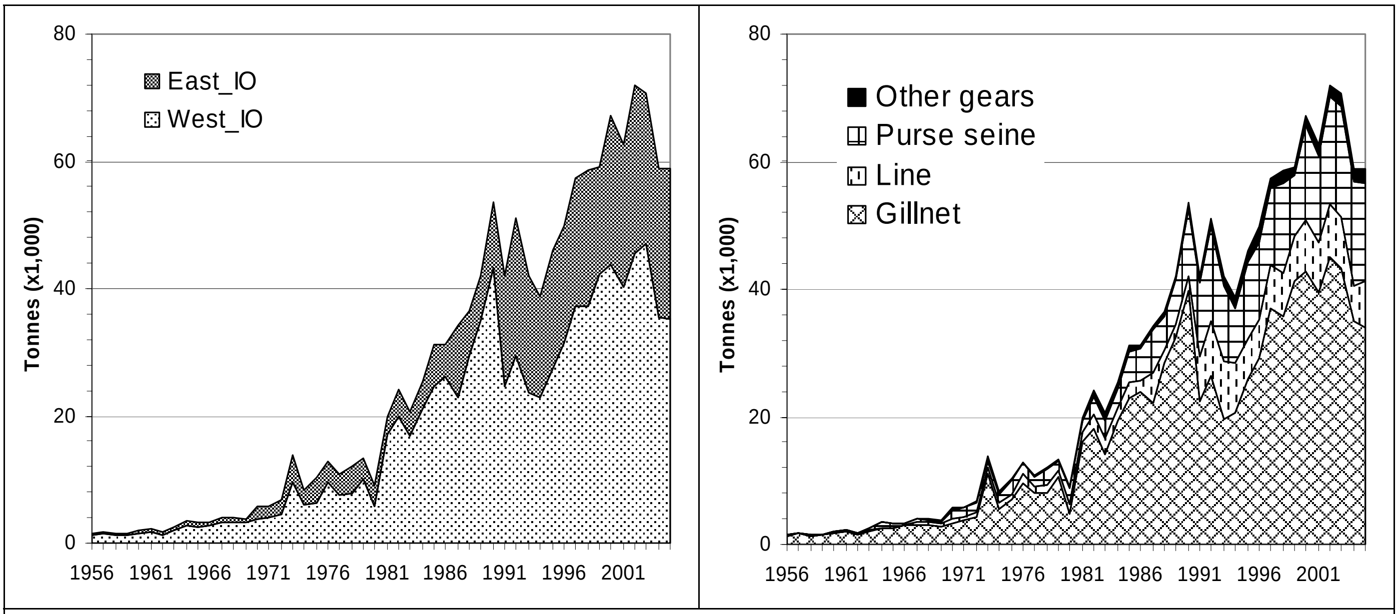

***Figure 1**. Kawakawa: (a) annual catches from 1956 to 2005 by (on the left) area i.e. Eastern and Western Indian Ocean and (on the right) gear.* Data as of October 2006

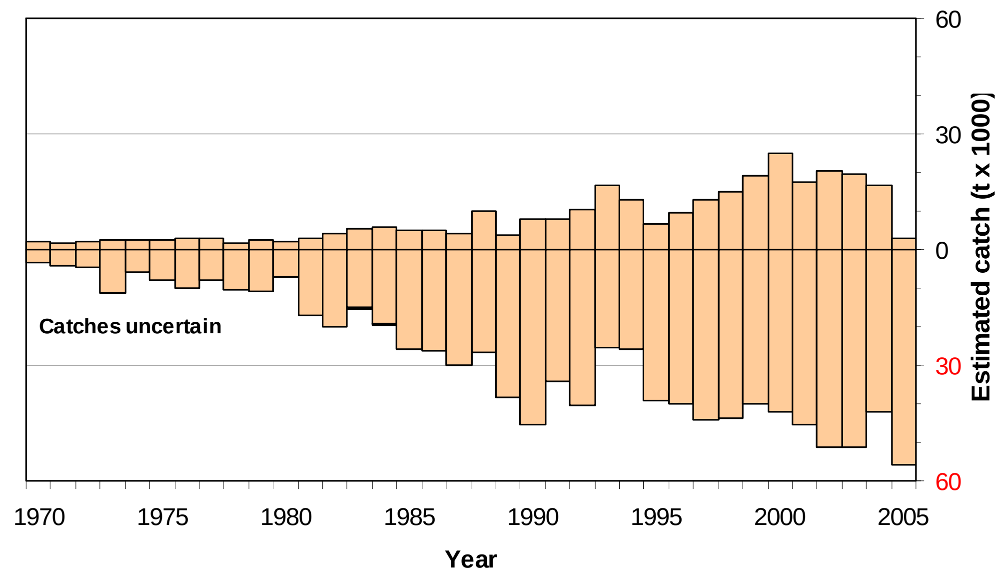

***Figure 2**. Kawakawa: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text.* Data as of October 2006

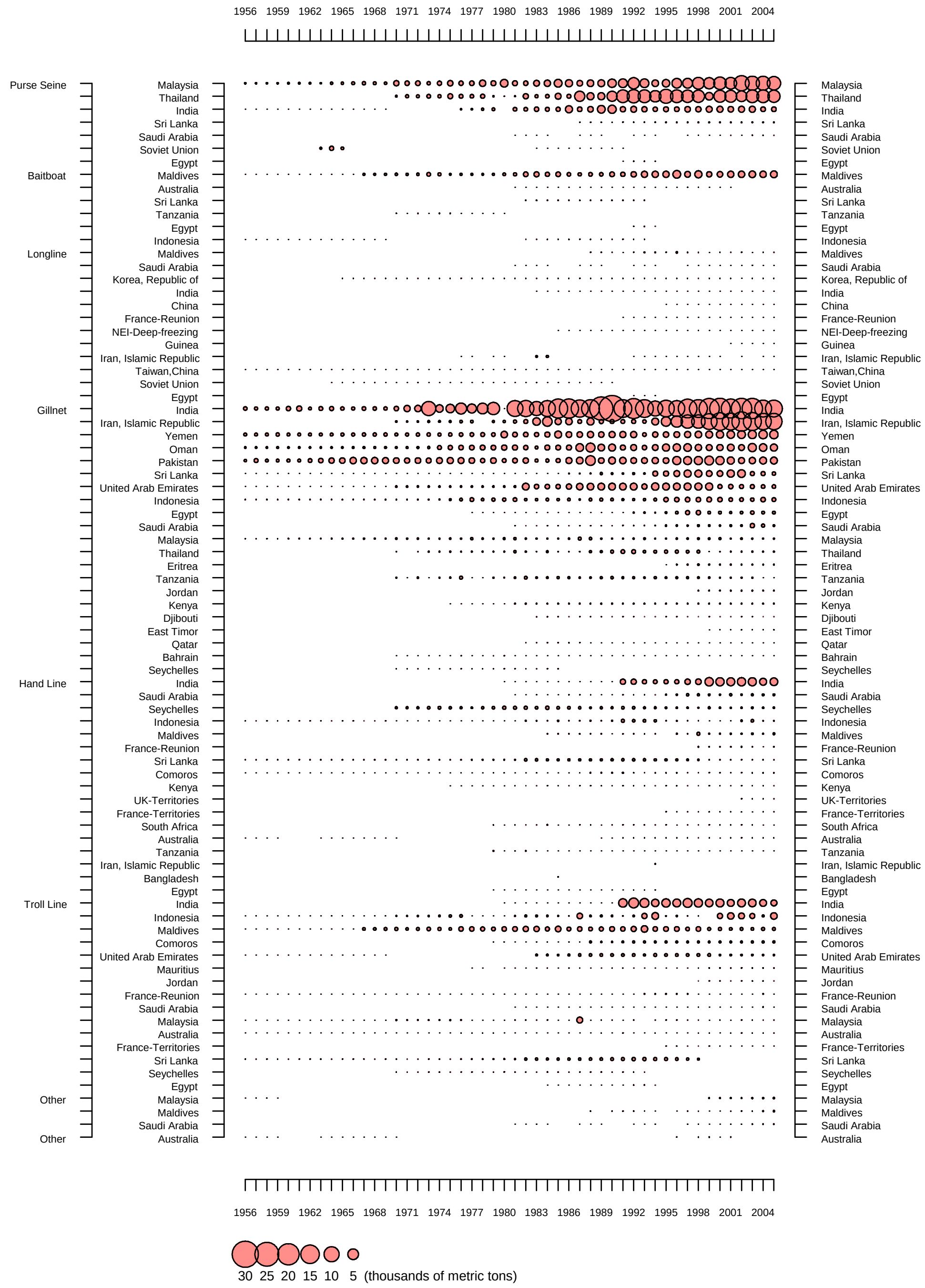

Figure 3. *Catches of kawakawa by gear and main fleets for the period 1956-2005 (in thousands of tonnes).*

Data as of October 2006

Executive summary of the status of the longtail tuna resource

(As adopted by the IOTC Scientific Committee 10 November 2006)

BIOLOGY

Longtail tuna *(Thunnus tonggol)* is an oceanic species that forms schools of varying sizes. It is most abundant over areas of broad continental shelf.

Longtail tuna grows to around 145 cm FL or 35.9 kg, but the most common size in Indian Ocean ranges from 40 to 70 cm. Longtail tuna grows rapidly to reach 40 to 46 cm in FL in one year.

The spawning season varies according to location. Off the west coast of Thailand there are two distinct spawning seasons: January-April and August-September.

Longtail tuna feeds on a variety of fish, cephalopods, and crustaceans, particularly stomatopod larvae and prawns.

No information is available on the stock structure of longtail tuna in the Indian Ocean.

FISHERIES

Longtail tuna is caught mainly by gillnet and in a lesser extent by artisanal purse seiners and most of the catch is taken in the western Indian Ocean area (Figure 1). The catch estimates for longtail tuna were derived from very small amounts of information and are therefore highly uncertain[14] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. Estimated catches of longtail tuna increased steadily from the mid 1950's, reaching around 9,000 t in the early 1970's and over 40,000 t by the mid-1980's. Peaks in catches occurred in 1980, 1987-88, 1995 and 2000. Current catches are around 61,000 t. In 2005, the countries attributed with the highest catches of longtail tuna were Iran (23,713 t or 44 % of the total catch), Oman (7,484 t, 14 %), Yemen (5,431 t, 10.2 %) and Pakistan (5,113 t, 9.6 %) (Table 1).

In 2005, twelve countries reported catches of longtail tuna in the IOTC region. Catches for other countries known to catch longtail tuna are estimated by the Secretariat according to the species composition per gear declared during the previous year or by the major fishing countries of the region (Figure 3).

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is no information on the stock structure of longtail tuna in the Indian Ocean.

Age and the growth are available for Longtail tuna in other oceans.

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for longtail tuna are highly uncertain. There has been a steady increase in the catches from the mid-1950's (Figure 1). Peaks in catches occurred in 1980, 1987-88, 1995 and 2000.
2. **Nominal CPUE Trends:** data not available to the Secretariat.
3. **Average weight in the catch by fisheries:** data not available to the Secretariat.
4. **Number of squares fished:** data not available to the Secretariat.

STOCK ASSESSMENT

While some localised, sub-regional assessments may have been undertaken, no quantitative stock assessment has been undertaken by the IOTC Working Party on Neritics.

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[14] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of unreporting fisheries for which catches had to be estimated.

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for longtail tuna in the Indian Ocean, therefore the stock status is uncertain.

The SC notes the decline in the catches since 2000. However, the reasons for this are not clear: it may be problem related to reporting, or it may be a normal fluctuation in the fishery — similar declines occurred in the mid 1980's, early 1990's and mid 1990's. Nevertheless, the SC recommended that this species be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

LONGTAIL TUNA SUMMARY

Maximum Sustainable Yield:	-
Preliminary catch in 2005 *(data as of October 2006)*	53,400 t
Catch in 2004	53,900 t
Mean catch over the last 5 years (2001-05)	60,600 t
Current Replacement Yield:	-
Relative Biomass ($B_{current}/B_{MSY}$):	-
Relative Fishing Mortality ($F_{current}/F_{MSY}$):	-

Table 1. *Best scientific estimates of the catches of longtail tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1956-2005 (in thousands of tonnes).*

Data as of October 2006

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Purse seine	Malaysia	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.2	0.2	0.1	0.7	0.5	0.5	0.3	0.4	0.7	0.5	0.5	0.9	0.6	1.4	0.6	0.5
	Thailand															0.0	0.2	0.2	0.3	0.2	0.5	0.3	0.3	0.4	1.8	0.6	1.1	6.9
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.2	0.2	0.1	0.7	0.7	0.7	0.6	0.6	1.2	0.8	0.8	1.3	2.4	2.0	1.7	7.4
Gillnet	Iran, Islamic Republic															0.6	0.1	0.7	0.9	0.9	0.9	1.4	1.6		0.8	1.0	2.2	2.9
	Oman	0.7	0.7	0.7	0.9	0.7	0.7	0.7	0.7	0.7	0.8	0.8	1.0	1.0	1.0	0.9	1.0	1.1	1.2	3.8	4.4	5.0	5.3	5.8	5.4	6.6	6.3	4.6
	Pakistan	0.8	2.0	1.0	1.0	1.2	1.1	1.7	2.5	3.5	3.8	5.1	4.9	4.9	4.5	4.0	3.3	3.9	3.1	4.2	4.7	4.4	3.9	2.3	4.0	1.8	2.8	3.5
	Yemen	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.5	1.1	1.3	1.5	1.5	1.7	1.5	1.7	1.4	1.2
	India	0.5	0.4	0.5	0.4	0.8	1.1	0.3	0.6	0.6	0.5	0.4	0.6	0.6	0.5	0.9	1.8	1.8	8.2	2.4	3.1	5.4	3.6	5.0	6.6	16.7	1.7	2.6
	United Arab Emirates	0.7	0.9	0.9	1.3	1.3	1.3	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	0.9	0.9	0.9	0.9	1.5	1.5	1.4	1.4	1.4	1.4	1.4	0.4	4.0
	Other Fleets	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.2	0.2	0.1	0.3	0.2	0.4	0.1	0.3	0.4	0.9	0.6	0.3	0.4	0.5	1.4	1.1
	Total	3.0	4.3	3.4	4.0	4.4	4.6	4.7	5.8	6.8	7.2	8.5	8.9	8.8	8.2	8.0	7.7	9.1	14.9	14.2	16.4	19.9	18.0	16.4	20.1	29.8	16.2	19.9
Other gears	India																									3.8	0.4	0.6
	United Arab Emirates	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3													
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	3.8	0.4	0.6
All	Total	3.2	4.5	3.6	4.3	4.7	4.9	5.0	6.1	7.2	7.6	8.9	9.4	9.3	8.6	8.8	8.4	9.9	15.4	14.9	17.6	20.7	18.8	17.7	22.6	35.6	18.3	27.9

Gear	Fleet	Av01/05	Av56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Purse seine	Iran, Islamic Republic	4.7	0.6														0.7	0.8	1.5	2.1	2.7	3.0	5.8	3.6	5.7	5.7
	Malaysia	3.5	1.1	0.8	1.0	1.5	1.3	0.8	0.8	1.1	1.3	1.5	2.4	1.5	0.8	1.0	1.7	1.8	2.6	2.3	3.0	2.6	4.3	3.7	3.6	3.4
	Thailand	2.5	1.6	6.8	5.9	2.2	1.5	1.4	1.2	1.4	1.0	5.3	2.0	3.2	2.0	3.4	2.6	2.6	2.5	5.1	4.4	1.0	2.7	3.2	2.8	2.9
	Other Fleets	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.3	0.1	0.0
	Total	10.9	3.3	7.6	6.9	3.7	2.8	2.2	2.0	2.5	2.3	6.7	4.4	4.7	2.8	4.5	5.0	5.1	6.6	9.6	11.2	6.6	12.9	10.8	12.3	11.9
Gillnet	Iran, Islamic Republic	23.7	8.3	5.6	6.1	11.8	11.7	12.1	16.9	19.4	14.9	14.6	9.8	8.2	11.5	27.2	16.5	17.9	18.2	21.3	38.7	31.9	24.1	26.7	18.0	18.0
	Oman	7.3	4.4	2.1	6.1	6.6	7.5	17.3	15.8	8.8	7.0	4.3	5.2	6.9	5.6	4.2	5.4	5.1	4.4	4.8	5.5	6.1	6.9	8.0	8.2	7.5
	Pakistan	5.3	4.0	1.2	1.3	2.1	4.4	6.0	6.3	4.9	6.2	6.1	5.8	4.5	5.8	5.0	4.7	5.6	5.5	6.4	6.1	5.2	4.9	5.9	5.1	5.1
	Yemen	5.0	1.5	0.4	1.0	1.1	0.5	0.6	0.7	0.6	1.4	0.7	1.4	1.8	2.4	2.3	2.6	3.0	3.3	3.7	4.0	4.4	4.7	5.1	5.4	5.4
	India	3.4	2.9	1.2	1.8	4.5	1.6	3.3	2.4	2.8	3.6	2.9	1.9	2.9	3.0	4.2	3.1	3.3	3.7	6.6	7.3	6.5	4.6	3.0	1.4	1.4
	United Arab Emirates	2.1	2.1	2.6	2.6	2.4	3.4	3.1	3.4	3.4	3.4	3.3	3.4	3.4	3.8	4.9	5.0	3.2	3.2	3.2	1.5	1.5	1.9	2.9	2.0	2.0
	Other Fleets	1.0	0.6	0.4	0.5	0.8	0.9	1.4	1.3	0.7	0.7	0.8	0.7	1.0	0.8	0.8	1.0	0.9	1.0	1.4	1.2	1.1	1.4	1.2	0.3	0.8
	Total	47.7	23.8	13.4	19.3	29.3	30.0	43.9	46.7	40.6	37.2	32.7	28.3	28.8	32.9	48.6	38.2	39.0	39.3	47.5	64.2	56.6	48.5	52.8	40.5	40.3
Other gears	India	1.4	0.7	0.3	0.4	1.2	0.4	0.8	0.7	0.7	0.9	1.2	0.8	1.2	1.2	1.7	1.3	1.3	1.5	2.7	3.0	2.6	1.9	1.3	0.5	0.5
	United Arab Emirates	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.8	0.8	0.5	0.5	0.5	0.2	0.2	0.3	0.5	0.3	0.3
	Other Fleets	0.2	0.1	0.3	0.5	0.1	0.1	1.6	0.0	0.0	0.1	0.1	0.1	0.0	0.6	0.2	0.0	0.1	0.2	0.2	0.1	0.3	0.2	0.2	0.2	0.3
	Total	1.9	1.1	1.0	1.3	1.7	1.1	2.9	1.3	1.3	1.5	1.8	1.4	1.8	2.4	2.7	2.1	2.0	2.2	3.4	3.3	3.1	2.4	1.9	1.1	1.2
All	Total	60.6	28.3	22.0	27.5	34.7	33.9	49.0	50.0	44.5	41.0	41.2	34.1	35.2	38.1	55.8	45.3	46.1	48.2	60.5	78.8	66.4	63.8	65.5	53.9	53.4

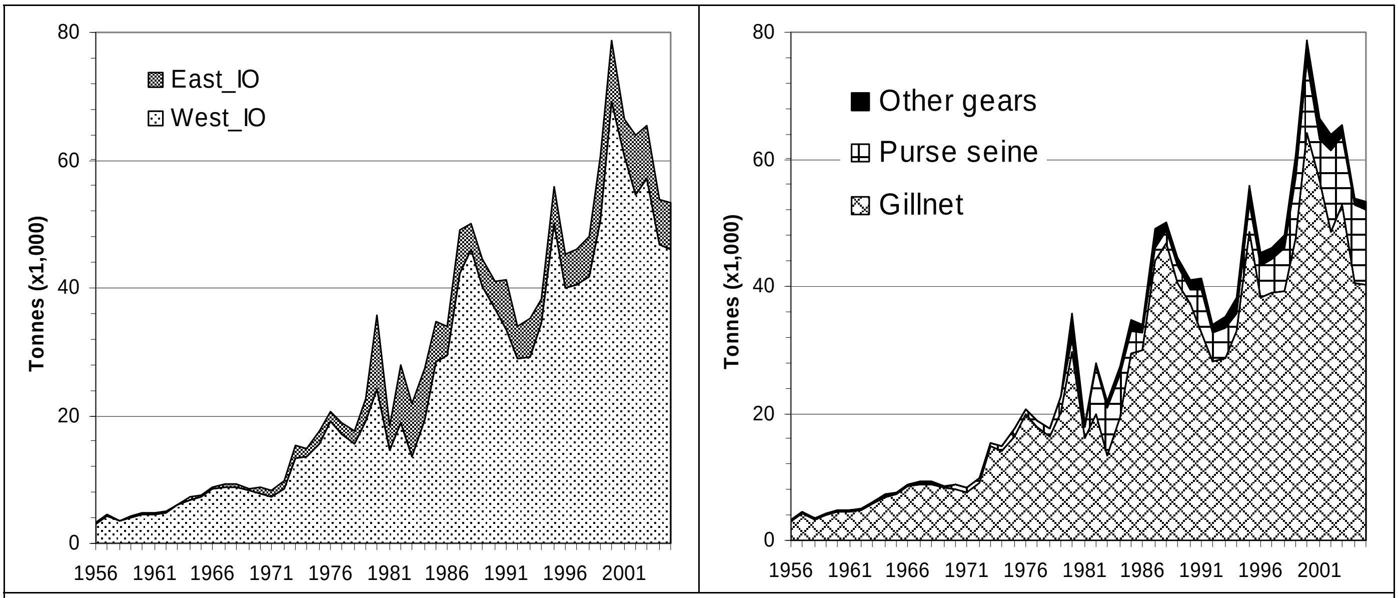

Figure 1. *Longtail tuna: annual catches from 1956 to 2005 by area (left) and gear (right).* *Data as per October 2006*

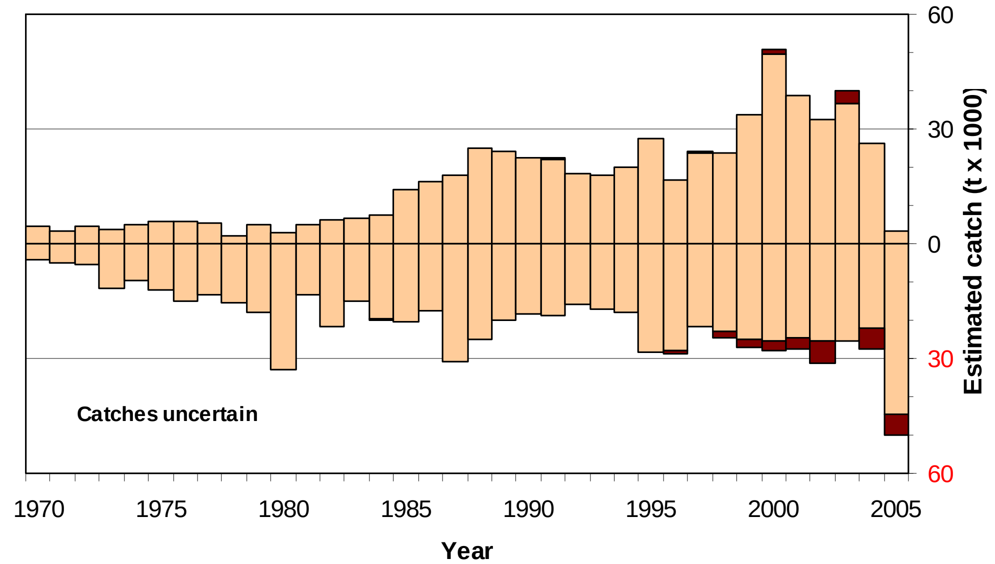

Figure 2. *Longtail tuna: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text. Dark sections represent estimates of catches by industrial fleets.* *Data as of October 2006*

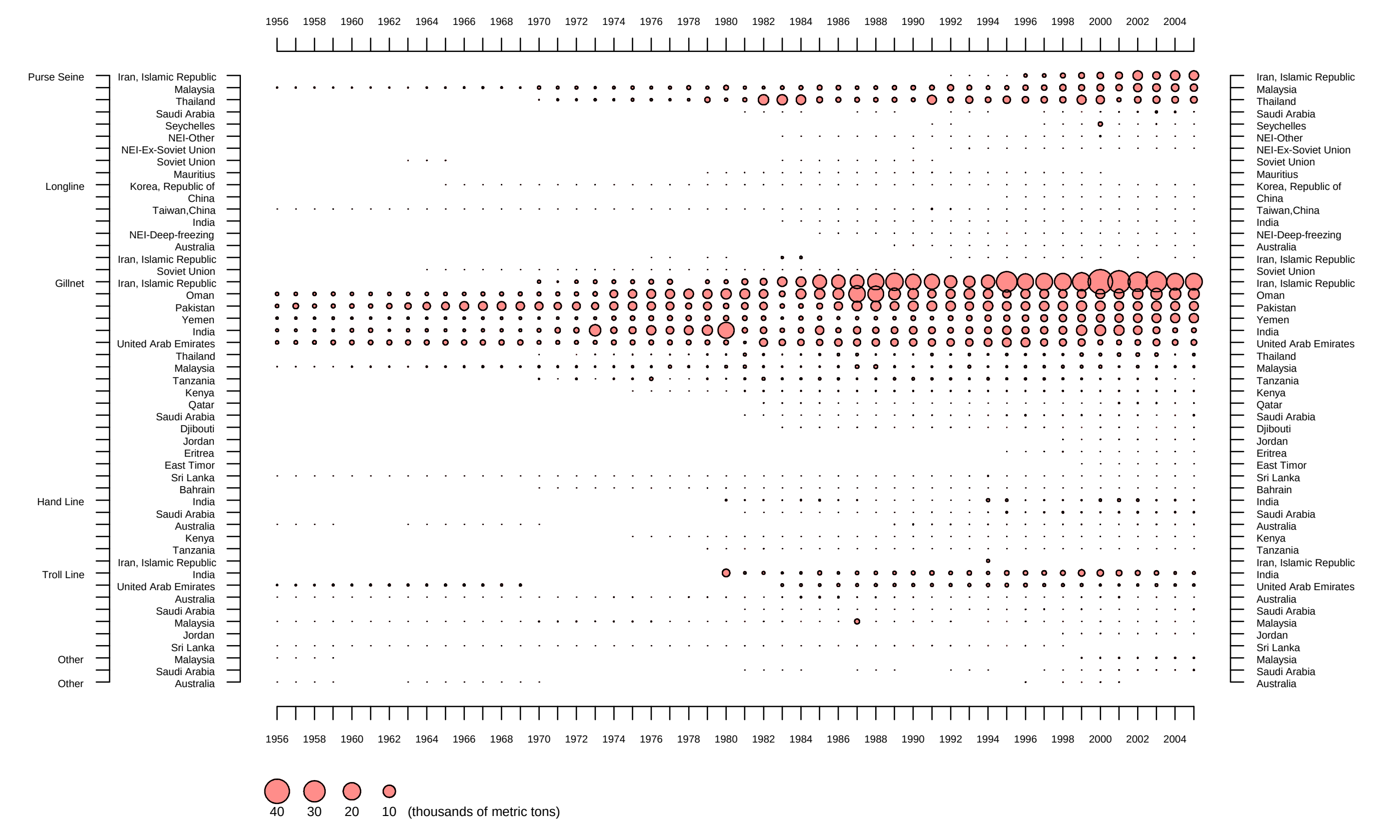

Figure 3. *Longtail tuna: catches by gear and main fleets for the period 1956-2005 (in thousands of tonnes).*

Data as of October 2006

Executive summary of the status of the narrow-barred Spanish mackerel resource

(As adopted by the IOTC Scientific Committee 10 November 2006)

Biology

The narrow-barred Spanish mackerel or king seer *(Scomberomorus commerson*) is a pelagic, top level predator found throughout tropical marine waters of the Indo-West Pacific. Juveniles inhabit shallow inshore areas whereas adults are found in coastal waters out to the continental shelf. Adults are usually found in small schools but often aggregate at particular locations on reefs and shoals to feed and spawn. Spanish mackerel appear to undertake lengthy migrations. Spanish mackerel feed primarily on small fishes such as anchovies, clupeids, carangids, also squids and shrimps.

Spanish mackerel may live for up to 15 years, and grow to 240 cm fork length or 70 kg. Females are multiple spawners. Year-round spawning has been observed in east African waters, with peaks during late spring to summer (April-July) and autumn (September-November) coinciding with the two seasonal monsoons which generate high abundances of plankton and small pelagic fish. Size at first maturity is estimated to be around 52 cm for males and 81 cm for females.

Genetic studies carried out on *S. commerson* from Djibouti, Oman and U.A.E. showed there were small genetic differences among stocks in these three places.

Fisheries

Spanish mackerel is targeted throughout the Indian Ocean by artisanal and recreational fishers. The main method of capture is gill net, but significant numbers of are also caught using trolling lines.

The catch estimates for Spanish mackerel were derived from very small amounts of information and are therefore highly uncertain[15] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. The catches of Spanish mackerel increased from around 50,000 t the mid-1970’s to 100,000 t by the mid-1990’s. The current average annual catch is around 117,500 t (for the period 2001 to 2005), with most of the catch obtained taken from the west Indian Ocean area. (Figures 1, 3 and Table 1).

Nineteen countries reported catches of Spanish mackerel in the IOTC region in 2005 (Figure 2). The highest catches were reported by India (29,081 t or 24 % of the total catch), followed by Indonesia (22,793 t, 19 %), Madagascar (12,000 t, 10 %), Pakistan (9,493 t, 8 %), Iran (7,079 t, 6 %) and Saudi Arabia (5,516 t, 5 %).

The size of Spanish mackerel taken varies by location with 32-119 cm fish taken in the Eastern Peninsular Malaysia area, 17-139 cm fish taken in the East Malaysia area and 50-90 cm fish taken in the Gulf of Thailand. Similarly, Spanish mackerel caught in the Oman Sea are typically larger than those caught in the Persian Gulf.

Availability of information for stock assessment

Numerous studies have been completed in Indian Ocean to determine the fecundity, the size at first maturity and age and growth parameters.

Genetic studies carried out on *S. commerson* from Djibouti, Oman and U.A.E. showed there were small genetic differences among stocks in these three places, therefore, stock assessment purposes, the use of sub-stocks may be appropriate.

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for narrow-barred Spanish mackerel are highly uncertain. The trend in catches indicate a large and continuous increase in the catches from the 1970’s to 2000, followed by a period of relatively stable catches at around 120,000 t (Figure 1).

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[15] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of unreporting fisheries for which catches had to be estimated.

2. **Nominal CPUE Trends:** data not available to the Secretariat.
3. **Average weight in the catch by fisheries:** data not available to the Secretariat.
4. **Number of squares fished:** data not available to the Secretariat.

STOCK ASSESSMENT

While some localised, sub-regional assessments have been undertaken, typically by national scientists, no quantitative stock assessment has been undertaken by the IOTC Working Party on Neritics.

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for narrow-barred Spanish mackerel tuna in the Indian Ocean, therefore the stock status is uncertain. The SC notes that Spanish mackerel is a relatively productive species with high fecundity and this makes it relatively resilient and less prone to overfishing; however, it recommends that this important species be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

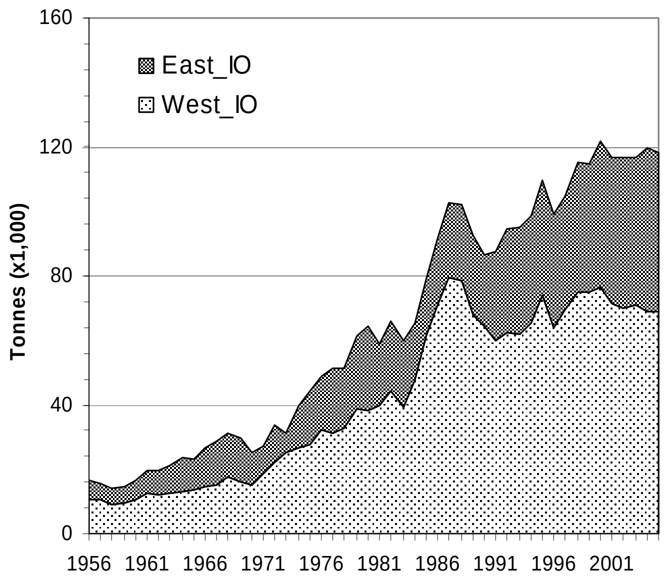
NARROW-BARRED SPANISH MACKEREL SUMMARY

Maximum Sustainable Yield:	-
Preliminary catch in 2005 *(data as of October 2006)*	118,240 t
Catch in 2004	119,700 t
Mean catch over the last 5 years (2001-05)	117,726 t
Current Replacement Yield:	-
Relative Biomass ($B_{current}/B_{MSY}$):	-
Relative Fishing Mortality ($F_{current}/F_{MSY}$):	-

Table 1. *Best scientific estimates of the catches of narrow-barred Spanish mackerel (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1956-2005 (in thousands of tonnes).* *Data as of October 2006*

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Gillnet	India	10.0	7.4	6.8	5.8	8.2	11.0	8.6	8.1	9.6	7.7	7.9	8.2	10.4	9.3	9.3	13.2	14.6	14.3	16.2	15.3	17.6	12.7	12.3	18.8	22.3	13.2	18.5
	Indonesia	1.1	1.0	1.1	1.0	1.1	1.3	1.4	1.4	1.5	1.7	1.8	1.7	1.8	2.0	1.1	1.1	1.3	1.2	1.0	5.1	3.4	4.6	4.0	3.6	5.8	4.2	5.9
	Pakistan	0.8	2.1	1.1	1.1	1.3	1.2	1.8	2.7	3.8	4.1	5.4	5.3	5.3	4.8	4.4	3.5	7.5	4.9	4.4	3.1	3.7	5.4	5.8	9.2	1.9	7.3	7.3
	Iran, Islamic Republic																											0.1
	United Arab Emirates	0.8	1.0	1.0	1.6	1.6	1.6	1.8	1.8	1.8	2.0	2.0	2.1	2.1	2.1	2.2	2.4	2.4	2.4	3.7	3.7	3.6	3.6	3.6	3.6	3.6	3.5	6.5
	Sri Lanka	0.8	0.9	1.0	1.2	1.2	1.3	2.1	3.0	2.6	2.2	3.8	5.4	5.3	5.2	3.9	2.6	2.9	3.3	3.2	3.1	3.9	3.8	3.9	4.5	6.1	5.0	4.5
	Saudi Arabia																										0.6	0.5
	Oman	1.3	1.3	1.3	1.6	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.7	1.7	1.7	1.6	1.7	1.9	2.1	6.7	7.8	8.9	9.4	10.3	9.5	11.7	11.1	8.2
	Egypt																						0.0	0.0	0.2	0.2	0.3	0.3
	Yemen	0.8	0.8	0.8	1.0	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.0	0.8	0.9	1.0	1.1	2.6	3.1	3.5	3.7	4.0	3.7	4.1	3.3	2.9
	Malaysia	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.2	0.2								3.0	3.3	3.6	2.9	3.5	4.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.2	0.1	0.0	0.0	0.7	0.6	0.8	0.8	0.7	0.9	1.5	2.6	1.8	2.1	1.6	3.1	2.8
	Total	16.0	14.8	13.4	13.5	15.4	18.4	17.9	19.2	21.5	20.8	23.7	25.7	27.9	26.3	23.9	26.0	32.4	29.9	38.6	42.1	46.2	49.0	48.9	58.8	60.3	55.0	61.7
Line	Saudi Arabia																										0.2	0.2
	Other Fleets	0.7	0.7	0.8	1.1	0.9	1.0	1.2	1.5	1.4	1.5	1.9	2.2	2.2	2.3	1.3	1.1	1.1	1.2	1.2	2.1	1.9	2.2	2.2	2.2	3.7	2.9	2.0
	Total	0.7	0.7	0.8	1.1	0.9	1.0	1.2	1.5	1.4	1.5	1.9	2.2	2.2	2.3	1.3	1.1	1.1	1.2	1.2	2.1	1.9	2.2	2.2	2.2	3.7	3.1	2.2
Other gears	Thailand															0.1	0.3	0.2	0.1	0.0	0.1	0.5	0.1	0.1	0.0	0.3	0.3	0.8
	Malaysia	0.1	0.1	0.1	0.1	0.3	0.4	0.4	0.4	0.8	1.1	1.2	1.0	1.1	1.0									0.0	0.2	0.0		0.4
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.0	0.6	0.9
	Total	0.1	0.1	0.1	0.1	0.3	0.4	0.4	0.4	0.8	1.1	1.2	1.0	1.1	1.0	0.1	0.3	0.2	0.1	0.0	0.1	0.5	0.2	0.3	0.5	0.3	0.9	2.1
All	**Total**	**16.7**	**15.6**	**14.3**	**14.7**	**16.6**	**19.8**	**19.6**	**21.1**	**23.7**	**23.4**	**26.8**	**28.9**	**31.2**	**29.6**	**25.3**	**27.4**	**33.7**	**31.2**	**39.8**	**44.3**	**48.6**	**51.4**	**51.4**	**61.5**	**64.3**	**59.1**	**66.0**

Gear	Fleet	Av01/05	Av56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Gillnet	India	28.4	16.8	16.2	17.6	15.7	20.7	16.8	19.0	19.8	14.7	15.8	22.3	18.8	22.4	26.0	22.4	23.2	29.3	28.3	33.3	25.2	33.0	31.1	26.2	26.2
	Indonesia	20.2	7.4	7.4	6.3	6.1	7.5	8.4	10.0	9.2	8.2	10.0	10.8	13.5	12.4	13.7	16.0	14.9	16.8	16.2	18.5	20.8	17.2	18.0	22.5	22.8
	Pakistan	9.3	6.4	7.9	6.9	7.3	7.6	7.8	10.2	6.8	6.3	10.1	8.4	8.4	7.2	8.6	10.1	12.5	12.8	13.3	10.8	9.4	8.8	9.4	9.5	9.5
	Iran, Islamic Republic	7.4	1.9	1.4	0.6	0.7	0.7	1.1	1.0	2.5	3.4	3.7	3.3	2.9	3.1	11.1	3.6	3.9	4.0	4.6	7.1	6.1	8.6	8.1	7.1	7.1
	United Arab Emirates	5.2	4.3	5.4	5.4	4.2	6.7	5.7	6.1	6.4	6.3	6.0	6.2	6.2	6.9	6.8	7.1	8.3	8.6	9.0	8.2	9.0	3.3	4.9	4.4	4.4
	Sri Lanka	4.7	3.7	4.0	3.7	3.8	4.0	4.1	4.2	4.3	4.3	4.2	4.1	4.1	4.1	4.8	4.0	4.2	4.6	5.0	4.9	4.9	5.1	4.5	4.5	4.5
	Saudi Arabia	3.6	2.5	0.7	0.8	7.1	7.7	7.0	7.1	6.7	7.6	7.8	7.9	8.3	8.5	6.1	5.0	3.7	4.7	3.8	3.5	4.9	4.0	3.1	2.9	3.2
	Oman	2.7	5.7	3.6	10.7	20.3	14.3	25.3	27.8	11.1	7.8	3.6	3.6	3.1	3.8	6.1	5.2	5.9	3.1	3.4	2.6	2.8	2.1	2.8	3.2	2.7
	Egypt	2.2	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.0	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.4	4.9	4.9
	Yemen	1.9	2.1	0.9	4.5	3.5	3.8	3.3	2.6	2.3	3.1	3.2	2.6	3.1	3.3	3.0	2.4	2.3	2.2	2.2	2.1	2.0	1.9	1.8	1.8	1.8
	Malaysia	1.4	1.6	3.6	2.2	2.8	3.7	4.0	3.4	2.6	2.8	3.0	3.7	3.0	2.9	2.0	2.2	2.4	3.2	0.7	0.9	1.1	1.8	1.6	1.5	0.9
	Other Fleets	3.9	2.0	2.6	2.1	2.9	2.9	3.1	2.8	2.8	4.0	3.7	4.2	3.6	2.9	3.5	3.5	3.5	3.7	4.4	3.3	4.0	4.0	3.9	3.6	3.9
	Total	90.8	54.7	54.0	##	74.5	79.6	86.7	94.4	74.7	68.7	71.3	77.2	75.2	77.8	91.8	81.7	85.0	93.5	91.0	95.4	90.5	90.1	89.6	92.2	91.8
Line	Madagascar	12.0	3.9				3.8	7.9	0.4	8.5	10.0	8.0	8.0	10.0	10.0	10.0	10.0	10.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
	India	2.8	0.7									1.4	2.0	1.7	2.0	2.4	2.0	2.1	2.7	2.6	3.0	2.3	3.0	2.8	2.8	2.8
	Saudi Arabia	2.4	0.9	0.3	0.3	1.2	1.4	2.0	2.3	2.5	1.3	1.4	2.2	2.6	2.9	0.9	1.0	2.3	2.4	2.7	2.4	2.3	2.3	2.7	2.2	2.4
	Other Fleets	2.9	2.3	3.0	2.6	2.3	2.8	3.7	2.9	3.6	3.8	3.7	3.1	3.6	3.9	2.7	2.9	3.1	2.8	2.3	2.7	3.7	2.4	3.0	3.0	2.5
	Total	20.0	7.7	3.3	2.9	3.5	8.0	13.5	5.6	14.6	15.1	14.6	15.4	17.9	18.8	16.0	15.9	17.5	19.8	19.5	20.1	20.3	19.7	20.5	20.1	19.7
Other gears	Thailand	4.6	1.0	0.9	0.5	0.6	0.9	0.9	0.4	1.0	1.2	1.1	1.6	1.5	1.2	1.8	1.5	1.4	1.4	1.4	3.2	3.6	4.5	4.5	5.6	4.8
	Malaysia	1.5	0.5	0.0	0.0		0.3	0.3	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2	2.4	2.7	1.7	1.5	1.6	1.4	1.5
	Other Fleets	0.5	0.4	1.5	1.1	0.7	2.7	1.3	1.9	2.0	1.2	0.1	0.3	0.4	0.4	0.2	0.2	0.5	0.6	0.5	0.5	0.5	0.6	0.6	0.5	0.5
	Total	6.7	1.8	2.5	1.5	1.3	3.9	2.6	2.4	3.1	2.5	1.5	2.1	2.0	1.8	2.1	1.7	2.0	2.1	4.3	6.4	5.7	6.6	6.7	7.4	6.8
All	Total	117.5	64.3	59.8	65.3	79.2	91.5	102.8	102.4	92.3	86.3	87.3	94.6	95.1	98.4	###	99.3	104.5	115.4	114.8	121.9	116.5	116.5	116.8	119.7	118.2



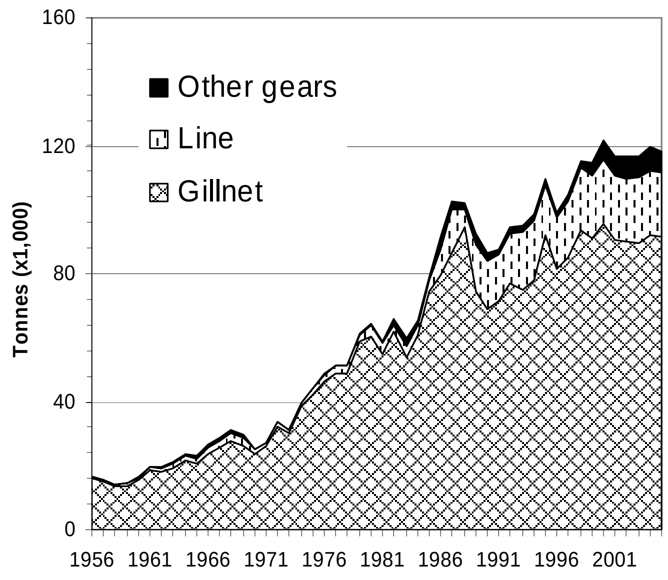


Figure 1. *Narrow-barred Spanish mackerel: (a) annual catches from 1956 to 2005 by (on the left) area i.e. Eastern and Western Indian Ocean and (on the right) gear.* *Data as of October 2006*

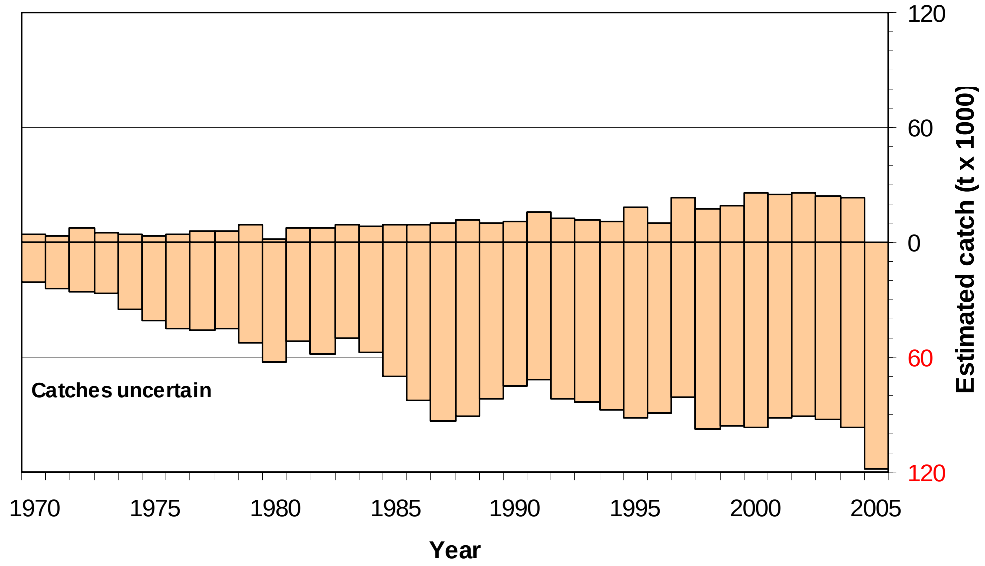


Figure 2*. Narrow-barred Spanish mackerel: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text.* *Data as of October 2006*

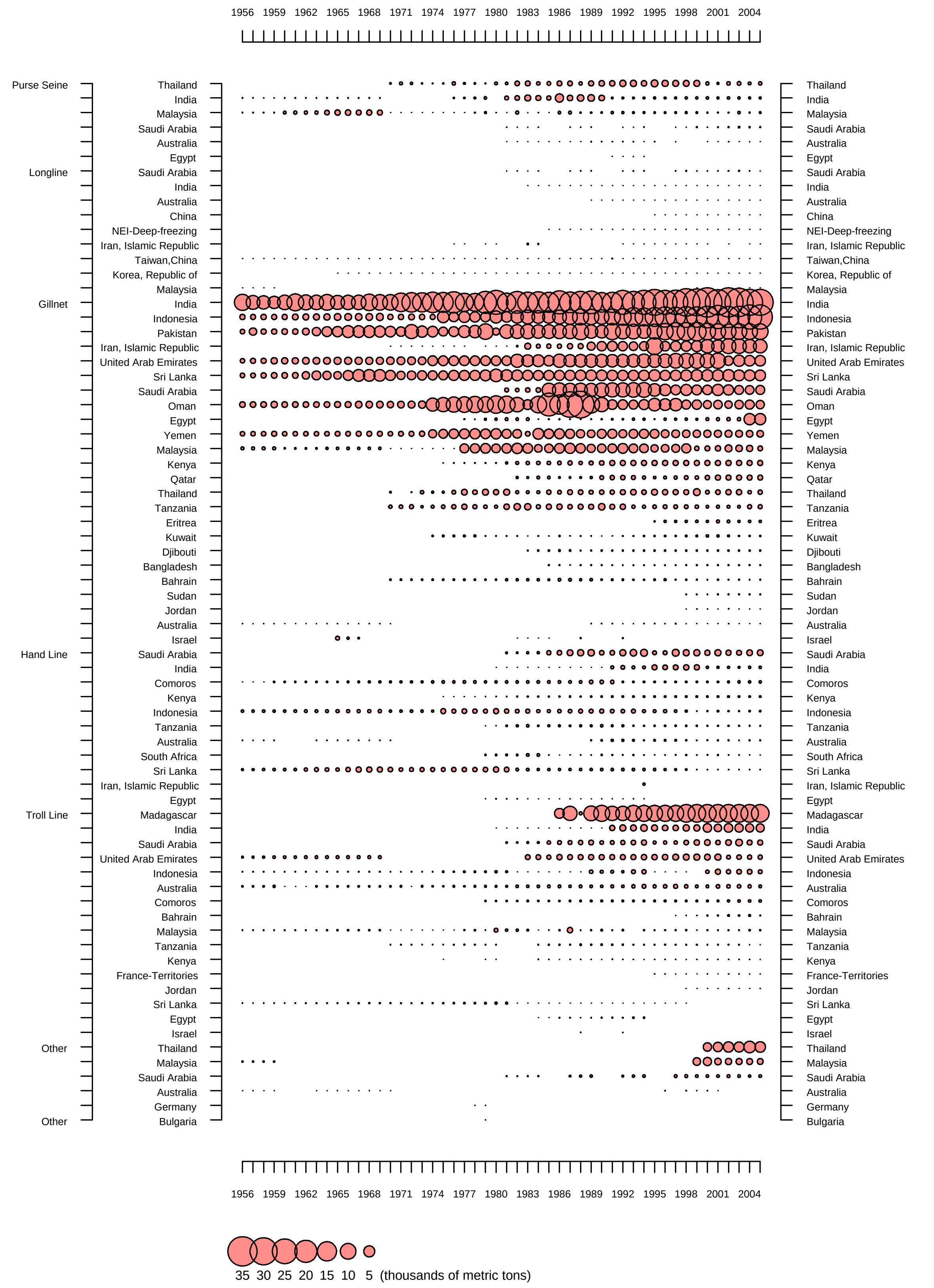


Figure 3. *Narrow barred Spanish mackerel: catches of by gear and main fleets for the period 1956-2005 (in thousands of tonnes).* *Data as of October 2006*

Executive summary of the status of the wahoo resource

(As adopted by the IOTC Scientific Committee 10 November 2006)

Biology

Wahoo (*Acanthocybium solandri*) occurs widely in the tropical and sub-tropical waters of the major oceans. Larger individuals are solitary but may also be found in small, loose aggregations. Like other oceanic scombrids, wahoo are often found in association with current lines, near seamounts and around floating objects and debris. Little is known of their early life history; however wahoo larvae are pelagic and prefer shallow water less than 100 m in depth. The distribution of juveniles is unknown.

As a top-level predator, wahoo feeds on a range of open-water prey including other scombrids (e.g. skipjack tuna, frigate tuna), scads, flying fish, squid and occasionally fishes of the mixed scattering layer (e.g. lantern fish).

Wahoo live for over six years, grow rapidly and can reach a size of 210 cm fork length and around 83 kg. Size changes with latitude, with average weight increasing with distance from the equator; this is apparently correlated to cooler temperatures.

Sexual maturity occurs at around of 90 cm but some wahoo may commence spawning after one year. Spawning occurs year-round in the tropics and during the summer months in subtropical waters. Wahoo are probably multiple spawners, with spawning occurring over a protracted period when favourable conditions (temperature, food) are encountered. Fecundity is relatively high (e.g. six million eggs per spawning for a 131 cm fish). Males appear to predominate at sizes greater than 140 cm.

Little information is available on wahoo movement, although seasonal changes in availability and the latitudinal variation in average size suggest that some seasonal migration may occur.

No information is available on the stock structure of wahoo in Indian Ocean.

Fisheries

Wahoo is mainly taken with hand line and gillnet combined with drifting long line, it is also a bycatch of longline fisheries. Trolling is a common method to catch wahoo in Maldives. It is caught in similar quantities in both western and eastern areas of the Indian Ocean (Figure 1). Wahoo is also a bycatch of longline fisheries. The catch estimates for wahoo were derived from very small amounts of information and are therefore underestimated and highly uncertain[16] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. Estimated catches of wahoo jumped from negligible levels to just below 300 t in the 1980's. Catches peaked in 1991 at 885 t and thereafter fluctuated between 300 and 500 t. In 2005, catches were around 300 t.

In 2005, seventeen countries reported catches of wahoo in the IOTC region. Catches for other countries known to catch wahoo are estimated by the Secretariat according to the species composition per gear declared during the previous year or by the major fishing countries of the region. In recent years, the highest catches were reported by France (114 t, equivalent to 35 % of the total catch), Sri Lanka (120 t, 34 %) and Indonesia (56 t, 17 %) (Figure 3).

Availability of information for stock assessment

There is no information on the stock structure of wahoo in the Indian Ocean.

Information is available on fecundity, the size at first maturity, age and growth of wahoo in other oceans.

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for wahoo are highly uncertain. Catches have been variable but around the 300-500 t mark since early 1990's (Figure 1).

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[16] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of unreporting fisheries for which catches had to be estimated.

2. **Nominal CPUE Trends:** data not available to the Secretariat.
3. **Average weight in the catch by fisheries:** data not available to the Secretariat.
4. **Number of squares fished:** data not available to the Secretariat.

STOCK ASSESSMENT

While some localised, sub-regional assessments may have been undertaken, no quantitative stock assessment has been undertaken by the IOTC Working Party on Neritics.

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for wahoo in the Indian Ocean, therefore the stock status is uncertain. However, wahoo is a relatively productive species with high fecundity and rapid growth and these attributes make it relatively resilient and not prone to overfishing.

The SC recommends that this species be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

WAHOO SUMMARY

Maximum Sustainable Yield:	-
Preliminary catch in 2005 *(data as of October 2006)*	339 t
Catch in 2004	400 t
Mean catch over the last 5 years (2001-05)	432 t
Current Replacement Yield:	-
Relative Biomass ($B_{current}/B_{MSY}$):	-
Relative Fishing Mortality ($F_{current}/F_{MSY}$):	-

Table 1. *Best scientific estimates of the catches of wahoo (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1956-2006 (in thousands of tonnes). Data as of October 2006*

Gear	Fleet	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
Gillnet	India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0													0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Line	Tanzania															0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0		
	Sri Lanka	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.2
Other gears	Indonesia																							0.0	0.0	0.0	0.0	0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total																							0.0	0.0	0.0	0.0	0.0
All	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.2

Gear	Fleet	Av01/05	Av56/05	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Gillnet	Sri Lanka	0.2	0.0				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1
	India	0.0	0.0	0.1	0.0	0.0	0.0			0.2	0.0	0.4	0.0	0.0		0.0	0.0	0.0					0.0	0.0	0.0	0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.4	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Line	France-Territories	0.1	0.0													0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1
	France-Reunion	0.1	0.0											0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.0
	Tanzania	0.0	0.0		0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
	Kenya	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sri Lanka	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.2	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.1	0.2
Other gears	Indonesia	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
All	Total	0.4	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.6	0.4	0.9	0.4	0.5	0.5	0.4	0.4	0.4	0.3	0.5	0.4	0.4	0.5	0.5	0.4	0.3

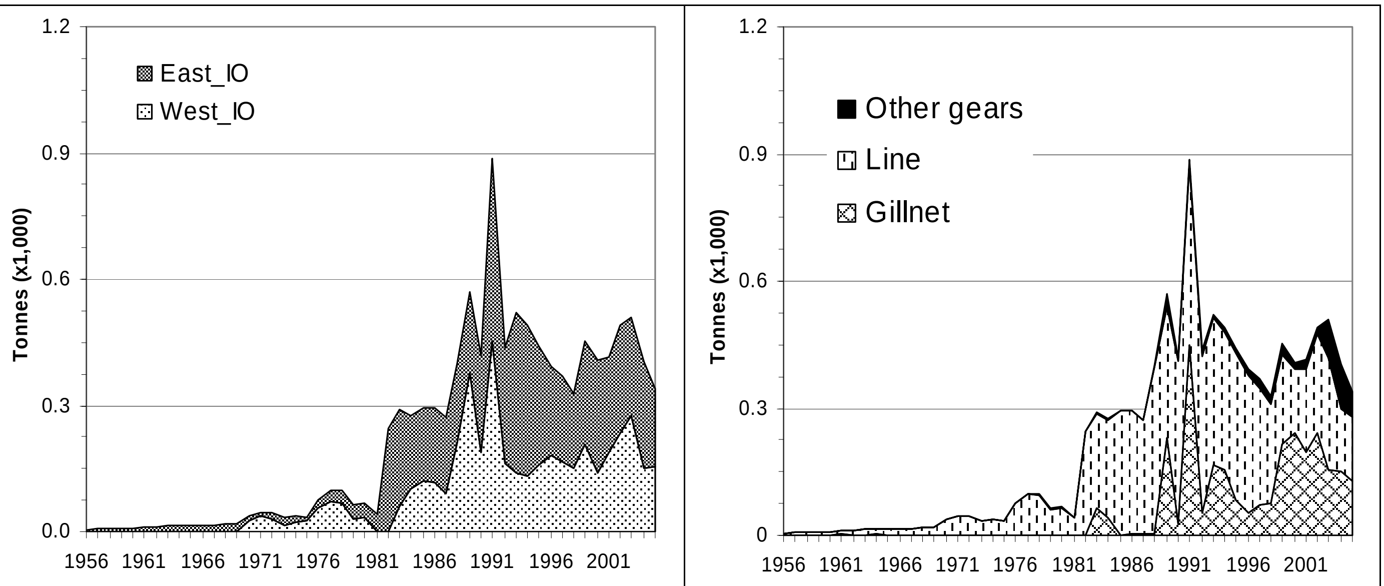

Figure 1. *Wahoo: annual catches (thousand of metric tonnes) by area (left) and gear (right) from 1956 to 2005).*

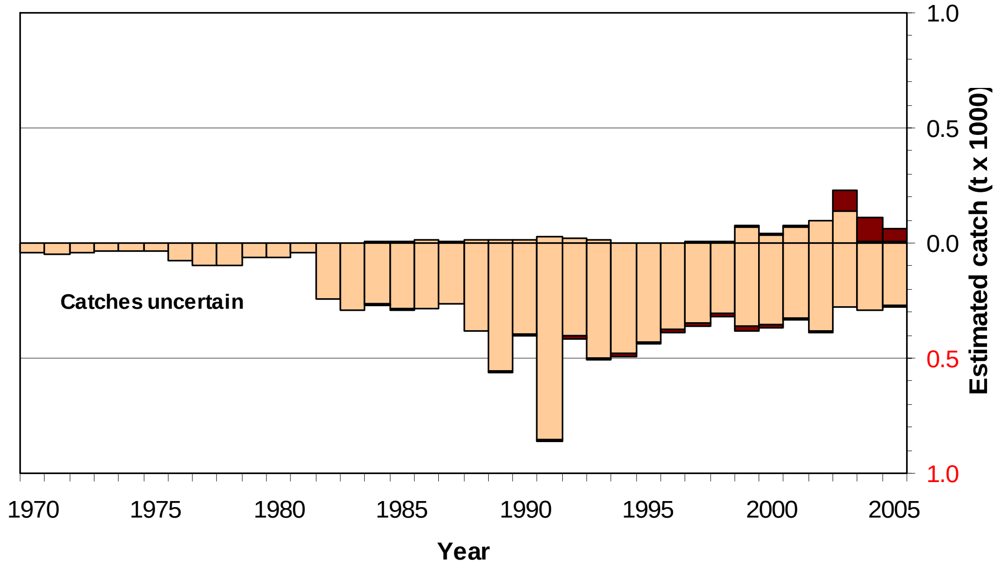

Figure 2. *Wahoo: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text. Dark sections represent estimates of catches by industrial fleets.*

Data as of October 2006

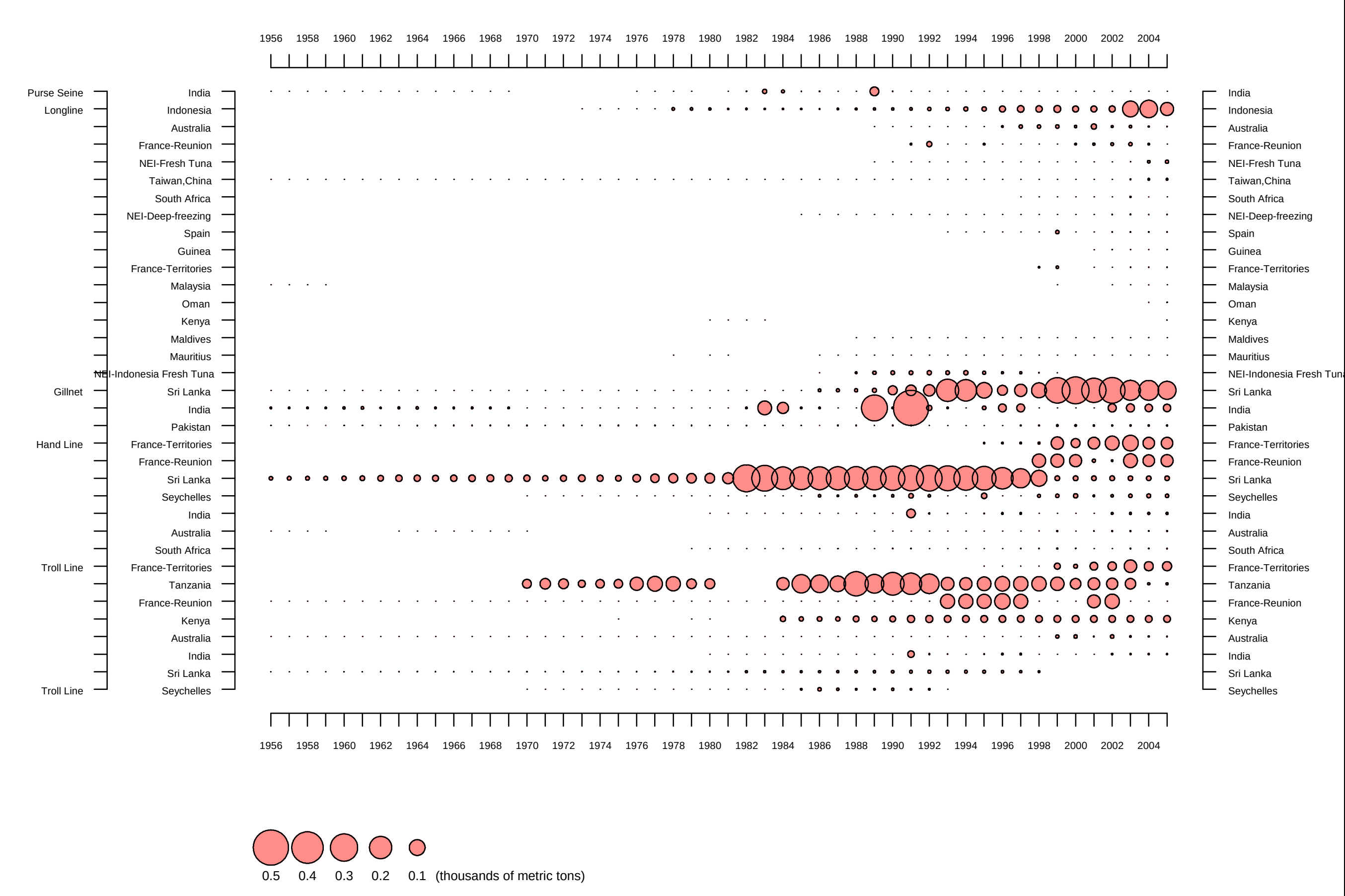

Figure 3. *Wahoo: catches by gear and main fleets for the period 1956-2006 (in thousands of tonnes). Data as of October 2006*

APPENDIX X

DRAFT TERMS OF REFERENCE FOR AN IOTC WORKING PARTY ON ECOSYSTEMS AND BYCATCH (WPEB)

These revised Terms of Reference for the former Working Party on Bycatch reflect the wish of the Scientific Committee to reinforce the ability of integrating ecosystem considerations in the advice that the Scientific Committee is mandated to provide to the Commission.

Recognizing that a number of priority issues have been identified for the Working Party by the Scientific Committee, largely emanating from the requirements of IOTC Resolutions and Recommendations, the work of the Working Party on Ecosystems and Bycatch will include the specific tasks listed below. ,.

1. Monitoring

− Create and maintain an inventory of non-target, associated and dependent species caught by fleets targeting tuna and tuna-like species in the Indian Ocean.

− Improve conventional statistics (catch, effort, size) of species under the IOTC mandate that are caught incidentally in non-targeted fisheries.

− Monitor and improve information on interactions with species that are not under the IOTC mandate, with emphasis on those species of interest to the Commission and for which no Species Group has been established (e.g., sharks, sea turtles and sea birds).

− Facilitate access by scientists to oceanographic and environmental data.

2. Research

− Evaluate the relative impact of the different abiotic and biotic factors (including oceanographic and climate phenomena, directed and incidental fishing, predation, competition, pollutions and other human impacts) that affect the abundance, distribution and migration of IOTC species.

− Characterize main feeding and reproductive habitats of IOTC species.

− Characterize the volume, composition and disposition of non-target species that are caught incidentally in tuna and tuna-like fisheries within the IOTC Convention area.

− Investigate trophic interactions of IOTC species.

− Investigate the impact that changes in fishing gears or fishing technology have on the catch of target and non-target species.

3. Modelling

− Develop and monitor reference points and indicators that explicitly incorporate ecosystem considerations.

− Participate in the development of simulation, dynamic and statistical models focusing on mixed-fisheries, multi-species, by-catch and ecosystem issues.

4. Advice

− Develop mechanisms which can be used to better integrate ecosystem considerations into the scientific advice provided by Scientific Committee to the Commission.

− Investigate through operational models, potential benefits at an ecosystem level of alternative management strategies, such as time-area closures.

− Advise on the impacts of tuna and tuna-like fisheries on the populations of non-target species of interest to the Commission.