



Report of the Ninth Session of the IOTC

Working Party on Tropical Tunas

Seychelles, 16-20 July, 2007

TABLE OF CONTENTS

1. Opening of the Meeting and Adoption of the Agenda	3
2. Review of Statistical Data for the Tropical Tuna Species	3
2.1 Nominal Catch (NC) data.....	3
2.2 Catch-and-Effort (CE) data	4
2.3 Size-Frequency (SF) data	5
2.4 Estimation of catches of non-reporting fleets	5
2.5 Data related issues for tropical tunas	6
2.6 summaries of the current status of the data for each of the tropical tuna species	7
3. New information on the fisheries, biology, ecology and oceanology relating to tropical tunas	10
3.1 Latest statistics on the bigeye tuna fisheries from the IOTC databases.....	10
3.2 Latest statistics on the yellowfin tuna fisheries from the IOTC databases	10
3.3 Latest statistics on the skipjack tuna fisheries from the IOTC databases	14
3.4 Purse seine fisheries in general	17
3.5 Longline fisheries in general	22
3.6 Fisheries in general	23
3.7 Environment.....	24
4. Stock assessment for yellowfin tuna	25
4.1 Abundance indices	25
4.2 Stock assessment	25
4.3 Intersessional Work plan	28
4.4 Technical advice on yellowfin tuna.....	29
5. Mandatory fisheries statistics	29
6. Minimum data requirements for the longline fleet.....	30
7. Minimum information requirements for iotc stock assessments	31
8. Research Recommendations and priorities	31
9. Items put forward by the WPTT for consideration by the scientific committee in 2007	32
10. Other business	32
10.1 Update on tuna tagging activities in the Indian Ocean.....	32
10.2 Tuna atlas to be produced	32
10.3 Report on the fishing capacity workshop.....	32
11. Adoption of the report	32
Appendix I. List of Participants	33
Appendix II. Agenda of the Meeting.....	35
Appendix III. List of documents presented to the meeting.....	36
Appendix IV. Additional information on the fisheries, biology, ecology and oceanology relating to tropical tunas	37

1. OPENING OF THE MEETING AND ADOPTION OF THE AGENDA

1. The ninth meeting of the Working Party Tropical Tunas (WPTT) was opened on 16 July 2007 in Victoria, Seychelles, by the Chairperson Dr Iago Mosqueira.
2. Dr Mosqueira welcomed the participants (Appendix I) and the agenda for the Meeting was adopted as presented in Appendix II.
3. The list of documents presented to the meeting is given in Appendix III.

2. REVIEW OF STATISTICAL DATA FOR THE TROPICAL TUNA SPECIES

4. The Secretariat presented a detailed description of the status of the IOTC databases for tropical tunas. The following information is summarised from document IOTC-2007-WPTT-03.

2.1 NOMINAL CATCH (NC) DATA

5. The nominal catch data series of yellowfin (YFT), bigeye (BET) and skipjack (SKJ) tunas are considered to be almost complete since 1950.
6. The Secretariat conducted several reviews of the NC database during 2006-07. While the changes to the estimates of the catches of yellowfin tuna and bigeye tuna were quite minor, the time series of catches estimated for skipjack tuna in 2007 was around 10% lower than that estimated in 2006. One of the main reasons for this change was because in 2007 Indonesia reported for the first time a complete set of nominal catches for its artisanal fisheries including the catches for individual species in 2004 and 2005. This information was used to assign catches to species - which was not possible in the past. In previous years, the data that were reported as 'unspecified tuna' (as much as 90,000 t in recent years) were thought to be comprise mainly skipjack tuna with lesser amounts of longtail tuna and kawakawa. The latest information indicates that there is much less skipjack tuna in this category, consequently the catch estimates are lower.
7. Although the quality of the available information on the three tropical tunas is generally good, the representativeness of the data is compromised by:

Some catch data not being available: several countries were not collecting fishery statistics, especially in years prior to the early 1970's, and others have not reported their statistics to IOTC. In most cases, the catches of tropical tunas in those countries were probably minor.

Poor resolution of catch data: catches of tunas and tuna-like species are sometimes reported in an aggregated¹ form. The Secretariat estimates the species and gear composition of these aggregates using a range of information but the accuracy of the estimates is probably low. The amount of catches received in aggregated form that the Secretariat consequently has to assign to gear and/or species has been accounting for up to 20% of the total catches in recent years.

Considerable uncertainty associated with the catch estimates from the following fisheries:

- Yemen artisanal fisheries: The catch series for this fishery was reviewed in 2005 and the database updated with the new estimates. In 2007 the Secretariat conducted a mission to Yemen to assess the status of fisheries data collection and processing. Some of the information collected during this mission was confounding, e.g. for one year, the catches of yellowfin tuna ranged from 20,000 t and 60,000 t depending on the reporting source. The amount of data on catch and effort is, however, likely to improve in the future due several initiatives currently being undertaken in the country.
- Indonesia artisanal fisheries: Catch estimates for some Indonesian fisheries continue to be uncertain. For example, in 2005 the catch estimate for yellowfin tuna caught by Indonesia's artisanal fisheries was reported to the IOTC Secretariat as 40,000 t; at the same time a catch of only 2,000 was reported to the FAO. Indonesia, however, has indicated that the catches of yellowfin tuna that have been recently estimated are more reliable than the previous catches because they are based upon the data collected through a more thorough sampling scheme.

¹ This is the case notably when data are not reported to the Secretariat and have to be taken from the FAO nominal catch database.

- Sri Lankan gillnet (and longline) fishery: Results from the IOTC-OFCF Project in 2005 and 2006 suggest that the catches of tropical tunas, mainly skipjack tuna and yellowfin tuna, recorded in the IOTC database for the decade prior to 2005 are likely to be overestimates.
- Fresh tuna longliners based in Indonesia: The catch series before 2002 is considered uncertain.
- Other fresh tuna longline fleets: Although the catches of fresh tuna longline vessels based in various ports of the Indian Ocean were re-estimated from data coming from past or recent sampling schemes, they are generally considered to be of poor quality, especially for those fleets operating from ports not covered by sampling schemes, and where past catches have been estimated using recent catch levels. Seventy eight longliners from India have been operating in the Indian Ocean since 2005: India reported preliminary catches for these vessels indicating that the catches were to be updated in the early future; in the mean time, the Secretariat estimated catches for these vessels using catch rates for the Taiwanese fresh-tuna longline fleet. The new catches estimated, recorded as NEI-ICE, are considered to be highly uncertain.
- Deep-freezing longline fleets: The Secretariat re-estimated new catches for the period 1992-2006 using new information collected during 2007. These estimates remain uncertain due to the many assumptions made in estimating the total catches and species breakdown. The number of vessels operating under flags of non-reporting countries has decreased markedly since 2001. The reason for this decrease is not fully known and revisions to the catch estimates may be undertaken when more information become available. The catches recorded for the 14-25 longliners operating under the Philippines flag are considered to be incomplete as the amounts of Indian Ocean bigeye tuna imported from Philippines by Japan and other countries under the IOTC Bigeye Tuna Statistical Document Programme for 2002-05 are higher than those reported by Philippines as total catches.
- Purse seiners: The catches of 6 to 11 former Soviet Union purse seiners, operating under unknown flags in recent years, are not available for 1995-1997 and 2003-2006. Total catches and effort for 1998-2002 were reported in 2003 for this fleet but the new data did not include catch by species and type of school. Since September 2005, six of the former Soviet Union purse seiners have been operating under the flag of Thailand and one under the flag of Equatorial Guinea. Between three and six large industrial purse seiners have been operating under the flag of Iran since 2001. The catches for these vessels are thought to be incomplete for some years as it is likely that only the catches within the EEZ of Iran and those unloaded in ports in Iran are available.

2.2 CATCH-AND-EFFORT (CE) DATA

8. Catch-and-effort records are available for the main fleets fishing for tropical tunas in the Indian Ocean, namely pole and line (SKJ and YFT), purse seine (SKJ, YFT and BET) and longline (BET and YFT). Some gillnet fisheries produce substantial catches of tropical tunas, but the contribution of other gears to the total catches is small.

Pole and line: Catch-and-effort statistics from the Maldives are available by species, month and atoll for 1970-1993. Catch and effort by species, year and atoll are available for 1993-2001; and by species and year from 2002 to 2006.

Longline: Catch-and-effort statistics are available since 1952 for Japan; since 1967 for Taiwan,China² and since 1975 for Korea. Catch and effort data for other fleets is scarce or inaccurate.

The catch and effort statistics provided by Japan and Taiwan,China are generally considered to be accurate. Nevertheless, some inconsistencies were found when comparing nominal catches and catch and effort data for Taiwan,China and Japan (Figures 16-19). These would indicate that either nominal catches or catches in the CE are not accurate or that size data are incomplete.

Korean CE statistics are considered to be inaccurate as many inconsistencies have been found in the data, e.g. when comparing the catches in this database with those reported as nominal catches. The catches of tropical tunas in recent years are, however, very low.

Purse seine: Catch-and-effort statistics are complete for European-owned purse seiners and those monitored by scientists from Europe and Seychelles. Statistics are also available for other fleets including the former Soviet

² Taiwan,China refers to Taiwan Province of China.

purse seine fleet (1998-2002; under Belize and Panama flags; 2005-06 for vessels under the Thailand flag), Mauritius and Japan. As is the case for the NC data, the CE data for the purse-seine fleet formerly under the Soviet Union flag are not considered to be accurate, especially the area fished, species composition and type of school fished information. No catch and effort data are available for the Iran purse seine fleet.

Gillnet: Few CE data are available for gillnet fisheries. This is of concern because gillnets have been used in both coastal waters and on the high seas in recent years. This refers mainly to the gillnet fisheries of Iran, Pakistan and the gillnet/longline fishery of Sri Lanka.

2.3 SIZE-FREQUENCY (SF) DATA

Purse seine: The quality of the data is considered to be good for purse seine fleets under European monitoring. Little or no data are available for Iranian, Japanese and ex-Soviet purse seiners. The size frequency statistics of Mauritian purse seiners since 1986 is complete.

Baitboat: The completeness and quality of the sampling on baitboat fisheries (Maldives) is considered to be good up to 1998. No data are available for 1999-2002 and since 2004.

Longline: Only Japan has been reporting size-frequency since the beginning of the fishery. In recent years, the numbers of fish being measured is very low in relation to the total catch; furthermore they have been decreasing year by year. Coverage rates in some areas are very low. The size-frequency statistics available from Korea are inaccurate and this limits their use. The recovery of size data from port sampling of fresh tuna longline fleets operating in Thailand and Indonesia continued in 2005 and 2006. Coverage rates for the Indonesia are around 40% (number of fish). Catch-at-size tables were estimated for fresh tuna longline vessels operating in Indonesia during 2003-06 and other ports for 1998-2006.

Taiwan,China provided size data for yellowfin tuna and bigeye tuna by year and quarter for 1980-2005.

Gillnet: Although size data are available for some important gillnet fisheries (including Iran, Sri Lanka and Oman³) sample sizes are very low.

Other gears Few size data are available for other gears.

2.4 ESTIMATION OF CATCHES OF NON-REPORTING FLEETS

9. The estimates of catches of non reporting fleets were updated in 2007. The high number of non-reporting fleets operating in the Indian Ocean since the mid-1980s has led to large increases in the amount of catch that needs to be estimated. This reduces confidence in the catch estimates for yellowfin tuna and bigeye tuna, and to a lesser extent, skipjack tuna.

- **Purse seine:** Catches for the six former Soviet Union purse seiners, currently under the Thailand flag, were estimated for January-August 2005-and those for the remaining purse seiner (Equatorial Guinea) for 2005-2006. The amount of catch that the Secretariat has to estimate for this fleet has decreased considerably in recent years. Currently only one vessel is operating under the flag of a non-reporting country.
- **Deep-freezing longline:** The catches by large longliners from several non-reporting countries were estimated using IOTC vessel records and the catch data from Taiwanese or Spanish longliners, based on the assumption that most of the vessels operate in a way similar to the longliners from Taiwan,China or Spain.
- **Fresh tuna longline:** Fresh tuna longline vessels, mainly from China, Taiwan,China, India and Indonesia, have been operating in the Indian Ocean since the early 1970's. The catches of these fleets were, up to 2006, estimated by the IOTC Secretariat.
- In 2006 Taiwan,China provided total catches for its longline tuna fleet operating in the Indian Ocean for the period 2000 to 2005. The catches for 2006 were provided in 2007. The catches provided are higher than those estimated by the IOTC Secretariat for most years. The new catches provided for 2001-05 were used to replace those in the IOTC database.

³ Size frequency data of yellowfin tuna was collected during 2003 in Oman

2.5 DATA RELATED ISSUES FOR TROPICAL TUNAS

Areas of concern:

- Poor knowledge of the catches, effort and size-frequency from fresh tuna longline vessels, especially from Taiwan,China, before 1998, and India since 2005.
- Poor knowledge of the catches, effort and size-frequency from non-reporting fleets of deep-freezing tuna longliners, especially since the mid-1980's.
- Lack of accurate catch, effort and size-frequency data for the Indonesian longline fishery before 2002.
- Poor knowledge of the species composition and size-frequency data for former Soviet Union purse seine boats.
- Poor knowledge of the catches, effort and size-frequency from industrial purse seiners operating under the flags of Thailand and Iran.
- Scarcity of data, especially size frequency data, for the Maldives hand line, troll line, gillnet and pole and line fisheries since 1998.
- Uncertainty about the catches, mainly gillnet, hand line and troll line, by domestic boats operating in Indonesia, Yemen and Sri Lanka.

Improvements have taken place in a number of areas. These include:

A better level of reporting: New NC, CE and SF datasets have been obtained for Sri Lanka domestic fisheries and Taiwan,China and Seychelles longline fisheries.

Revision of the IOTC databases: Several revisions have been conducted during the last year on the IOTC databases. This has led to revised NC data for some countries.

An improved Vessel Record: More information has been obtained on the number and type of vessels operating under flags of non-reporting parties. This information comes mostly from various licensing schemes in the Indian Ocean and has become an important element in the estimation of the catches of non reporting fleets.

Improved estimation of catches of non-reporting fleets: The collection of historical and current information on the landings of small fresh tuna longliners in ports in the Indian Ocean has improved the accuracy of earlier estimates. The more complete Vessel Record also permitted the estimation by flag of the catches of deep-freezing longliners. The catches of the former Soviet Union purse seiners for 1998-2002 are considered to be more accurate.

Estimation of catch-at-size for Indonesia, China, Taiwan,China, Malaysia, Maldives, Oman and other fresh tuna longline fleets: The collection of size data in Thailand, Sri Lanka and Indonesia underpins the estimates of catch-at-size for fresh tuna longliners for 1998-2006 (longliners based in ports other than Indonesia) and 2002-06 (longliners based in Indonesia).

IOTC/OFCF sampling programmes: The collection of information on the activities of fresh tuna longliners landing in Phuket and Indonesia has continued during 2006. This has led to more complete and accurate estimates of the catches by these fleets. Other valuable data collected under these programmes include length frequencies (which will allow length-length, length-weight and weight-length relationships to be updated). Size data were also obtained for Sri Lanka (skipjack tuna and yellowfin tuna) artisanal fisheries since 2005.

Report on the IOTC Secretariats visit to Yemen (IOTC-2007-WPTT-INF02)

10. A report on a mission to Yemen in March 2007 was provided by the Secretariat. The goal of the mission was to begin to address the concerns expressed by the IOTC Scientific Committee regarding the unavailability of catch and effort data for Yemen and the unavailability of size data for the major tuna species, notably yellowfin tuna. Staff visited the Ministry of Fish Wealth, the World Bank Office and FAO (all Sana'a) and the Marine Science Research and Resource Centre (Aden)

11. The WPTT was updated on the fisheries in Yemen, current fisheries data collection and future data collection initiatives. The IOTC/OFCF Project plans to assist Marine Science Research and Resource Centre to implement data collection activities in three landing locations (tentatively Sheher, Al-hami and somewhere in Al-maharah - to be determined) to and develop a sampling strategy to obtain precise catch and size estimates from the fleets

operating in these areas. The IOTC-OFCF project plans to send a mission to Yemen in November 2007 to assess if the proposed activities can be carried out and organize the training of local staff

12. The WPTT congratulated Miguel Herrera of the IOTC Secretariat for undertaking this challenging but most worthwhile assignment.

2.6 SUMMARIES OF THE CURRENT STATUS OF THE DATA FOR EACH OF THE TROPICAL TUNA SPECIES

YELLOWFIN TUNA (YFT)

Retained catches are generally well known; however, catches are uncertain for:

- many artisanal fisheries, notably those from Indonesia, Sri Lanka, Yemen and Comoros
- non-reporting industrial purse seiners and longliners (NEI), longliners of India and purse seiners of Iran.

Discards are believed to be low although they are unknown for most industrial fisheries, notably industrial purse seiners.

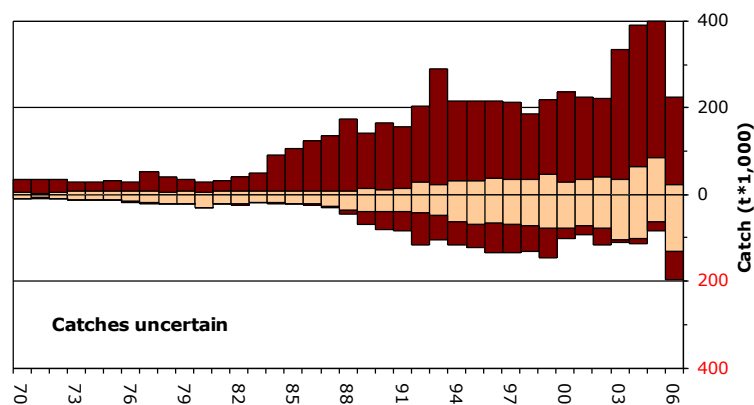


Figure. Uncertainty of annual catch estimates for yellowfin tuna. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets. Data as of October 2007

CPUE Series: Catch and effort series are available from various industrial and artisanal fisheries. Nevertheless, catch and effort are not available for important artisanal fisheries or they are considered to be of poor quality for the following reasons:

- poor quality effort data for the gillnet/longline fishery of Sri Lanka
- no data are available for the artisanal fisheries of Indonesia, Yemen and Comoros

Trends in average weight can be assessed for several industrial fisheries but they are very incomplete or of poor quality for some artisanal gears, namely hand lines, troll lines, many gillnet fisheries (Yemen, Oman, Indonesia) and the pole and line fishery of Maldives in recent years.

Catch-at-Size(Age) table: This is available although the estimates are more uncertain in some years and some fisheries due to:

- size data not being available for most artisanal fisheries, notably Yemen and Indonesia (lines and gillnets), Comoros (lines) and Maldives (pole and lines) in recent years
- the paucity of size data available from industrial longliners from the late-1960s up to the mid-1980s
- the paucity of catch by area data available for some industrial fleets (NEI, Iran).

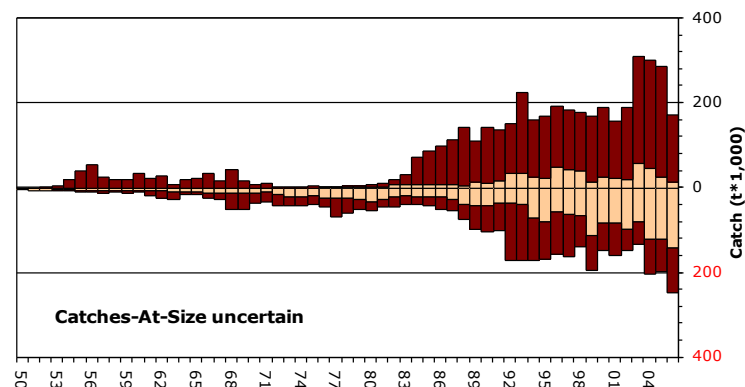


Figure. Uncertainty of catch at size data for yellowfin tuna. The amount below the zero-line indicates the amount of catch for which the estimated catch at size has been categorised as uncertain according to the criteria given in the text. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets. Data as of June 2007

BIGEYE TUNA (BET)

Retained catches are generally well known; catches are uncertain for non-reporting industrial purse seiners and longliners (NEI) and for other industrial fisheries (Philippines, Iran, Thailand).

Discards are believed to be low although they are unknown for most industrial fisheries, notably industrial purse seiners.

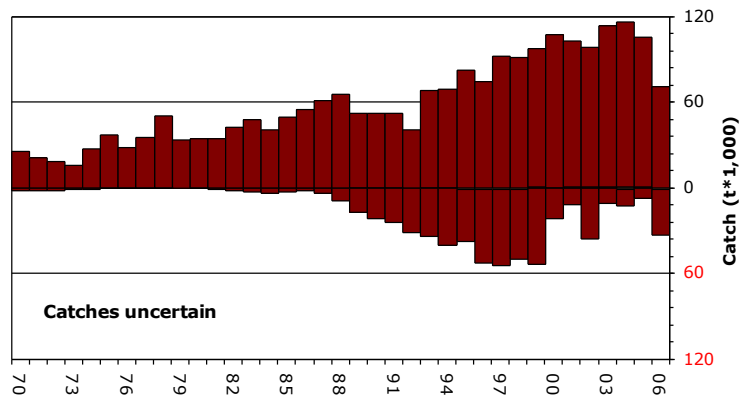


Figure. Uncertainty of annual catch estimates for bigeye tuna. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets. Data as of October 2007

CPUE Series: Catch and effort series are available from various industrial fisheries. Nevertheless, catch and effort are not available from some fisheries or they are considered to be of poor quality, especially throughout the 1990s for the following reasons:

- non-reporting by industrial purse seiners and longliners (NEI)
- uncertain data from significant fleets of industrial purse seiners from Iran and longliners from Philippines.

Trends in average weight can be assessed for several industrial fisheries although they are incomplete or of poor quality for most fisheries before the mid-1980s and in recent years (for the above fleets plus longliners from South Korea and Seychelles).

Catch-at-Size(Age) table: This is available but the estimates are more uncertain for some years and some fisheries due to:

- the paucity of size data available from industrial longliners before the mid-60s and from the early-1970s up to the mid-1980s
- the paucity of catch by area data available for some industrial fleets (NEI, Iran)

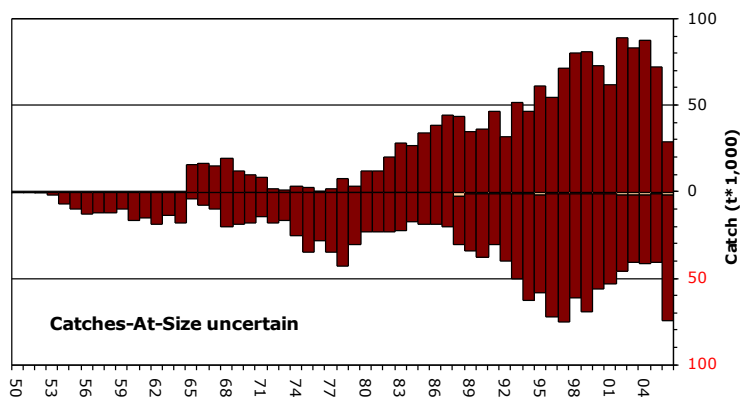


Figure. Uncertainty of catch at size data for bigeye tuna. The amount below the zero-line indicates the amount of catch for which the estimated catch at size has been categorised as uncertain according to the criteria given in the text. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets. Data as of June 2007

SKIPJACK TUNA (SKJ)

Retained catches are generally well known for industrial fisheries, uncertain for many artisanal fisheries, notably because:

- catches are not being reported by species
- uncertainty about the catches from some significant fleets including the Sri Lankan gillnet/longline fishery and the industrial purse seiners from Iran.

Discards are believed to be low although they are unknown for most industrial fisheries, notably industrial purse seiners.

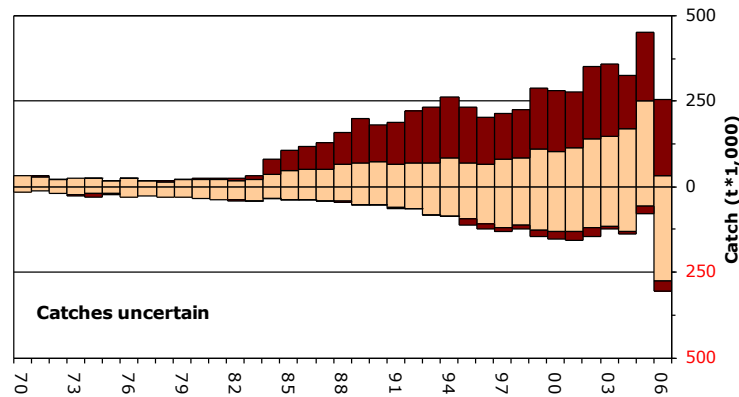


Figure. Uncertainty of annual catch estimates for skipjack tuna. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets. Data as of October 2007

CPUE Series: Catch and effort series are available from various industrial and artisanal fisheries. Nevertheless, catch and effort are not available from important artisanal fisheries or they are considered to be of poor quality for the following reasons:

- almost no data are available for the artisanal fisheries of Indonesia
- the poor quality effort data for the significant gillnet/longline fishery of Sri Lanka (for years before 2005)

Trends in average weight cannot be assessed before the mid-1980s and are incomplete for most artisanal fisheries thereafter, namely hand lines, troll lines, many gillnet fisheries (Indonesia) and the pole and line fishery of Maldives in recent years.

Catch-at-Size(Age) table: CAS are available but the estimates are thought compromised for some years and fisheries due to:

- the lack of size data before the mid-1980s
- the paucity of size data available for some artisanal fisheries, notably most hand lines and troll lines and many gillnet fisheries (Indonesia)
- the lack of some biological information such as length-age keys for the Indian Ocean.

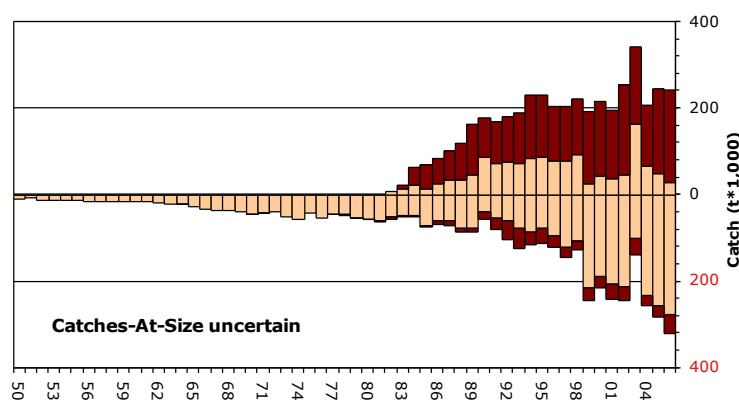
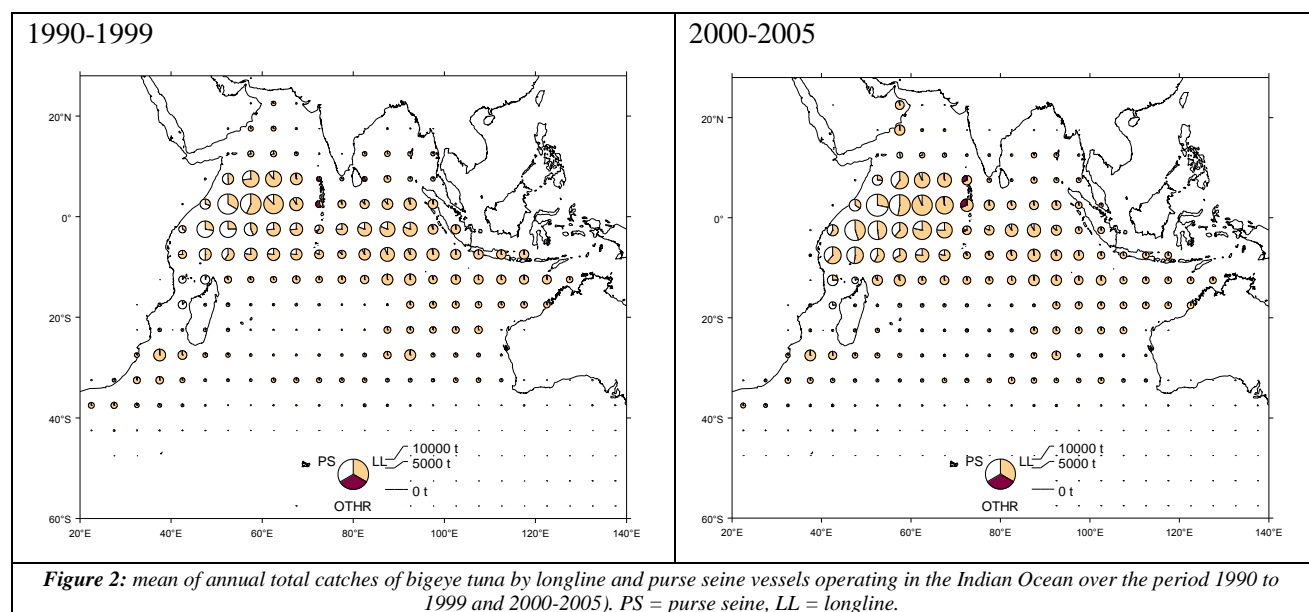
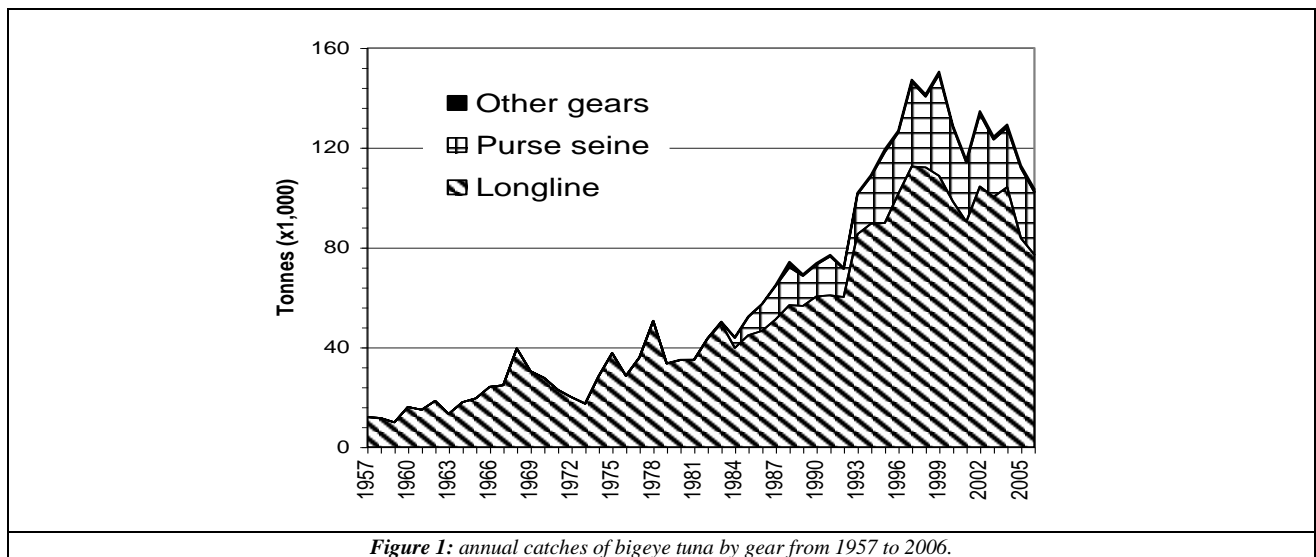


Figure. Uncertainty of catch at size data for skipjack tuna. The amount below the zero-line indicates the amount of catch for which the estimated catch at size has been categorised as uncertain according to the criteria given in the text. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets. Data as of June 2007

3. NEW INFORMATION ON THE FISHERIES, BIOLOGY, ECOLOGY AND OCEANOLOGY RELATING TO TROPICAL TUNAS

3.1 LATEST STATISTICS ON THE BIGEYE TUNA FISHERIES FROM THE IOTC DATABASES

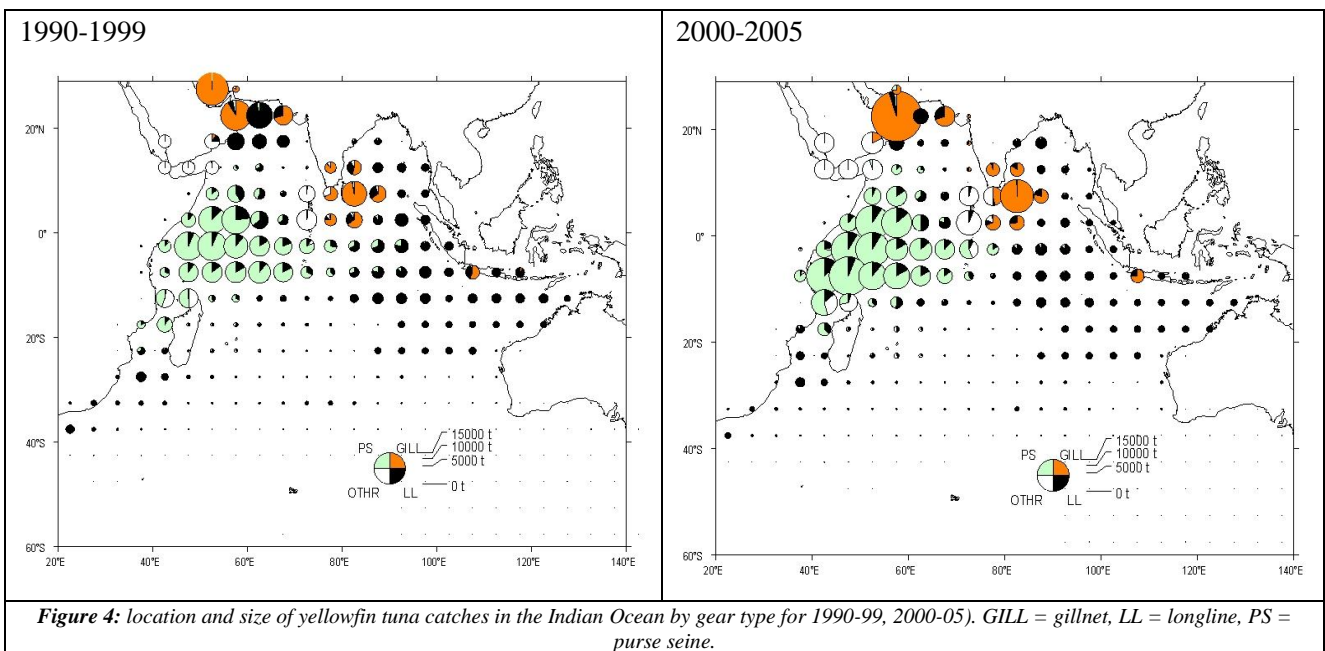
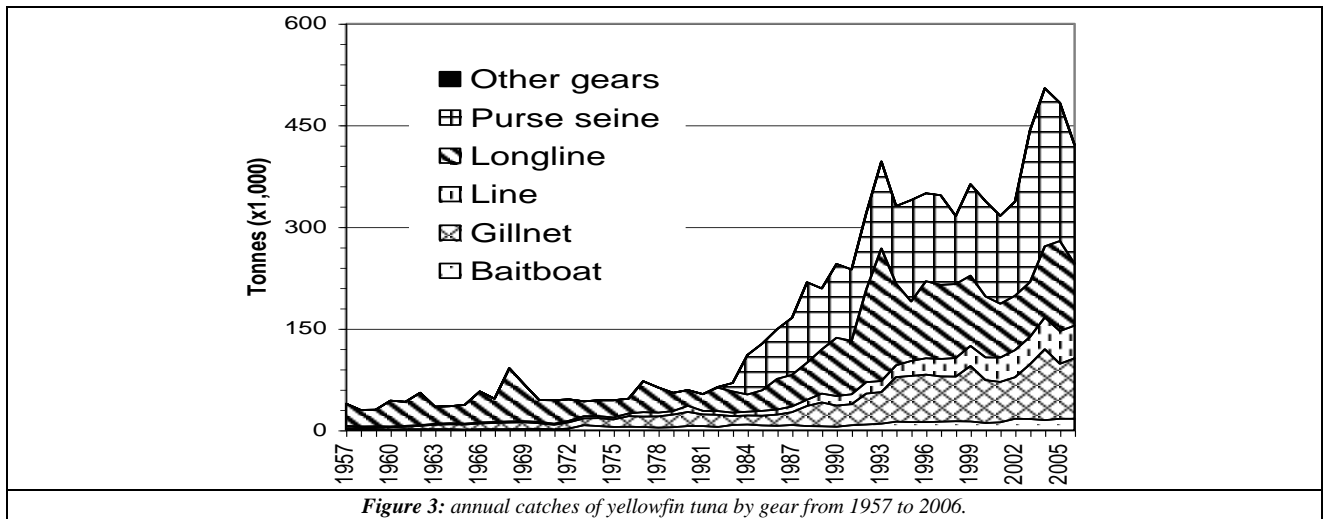
13. Bigeye tuna is mainly caught by industrial longline and purse seine fisheries (Figure 1). Total annual catches averaged 121,000 t over the period 2002 to 2006. The 2005 catch was 113,000 t and the provisional 2006 catch stands at 104,000 t. The location of the fishery has changed little since 1990. Bigeye tuna is fished throughout the Indian Ocean, with the majority of the catch being taken in western equatorial waters (Figure 2). Additional figures characterising the fisheries for bigeye tuna are provided in Appendix IV.



3.2 LATEST STATISTICS ON THE YELLOWFIN TUNA FISHERIES FROM THE IOTC DATABASES

14. Yellowfin tuna is mainly caught by purse seine, longline and gillnet fisheries (Figure 3). Total annual catches averaged 423,000 t over the period 2002 to 2006. The extraordinary high catches of yellowfin that were a feature of the tropical tuna fisheries in the Indian Ocean from 2003 to 2006 appear to be finished. Total catches peaked at 453,000 t in 2003, 505,000 t in 2004 and 483,000 t in 2005 before decreasing to 421,000 t in 2006. Early indications from the fisheries in 2007 indicate that catches appear to be returning to pre 2003 levels. The location of the fishery has changed little since 1990. Yellowfin tuna is fished throughout the Indian Ocean, with the majority of the catches being taken in western equatorial waters (Figure 4). The location and relative magnitude of the extraordinary high catches made in 2003 to 2005 are also shown (Figure 5). Additional figures

characterising the fisheries for yellowfin tuna are provided in Appendix IV.



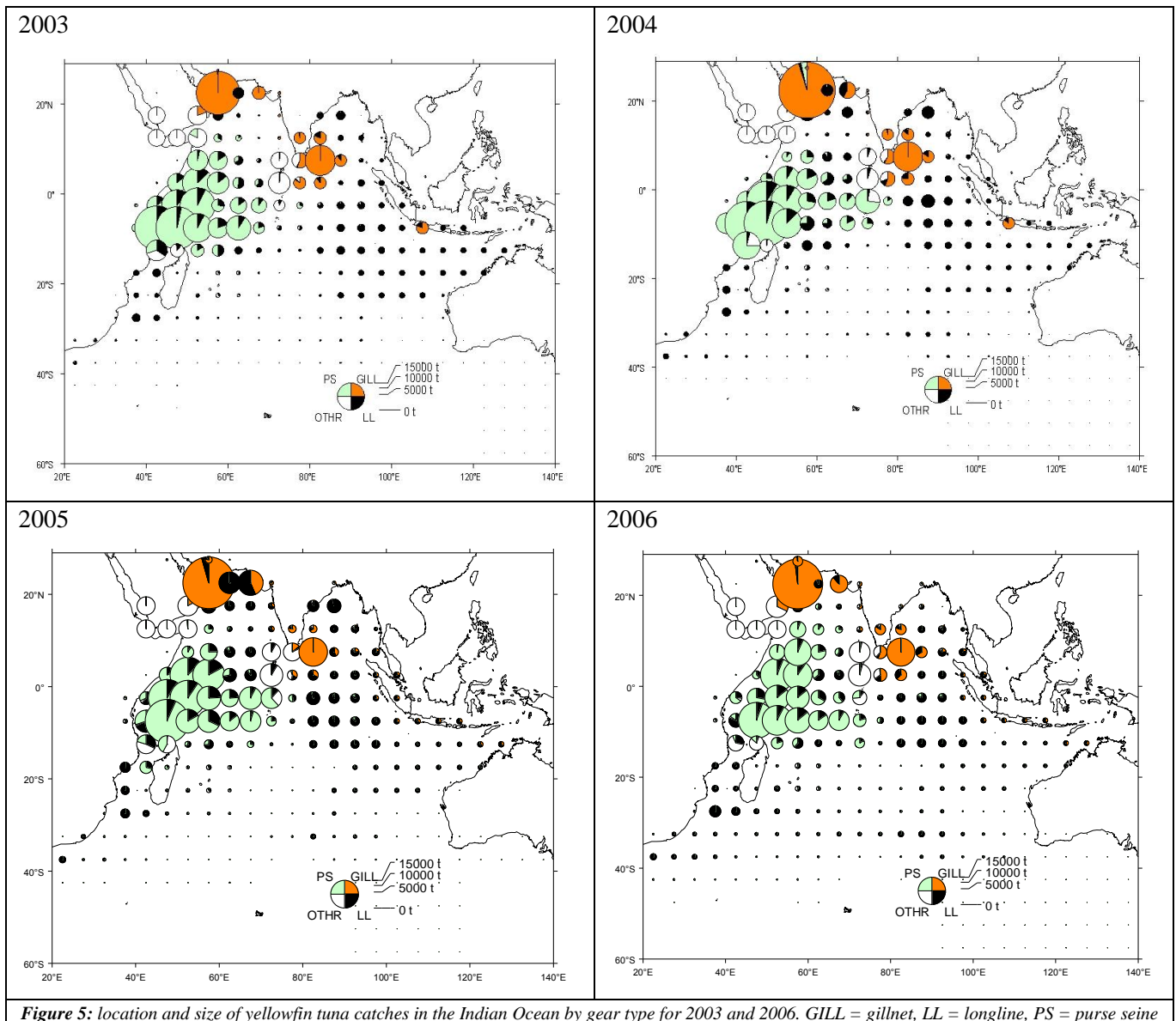


Figure 5: location and size of yellowfin tuna catches in the Indian Ocean by gear type for 2003 and 2006. GILL = gillnet, LL = longline, PS = purse seine

3.2.1 Update on the Maldives yellowfin tuna fishery

15. In 2007, the WPTT received a major presentation on the Maldives fisheries which provided a considerable amount of previously unavailable information (IOTC-2007-WPTT-23), an excerpt on the yellowfin fisheries is given below.

Catch

16. Yellowfin tuna is the second most important species caught in the Maldives and currently makes up 13 – 15% to the total tuna catch. Catches increased threefold between 1991 and 2002, in recent years have been around 25,000 t annually (Figure 6).

17. Traditionally, the yellowfin fishery in the Maldives was a pole-and-line fishery. Almost all the catch comprised small juvenile yellowfin, 30-60 cm FL. However, over the past decade there have been increasing catches of large yellowfin, 60-160 cm TL. This is a direct result of the development of new markets (both domestic and export) for large yellowfin. The favoured gear for catching large yellowfin is livebait handline. Pole-and-line is used, particularly in the northern atolls, where many vessels install pulley systems during the main large yellowfin season there (December to March). The EEZ catches are all from longline (Figure 6).

18. The collection and compilation of data for yellowfin tuna is more complicated than skipjack because of the variety of gears being used. This has resulted in compatibility problems with the existing data base which has a more traditional form collection and reporting. Overcoming these would require additional human resource training at the Statistics Unit. For instance it appears that yellowfin tuna caught by the handline fishery is reported

together with the pole-and-line caught fish. The effort data is not recorded separately for pole-and-line and handline fishery.

CPUE

19. Yellowfin CPUE in the pole-and-line fishery has been increasing steadily from 1990 onwards (Figure 7). During this period, the adjusted, or the standardized CPUE increased from just over 20 kg per day to over 100 kg /day in 2006. From 2000 onwards the annual increase CPUE was much higher, presumably because of targeted fishing taking due to increased saleability yellowfin tuna.

20. In addition to catches of yellowfin by Maldivian pole-and-line vessels, catches are made by commercial longliners in the outer waters of the Maldivian EEZ. These statistics are believed to be grossly underreported.

Size of the catch

21. The size of the yellowfin tuna catch ranges from 80 – 150 cm FL. The most common size class is 40-60 cm FL in the pole and line fishery. The larger size classes are taken in the handline and longline fisheries. Figure 8 shows the size frequency distributions of yellowfin from 1997 to 2006.

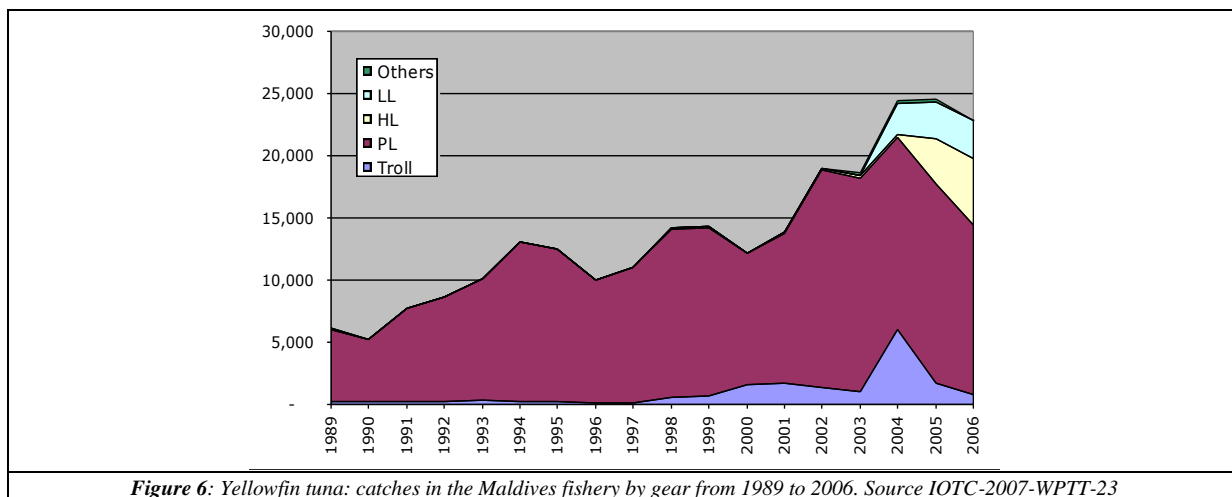


Figure 6: Yellowfin tuna: catches in the Maldives fishery by gear from 1989 to 2006. Source IOTC-2007-WPTT-23

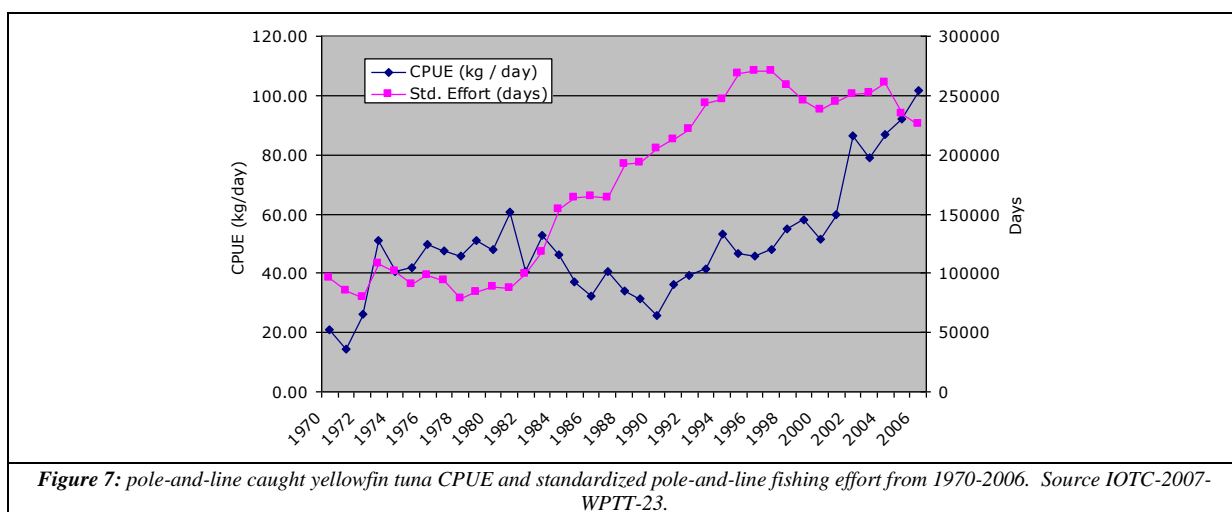
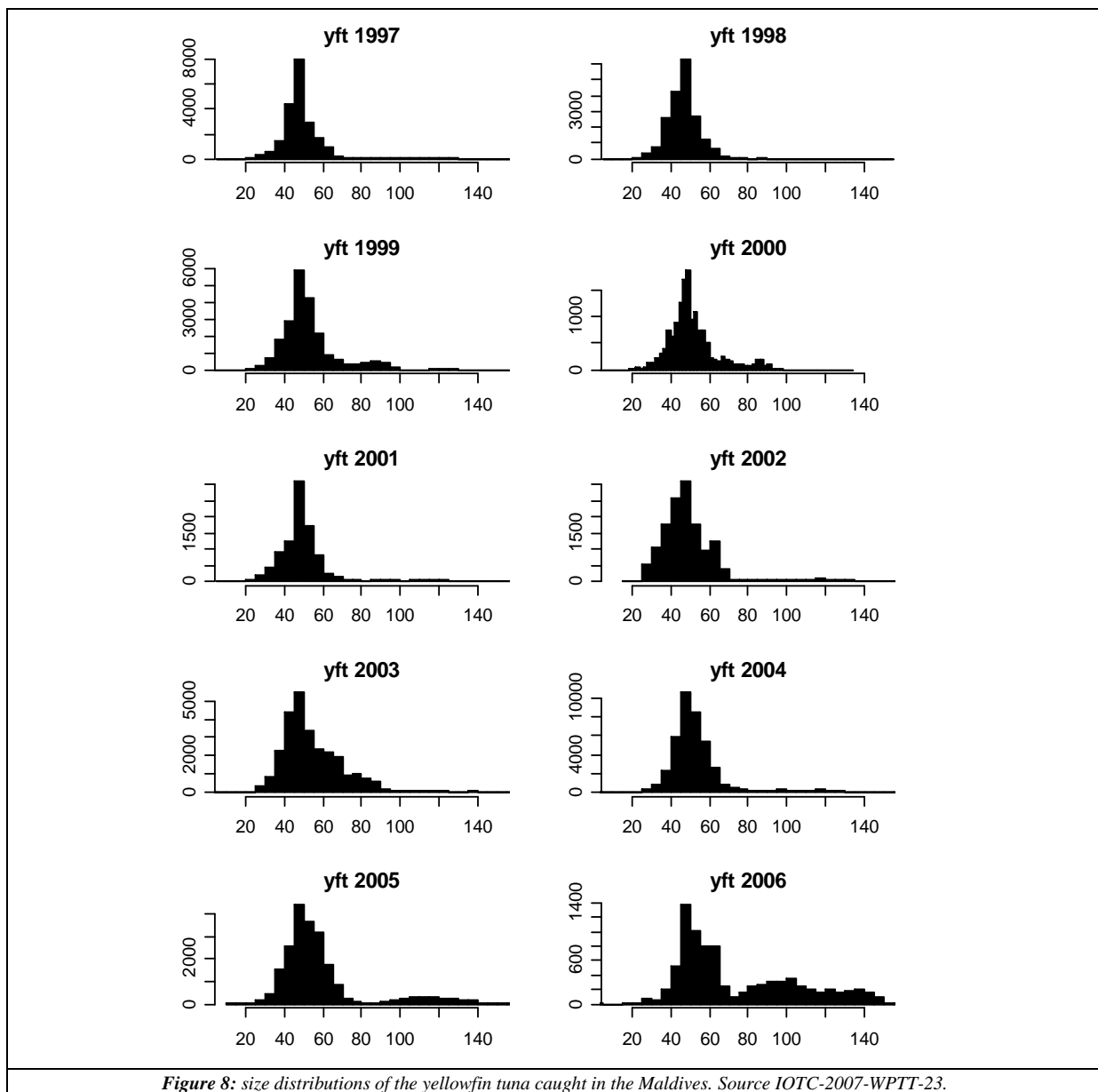


Figure 7: pole-and-line caught yellowfin tuna CPUE and standardized pole-and-line fishing effort from 1970-2006. Source IOTC-2007-WPTT-23.



3.3 LATEST STATISTICS ON THE SKIPJACK TUNA FISHERIES FROM THE IOTC DATABASES

22. Skipjack tuna is mainly caught by purse seine, gillnet and baitboat —using pole and line (Figure 9). Total annual catches averaged 507,000 t over the period 2002 to 2006 and are increasing. The 2005 catch was 530,000 t and the provisional catch estimate for 2006 stands at 562,000 t. The location of the fishery has changed little since 1990 (Figure 10). Skipjack tuna is fished throughout the equatorial waters of the Indian Ocean with the majority of the catch being taken in western areas. Additional figures characterising the fisheries for skipjack tuna are provided in Appendix IV.

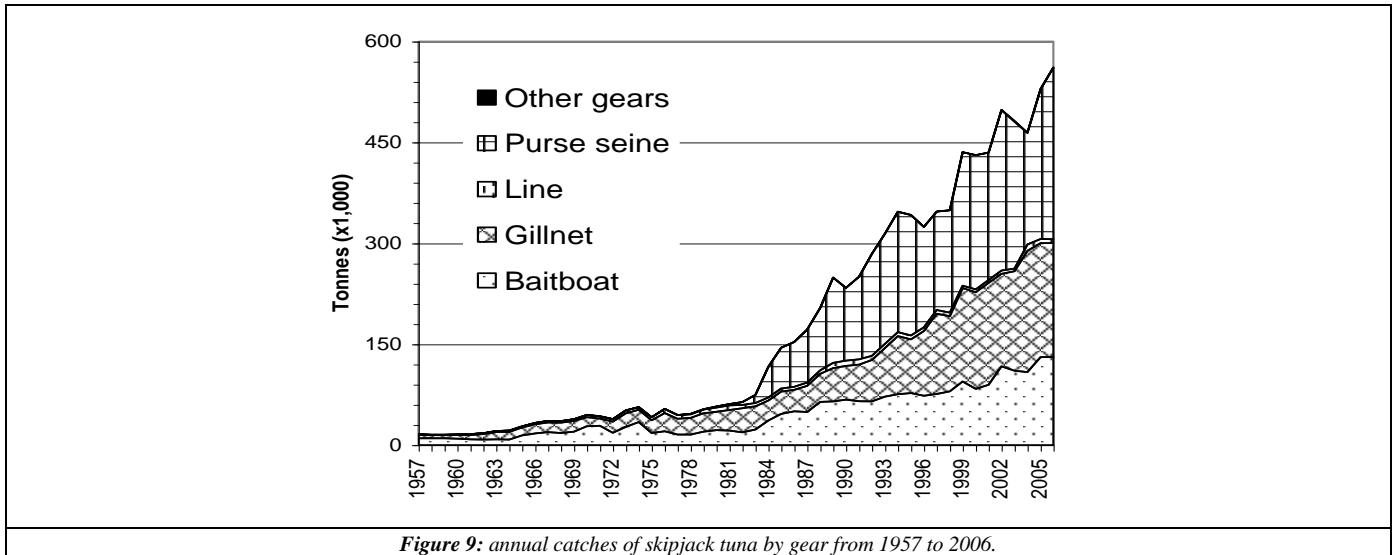


Figure 9: annual catches of skipjack tuna by gear from 1957 to 2006.

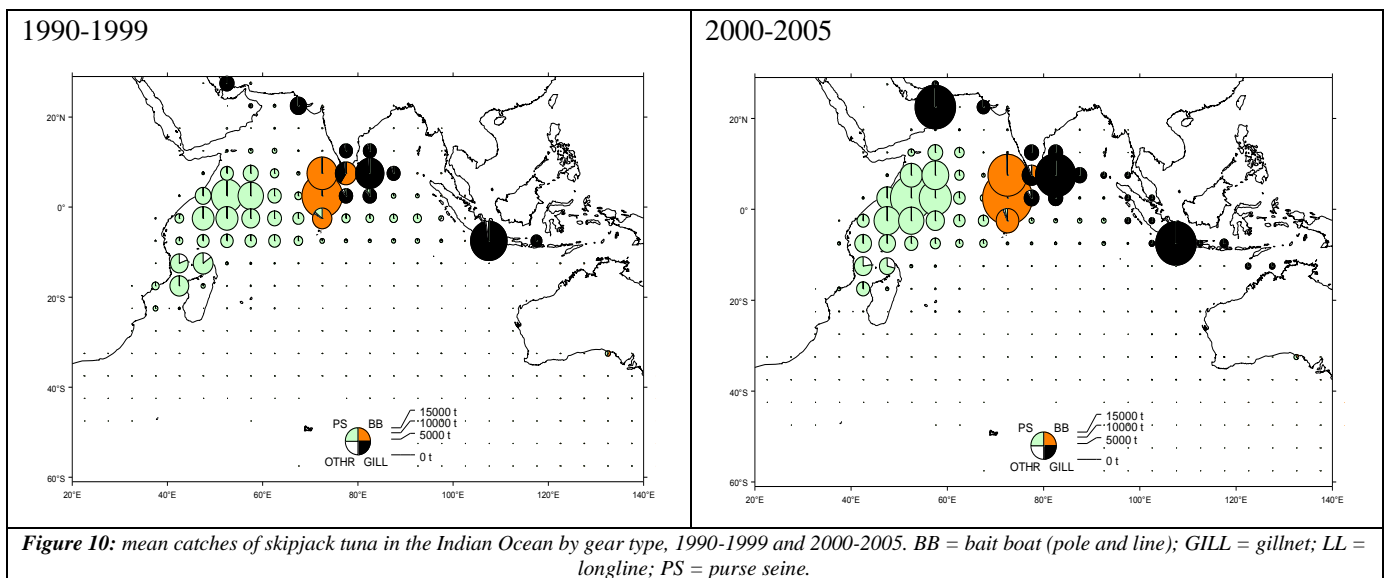


Figure 10: mean catches of skipjack tuna in the Indian Ocean by gear type, 1990-1999 and 2000-2005. BB = bait boat (pole and line); GILL = gillnet; LL = longline; PS = purse seine.

3.3.1 Update on the Maldives skipjack tuna fishery

Catch

23. In 2007, the WPTT received a major presentation on the Maldives fisheries which provided a considerable amount of previously unavailable information (IOTC-2007-WPTT-23), an excerpt on the skipjack fisheries is given below.

24. Skipjack tuna continues to be the most important species in the Maldives, contributing about 80% of the total tuna catch. In 2006 a record catch of 138,458 t of were landed by the livebait pole-and-line sectors (Figure 11) From 1988 to 1993 skipjack catches were stable at around 58-60,000 t per year. Since then recorded catches have increased markedly with current catches reaching close to 140,000 t.

25. Tuna sampling has been a regular activity undertaken by the MRC since mid 1980s. Figure 12 shows the size frequency distributions of skipjack from 1999 to 2006.

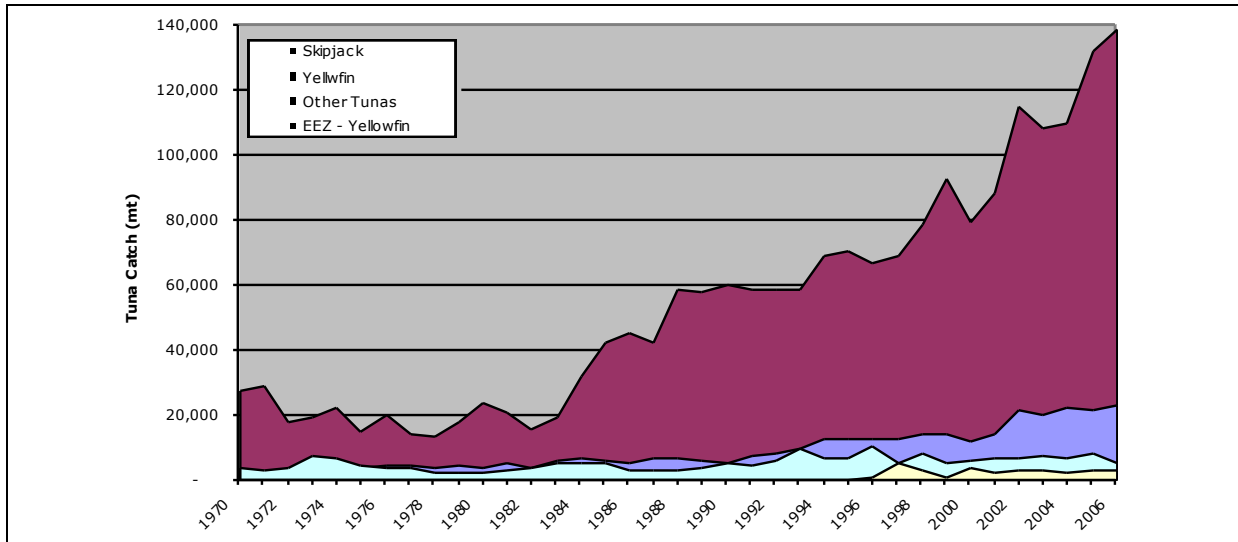


Figure 11. Catches of tuna by the Maldives fisheries 1970 to 2006.

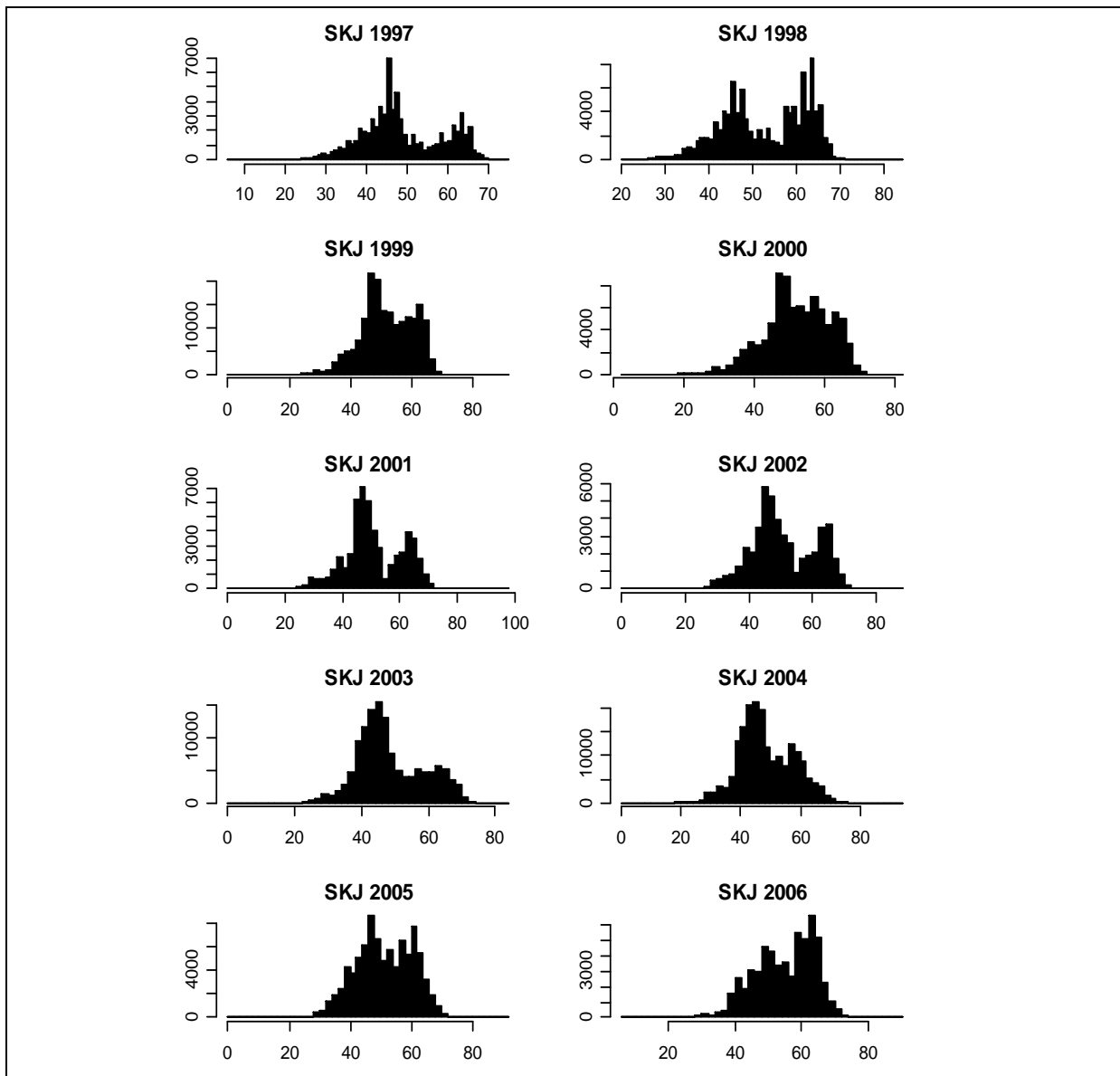


Figure 12: Summary of skipjack size frequency data, 1999-2006. The annual sample sizes ranged between 48,000 of 131,000 obtained from more than one locations.

CPUE trends

26. CPUE (kg/fishing trip) is calculated to give a crude measure of relative abundance (Figure 13). The annual CPUE indices are variable; however, the overall index CPUE appeared to show a declining trend from 1988/89 to around mid 1990s. Then from mid 1990s the CPUE has been increased a sharp increase to over 600 kg/trip. The Maldives skipjack CPUE trends are influenced by changes in oceanographic conditions (El Nino and La Nina years), increasing area of exploitation and a consistent increase in fishing power.

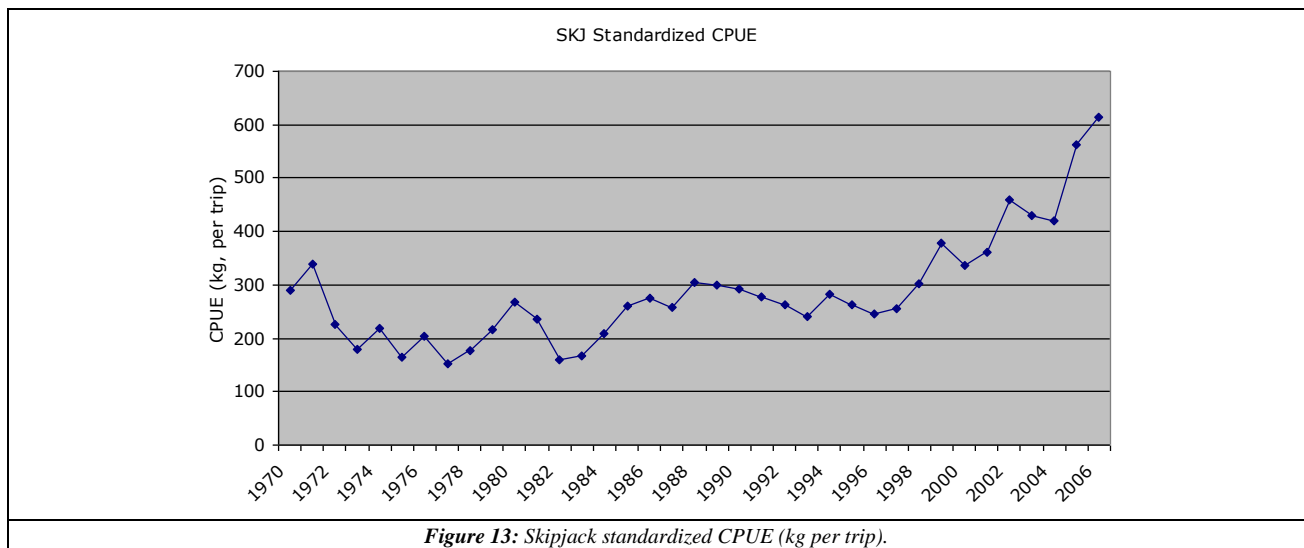


Figure 13: Skipjack standardized CPUE (kg per trip).

3.4 PURSE SEINE FISHERIES IN GENERAL

Results obtained from the biological sampling of large bigeye tuna caught on free schools by purse seiners in the Indian Ocean (IOTC-2007-WPTT-04)

27. This document reported biological characteristics observed from 25 bigeye tuna caught on free schools by purse seiners in June 2003 in the area west of Seychelles and 25 bigeye tuna caught in May 2007. The sizes of the specimens sampled in 2003 ranged between 38 and 82 kg (average weight 57 kg), while the 2007 specimens were smaller, ranging between 26 and 55 kg (average weight of 36 kg). All these large bigeye were caught in warm surface waters (over 25°C). All females examined were not reproductively active. The two samples indicate that this area/time was dominated by feeding activities rather than spawning activities. The tuna were actively feeding on fish and crustacean prey with a high number of prey per stomach. The bigeye cigar fish *Cubiceps pauciradiatus* dominated the diet. The stomach content analyses indicated that the bigeye tuna were feeding at the surface (and not in deep waters as longline caught bigeye) on a small range of prey species: During this program, 83% of the prey mass was cigarfish. This paper highlights the peculiarities of this fishing strata where large bigeye have been commonly caught by purse seiners during recent years.

Time and space diagrams of the Indian Ocean purse seine fisheries during the period 1982-2006 (IOTC-2007-WPTT-06)

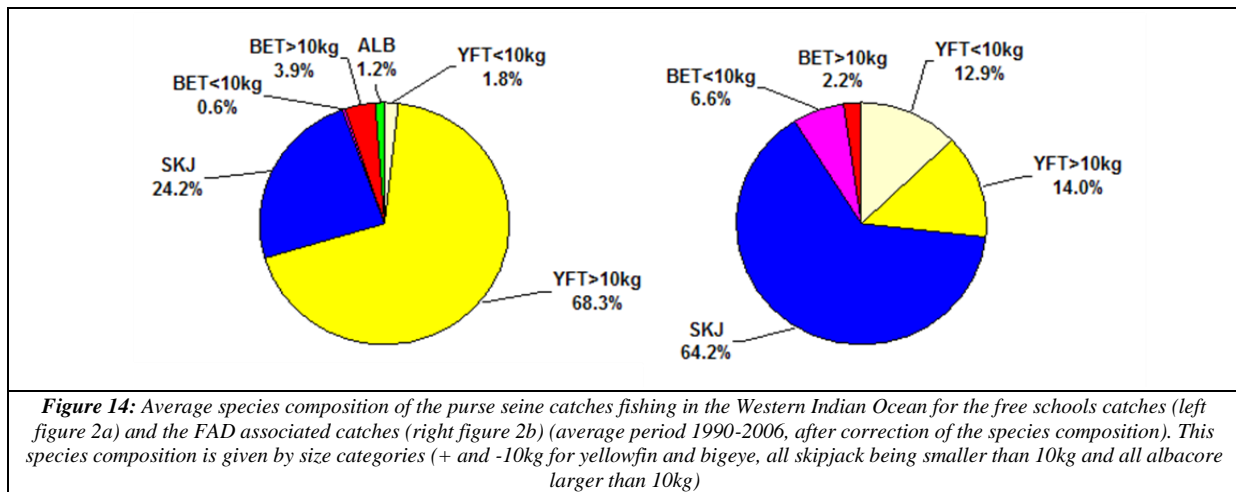
28. This document presented a visual representation of the time and space variability of the purse seine fisheries active in the Indian Ocean since the beginning of this fishery in 1982 until 2006. The data base used is the IOTC catch and effort file on March 2007, updated by the EU data for 2006. Pie diagrams are used to show the monthly and yearly catches by the large area used by EU scientists in their data processing (the so-called ET areas). All these diagrams are made by fishing mode (free schools and FADs), and the two major fishing countries, Spain and France.

Species composition of FAD and free swimming schools fished by purse seiners in the Western Indian Ocean during the period 1990-2006 (IOTC-2007-WPTT-05)

29. This document reported on a range of analyses of the data collected from a large number of purse seiners landing tunas in the Indian Ocean. This document reports on the time and area species composition of FAD and free swimming tuna schools landed by purse seiners in the Western Indian Ocean over the period 1990-2006.

Each purse seine set was classified into one of seven categories according to its species composition. The paper analyses the importance and changes of each category in the five main fishing zones of the purse seine fishery.

30. A total number of 3813 free schools and of 5440 FAD schools samples were analyzed (a total weight of tunas of 32,400 t). The species compositions of each of the two set types appeared to be typical and consistent in each area during the studied period (Figure 14): FAD schools samples are dominated by the three tropical species – bigeye, yellowfin and skipjack (72 % of schools) or by a mixture of yellowfin and skipjack (22 %). Over 60% of free schools comprised only one species (yellowfin 50 % or skipjack 12 %), other free schools were made up of the three tropical species. Albacore tuna (a more temperate species) was found in 10 % of the free schools. Species composition of free schools is more variable towards the northern and southern at the peripheries of the main fishing zones.



Preliminary data obtained from supply logbooks implemented by the Spanish fleet since 2004 (IOTC-2007-WPTT-07)

31. The document presented preliminary results from a study examining the contribution of supply vessels providing support for the Spanish purse-seine fleet in the Indian Ocean. Supply boats work alongside the tuna purse-seine fleet, providing support for a range of activities and contributing to improving fishing performance. These vessels are 35-40 m long, with 650-1600 hp and 7-10 crew members. The main activities are to produce objects, deploy and monitor them, also indirectly provide relief for the fishing vessels by transporting provisions, the injured, tackle and so on. When they detect an object with fish, they notify the purse-seine/s (normally one, occasionally two) they are associated with in order for them to undertake the fishery.

32. This is the first study using logbooks for monitoring the supply vessels. Previously, the only source of data came from observers. Since 1999, the number of supply vessels working in collaboration with the Spanish purse-seine fleet in the Indian Ocean, has gradually increased, reaching a maximum of 15 in 2004 and settling at 13 in 2005 and 2006. One to 11 campaigns were monitored per vessel from November 2004 to March 2007. A total of 83 campaigns, equating a total of 4484 days at sea have been covered. The mean duration of a campaign was 54 days, the shortest being 8 days long and the longest 124 days. Two types of supply vessels were identified: those that spend most time anchored over a seamount (2 vessels), and those that navigate in a similar way to the purse-seiners (11 vessels). Currently there is little information on the former as they spend most of their time anchored to seamounts and rarely put into port. There are 11 supply vessels belonging to the second type—navigating in close collaboration with purse-seiners. For these vessels, navigation (with or without searching) takes up 62% of their time at sea, visiting objects 22% and deployment 11.5%. On average vessels deployed about 0.6 buoys per day and visited 1.1 FADS. Once supply logbooks are put into full effect in supply vessels, they are expected to provide a source of data that will contribute to a better understanding of the behaviour of these boats that support the purse-seine fishery and should be included in standardizing the fishing effort over objects in IOTC assessments of stocks of tropical tuna species.

Statistics of the Spanish purse seine fleet in the Indian Ocean (1984-2006) (IOTC-2007-WPTT-08)

33. Document IOTC-2006-WPTT-08 provided summary statistics of the Spanish purse seine fleet fishing in the Indian Ocean from 1984 to 2006. Data included catch and effort statistics as well as some fishery indices by species and fishing mode. Information about the sampling scheme and the coverage of sampling, together with

maps and diagrams representing the fishing pattern of this fleet by time and area strata are also included. This information was incorporated in the presentation made for IOTC-2007-WPTT-18

French purse-seine tuna fisheries statistics in the Indian Ocean, 1981-2006 (IOTC-2007-WPTT-17)

34. This document presents a summary of the main general French purse-seiners activities in the Indian Ocean since 1981: effort, catch by species and fishing type (log and free swimming schools), catch per unit of effort, sampling and mean weights for the main species. This information was incorporated in the presentation made for IOTC-2007-WPTT-18

Statistics of the main purse seine fleets fishing in the Indian Ocean (1981-2006) (IOTC-2007-WPTT-18)

35. This document presents a summary of the statistics of French, Spanish, Italian, Seychelles and EU related NEI purse seine fleets fishing in the Indian Ocean since 1981: effort, catch by species and fishing type (log and free swimming schools), catch per unit of effort, sampling and mean weights for the main species.

36. Both the number of vessels and the carrying capacity in terms of tonnage have increased since 2003 (Figure 15). The number of free-school sets in 2006 (6800 sets) was slightly down on the 2005 high (7358) but still above the average of the last five years (6016 sets). The number of log sets was the highest in 9 years (6621), well above 5609 which was being the average for the last 5 years (Figure 16). The amount of area being explored by the fishery has, overall, an increasing trend (Figure 17). Total catches in 2006 (390,595 t) were slightly above the average for the past 5 years (384,689 t). 313,283 tuna were measured in 2006, of which 60% was yellowfin tuna.

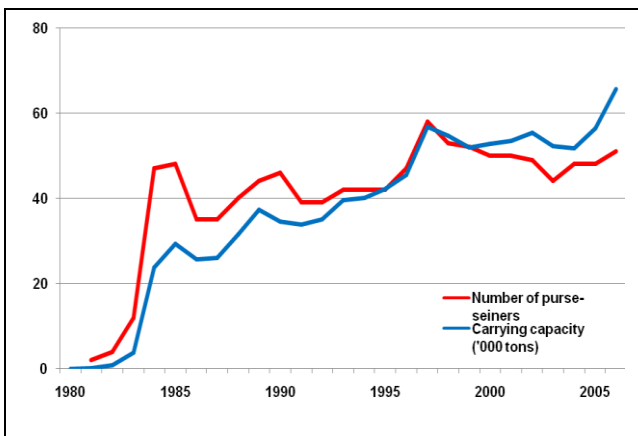


Figure 15: Trends in the major purse seine fleets in terms of the numbers of vessels and carrying capacity

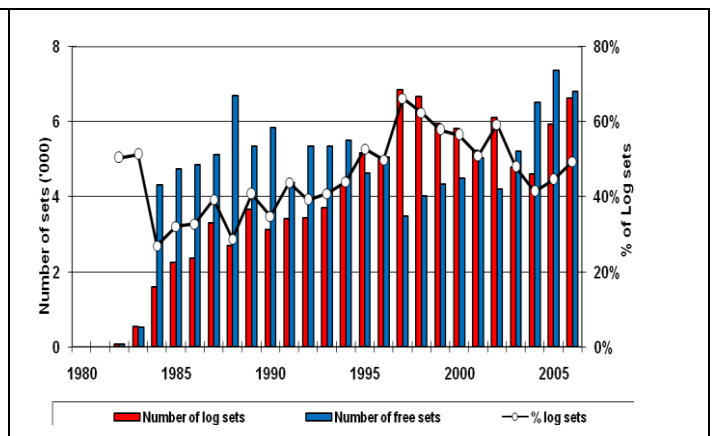


Figure 16: Trends in fishing effort in the major purse seine fleets: numbers of sets of FADs and free schools

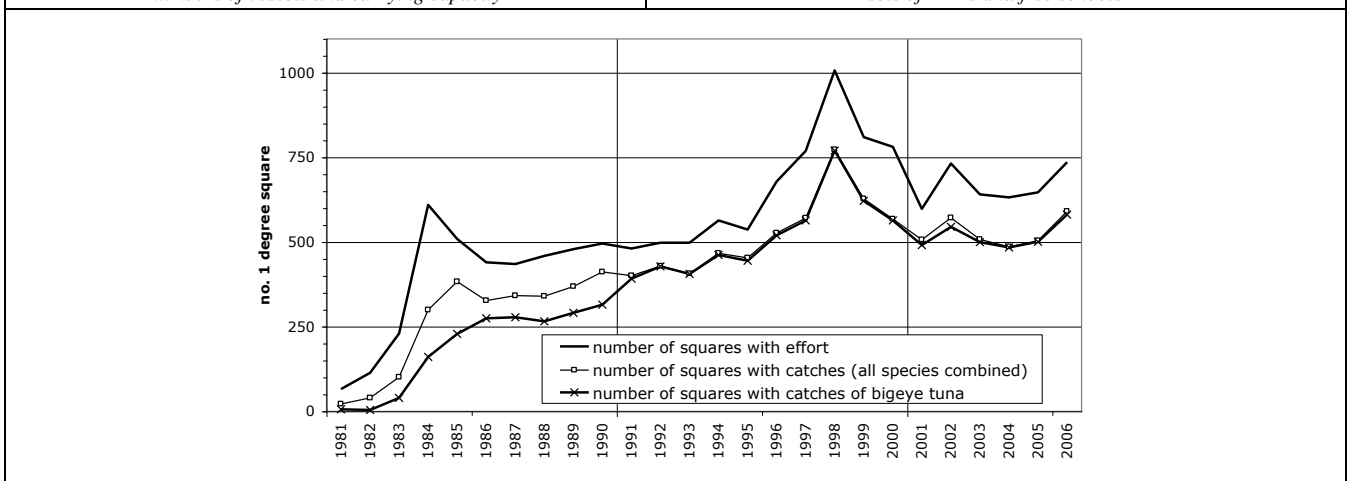


Figure 17: Number of one degree squares explored in the purse seine fishery from 1980 to 2006

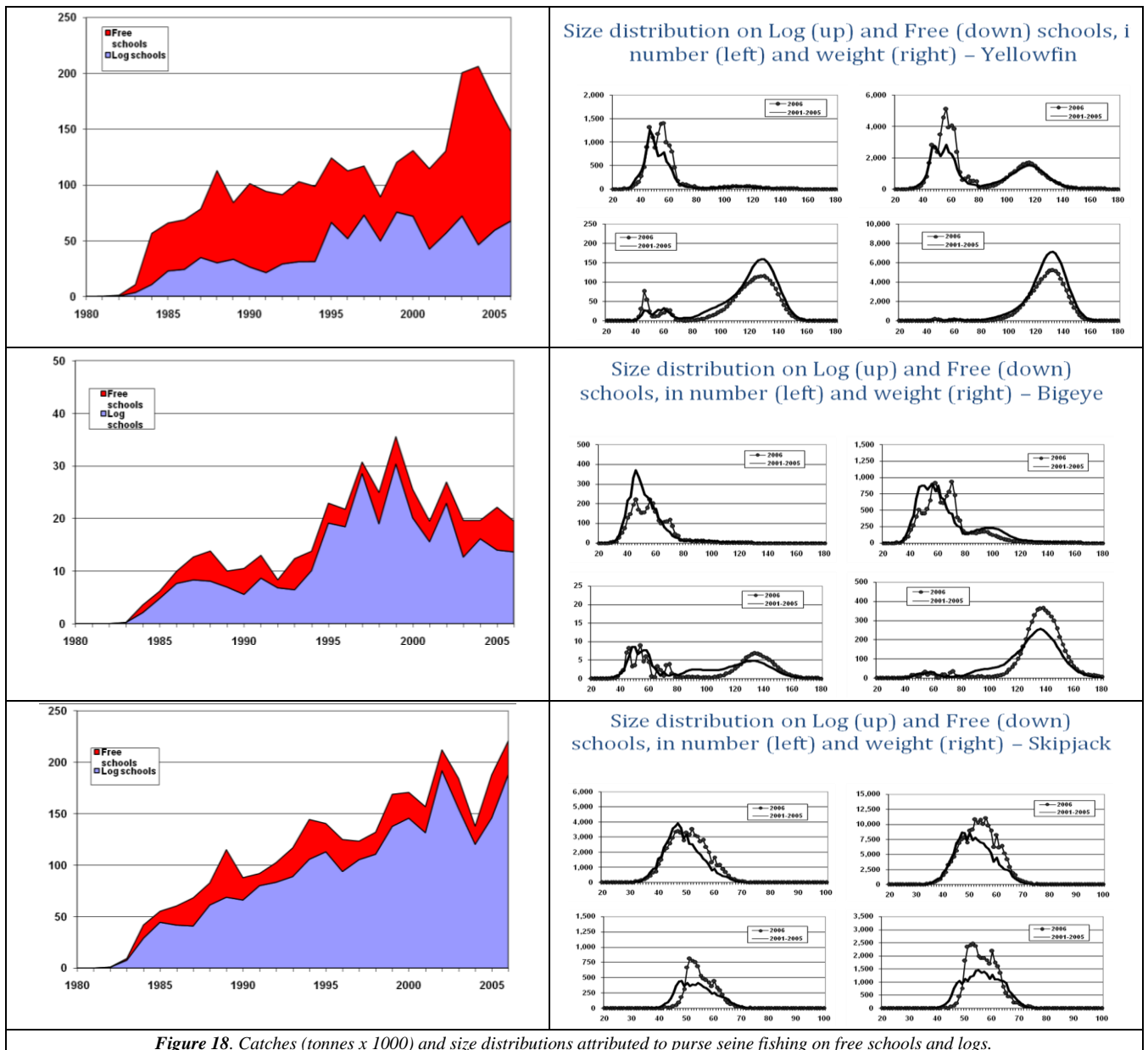


Figure 18. Catches (tonnes x 1000) and size distributions attributed to purse seine fishing on free schools and logs.

37. Most bigeye and skipjack are captured by purse seine vessels fishing log schools. By contrast yellowfin tuna is mostly fished from free schools. (Figure 18). The size and weight of yellowfin and bigeye tunas differs between log and free school whereas skipjack changes little (Figure 18).

Preliminary analysis of tuna catches by Purse Seiners fishing in the Western Indian Ocean over the period January to April 2007 (IOTC-2007-WPTT-20).

38. This paper reported on a comparison of the catches and CPUE of the Purse seine fleet active in the western Indian Ocean during the four first months of 2007 and during the same period in previous years. This analysis focused mainly on yellowfin tuna, taking note that the yellowfin catches by the purse seine fleet in 2007 have been at low levels. The paper also analysed the 2007 fishing zones as well as the catches at size observed for yellowfin. The low levels of catches observed in both the FAD and the free schools fisheries are discussed. These low catches and CPUEs observed during the first months of 2007 could correspond either to a low overfished adult biomass following four years of high catches, or to an environmental anomaly temporarily reducing the stock catchability (and the fishing mortality). Such an environmental anomaly could be compared to the anomaly observed during the September 1997-April 1998 period, but at a much less severe level for the yellowfin fishery.

39. The WPTT noted that the management advice on yellowfin to be provided by it to the Scientific committee in 2007 should take into account as much of the 2007 catch information as possible. To this end the WPTT called on the scientists working with the data from the major purse seine fleets and the Japanese and Taiwanese longline fleets to provide their catch data to the Secretariat in time for this meeting in November 2007.

Some Scientific Information of Tunas Harvested by Thai Purse Seiners (IOTC-2007-WPTT-22)

40. At present there are six tuna purse seiners operating under Thai flag in the Indian Ocean. These vessels range between 1400-2700 gross tonnage and have been authorized for tuna fishing in the IOTC areas since September 2005. The operating areas range from 10°58.5'N-8°22.4'S and 42°28'E-85°36.3'E. Tunas caught by this fleet are taken back to Thailand for canning.

41. Before the commencement of the current fleet in 2005 the total annual catches were less than 2,000 t. After the entry of the six tuna purse seiners, production rose sharply to 12,216 t in 2005 and increased almost double fold in 2006. The highest catches were taken in February – May. Monthly CPUEs ranged from 15 to 55 tonnes/day. The high CPUE was in the period February – May. Skipjack made up 71.98% of the total catch, followed by bigeye 17.02%, yellowfin 10.06% and the bonito 0.94%. The sizes of skipjack, bigeye and yellowfin in 2006 were 41-76 cm, 41-133 cm and 33-152 cm respectively, and with mean length 67.5, 77.5 and 61.5 cm respectively.

Tuna purse seine landings in Phuket, Thailand, from 1993 to 2006 (IOTC-2007-WPTT-25)

42. Since the industrial purse seine and longline vessels started to land tunas at Phuket fishing port in 1993 the port has developed as has the collection of catch, effort and CPUE and biological data. Over the period from 1993 to 2006 the annual landing and value of tunas at Phuket, Thailand has ranged from 1,365 t (valued at \$US1.12 million to 31,017 t and (\$US 29.32 million). Catch and value decreased slightly during 1995 to 1997; there was a sharp increase in 1998; then a marked decrease over 1999 to 2006. The fisheries appear to be influenced by the state of the monsoon season. From 2002 to 2007, the species composition of purse seine fleets catch comprise mainly skipjack (63 %) as the main target, followed by yellowfin (21 %) and bigeye (16%).

AZTI Discard Sampling Programme in the Spanish Purse-Seiner fleet in the Western Indian Ocean (2003-2006) (IOTC-2007-WPTT-31)

43. This document presented the preliminary results of the observed programme carried out by AZTI-Tecnalia in the tuna purse-seiner fleet operating in the Western Indian Ocean. Since 2003 AZTI-Tecnalia has carried out part of the Spanish tropical tunas sampling programme for the collection of data in the fisheries sector under the EU Data Collection Regulations. One of the objectives of the sampling programme set up in this framework is to estimate the discards of bycatch species in the EU fishery. The sampling is carried out by on board observers and includes the following data: route data, set and drifting Fish Aggregating Device (FAD) characteristics, retained catch, discard and bycatch estimates, and length distributions by species.

44. The coverage of the fishing days sampled has increased year by year, increasing from 2.4 % in 2003 to 4.2 % in 2006. Retained catches are up to 160 t/set in free school sets and up to 45 t/set in FAD sets. Discards from free school sets were up to 2.5 t/set compared with 1.6 t/sets from FAD sets. Skipjack and frigate tuna were the main discard species in FAD sets and skipjack and frigate tuna in free school sets. 34 associated species were observed in log sets. *Elegatis bipinnulata*, *Coryphaena hippurus*, *Carcharhinus falciformis*, and *Istiophoridae* were the most common species. The free school data was not analysed due to the low coverage. The 'Other fish' group made up more than 95% of the total associated fauna catches the remaining groups were turtles, billfishes, cetaceans and sharks. 11 turtles were captured during the 4 year period. This document was intended for the WPEB; however due to timing problems, it was presented to the WPTT as many of the participants are also members of the WPEB.

Optimum sample number for estimating shark by-catch in the Spanish Purse Seiners in the Western Indian Ocean (IOTC-2007-WPTT-26)

45. The tuna purse-seine fishery has as main target species skipjack tuna (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*) but it also has an impact in other species of the pelagic ecosystem. Bycatch normally depends on the structure, behaviour and spatial organisation of the different species included into the fish aggregations. Among the incidentally captured species in this fishery are other tuna-like fishes, sharks, turtles. The main aim of this working document is to estimate the sampling level coverage needed to get accurate and reliable estimates of the shark by-catch in the Spanish purse seine fishery. This document was intended for the WPEB; however due to timing problems, it was presented to the WPTT as many of the participants are also members of the WPEB.

3.5 LONGLINE FISHERIES IN GENERAL

Tuna longline landings in Phuket, Thailand, from 1994 to 2006 (IOTC-2007-WPTT-21)

46. Five hundred and seventy surface tuna longline vessels (Taiwanese, Chinese and Indonesian) were recorded at Phuket fishing port during 1994 to 2006. The Chinese longline fleet has not unloaded at Phuket since May 2005. The annual landing and value of tunas at Phuket varied from 1,415 t (worth \$US3.6 million) to 5,591 t and (\$US20.57 million) between 1994 to 2006. The trend of landing and value from longliners was a increased slightly from 1994 (622 t, \$US2.07 million) to 2005 (5,591 t, \$US19.47 million). The most productive fishing occurred in the eastern Indian Ocean during November to March (the northeast monsoon). The target species included yellowfin, followed by bigeye, billfish (Striped marlin (*Tetrapturus audax*), blue marlin (*Makaira mazara*), black marlin (*M. indica*), Indo-pacific sailfish (*Istiophorus platypterus*) and shortbill spearfish (*Tetrapturus angustirostris*), and swordfish (*Xiphias gladius*). Taiwanese and Indonesian fleets caught mainly yellowfin while bigeye was the main target species of Chinese fleet. The marketing system and vessel information are reported in this paper.

Thai tuna longliners in the in the Indian Ocean from 2000 to 2006 (IOTC-2007-WPTT-29)

47. Data from the logbooks of Thai tuna longliners operating in the Indian Ocean from 2000 to 2006 revealed important information of their fishing operation and effort. Total annual catches were 382.6 t in 2000, 390.9 t in 2001, 93.6 t in 2002, 252.5 t in 2003, 272.4 t in 2004, 280.1 t in 2005 and 414.5 t in 2006, with the value of 2, 1.84, 0.46, 1.16, 1.58, 0.98 and 2.42 million US\$ respectively. The areas of fishing included Bay of Bengal, west coast of Indonesia, Maldives and Chagos archipelagos, east and south of Seychelles, east coast of Somalia and southern part of the Indian Ocean.

48. The highest catch rates were reported off the west coast of Indonesia, followed by areas off Maldives and Chagos archipelagos (1.6 and 1.5 fish/100 hooks). The lowest catch rate was reported in the Bay of Bengal (0.7 fish/100 hooks and 0.026 metric tons/100 hooks). The main species caught were bigeye tuna, yellowfin tuna, albacore tuna, and swordfish and marlin comprising 37%, 36%, 20% and 7% of the total catch in seven years. Bigeye tuna was taken in all fishing grounds with the highest catch in southern part of Indian Ocean. Yellowfin tuna was also taken in all fishing grounds with the highest abundance reported in the east and south of Seychelles and the lowest abundance reported in the eastern Indian Ocean. Albacore tuna was most dominant in the southern areas of the Indian Ocean. Other species recorded included swordfish (*Xiphias gladius*), sharks, blue marlin (*Makaira mazara*), black marlin (*M. indica*), striped marlin (*Tetrapturus audax*) and sailfish (*Istiophorus spp*).

Indices of yellowfin and skipjack tunas caught by long lining in north-eastern Arabian Sea and Andaman & Nicobar waters (IOTC-2007-WPTT-30)

49. Yellowfin tuna and skipjack tuna are the two major components of tuna fisheries in the Indian EEZ. Data collected through the exploratory tuna longline surveys by the Fishery Survey of India vessels in the North-eastern Arabian Sea and Andaman and Nicobar Waters during the period 2000-06 were used to calculate the Hooking Rate (HR) and Catch Rate (CR) for these species and aggregate HR for all fish caught in the operations.

50. In the Indian EEZ in the north-eastern Arabian Sea the hooking rates of yellowfin tuna ranged from 0.2 to 0.6% compared to 0.002 and 0.18% for skipjack tuna. The catch rates for yellowfin tuna ranged from 24 kg to 187 kg per 100 hooks compared to 0.03 kg to 12 kg per 100 hooks for skipjack tuna. In the Indian EEZ around the Andaman and Nicobar Waters the hooking rate of yellowfin tuna ranged from 0.08 to 0.34% and 0.005 to 0.056% for skipjack. The highest catch rate of yellowfin tuna was 107 kg per 100 hooks in the year 2005 with a minimum catch rate of 27 kg per 100 hooks recorded in the year 2000. In the case of skipjack tuna the catch rate was minimum 0.2 kg/ hooks during 2000 and 2006 (0.2 kg/100 hooks) and the maximum 1.3 kg/100 hooks in the year 2002 (Fig.2). In both the regions the results indicate that there have been peak years for hooking rates corresponding to the years 2003 and 2005. The trends also exhibit that the tuna fisheries in the Indian EEZ experience higher hooking rates during pre-monsoon and monsoon seasons in the Arabian Sea and during monsoon and post-monsoon seasons in the Andaman and Nicobar Waters.

Capture depths of longline targeted species (yellowfin, bigeye, swordfish): preliminary results obtained from experimental longline fishing carried out in Seychelles' oceanic waters (IOTC-2007-WPTT-28)

51. Understanding the vertical habitat of pelagic species assists longline fishers to set their lines at a specific depths depending on the time of the day and environmental conditions and maximizes their chances to catch targeted species and limit the amount of bycatch. Longline fishing experiments were conducted as part of the

CAPPES (Capturabilité des grands pélagiques à la palangre dans les eaux des Seychelles) project using a instrumented longline, equipped with hook timers and temperature-depth-recorders from December 2004 to May 2006. Conductivity, temperature and depth profiles were also recorded. These experiments collected data on the vertical habitat of pelagic fishes during daytime and night.

52. The lines were set in two different ways: shallow at night (setting after sunset and hauling before sunrise) to target swordfish as traditionally done by local fishermen; and deep during the day (setting before sunrise, hauling at noon) targeting tuna. For each fish caught (target or bycatch) the basket number, hook number were recorded. The depth of captured were later determined. Results showed capture depths for the target species - yellowfin, bigeye and swordfish during both daytime and night-time sets. While yellowfin tuna and swordfish were mainly caught in the first 150m (both for day and night sets), bigeye tuna were captured close to the surface during night and below 150m during daytime.

Modelling the hook depth of tuna longline in the tropical areas of the Indian Ocean (IOTC-2007-WPTT-13-rev1)

53. To have a better understanding of the hook depth for tuna longline, a survey on the tuna longline fishing ground was conducted from October to November 2006 in the tropical areas of the Indian Ocean. The longliner *Yueyuanyu* No.168 was used as the platform for data sampling. We considered hook depth rate as the dependent variable, and the current shear coefficient, the wind speed, the hook code, the weight of the messenger weight independent variables.

54. We developed the hook depth rate model and hook depth model by the analysis of covariance with completely randomized design of general linear model with the software SPSS. The results indicated that the wind and surface current effects on the hook depth might be ignored; the undercurrent of the equator would be the key factor affecting hook depth; there were negative correlations between hook depth rate and current shear, angle of attack; and the hook depth rate were declining along the increasing off the hook code. Based on the comparison between the hook depth calculated by the model and the actual hook depth measured by TDR (almost all of the differences were within 30m, the max difference attained to 50m), it is suggested that a predicted hook depth model could be developed by this method.

The relationship between the thermocline and the catch rate of *Thunnus obesus* in the tropical areas of the Indian Ocean (IOTC-2007-WPTT-14-rev1)

55. An investigation of the relationship between the thermocline and the vertical distribution of bigeye tuna was undertaken using data collected during two surveys on tuna fishing grounds were carried out onboard the longliners, *Huayuanyu* No.18 and *Huayuanyu* No.19 from September to December 2005 and *Yueyuanyu* No.168 in October and November 2006 in the tropical areas of the Indian Ocean. The depth and intensity of the thermocline were estimated from the data. The catch rates of bigeye tuna in relation to the thermocline were analyzed. The results showed that a) the average catch rates of bigeye tuna below the thermocline was higher than that at the thermocline; b) the days, having catch rates at the depth below the thermocline higher than that at the thermocline, were accounted for 69.6%, 100% and 62.5% of all the surveying days of three longliners, respectively; c) the average catch rates of bigeye tuna at and below the thermocline (in both 2005 and 2006, separately) were not significantly different.

3.6 FISHERIES IN GENERAL

The Maldivian Tuna Fishery – An Update (IOTC-2007-WPTT-23)

56. The Maldivian pole-and-line tuna fishery has been in existence for hundreds of years. The sailing fleet underwent mechanization in the 1970s. By mid 1980s the purpose-built second generation vessels that replaced the converted sailing vessels increased the catch by threefold. However, further rapid increase in catch was slow until late 1990s with third generation fibreglass (FRP) vessels joining the fleet. Catches then doubled from 1996 to 2006. Private sector investments in post-harvest sector are driving the most recent phase of fishery expansion. These include the additional collection and storage facilities, tuna canneries and the rapidly growing fresh tuna export business.

57. Total reported tuna catches at present are 170,000 mt of which 80% is skipjack tuna (*Katsuwonus pelamis*) followed by yellowfin tuna (*Thunnus albacares*). Other coastal varieties, frigate tuna (*Auxis thazard*) and kawakawa (*Euthynnus affinis*) are caught in small quantities, <5% at present. Roughly a third of this catch is

consumed locally the rest are exported in canned, fresh/chilled, frozen, dried, and other forms. The total export earnings in the recent years were in excess of US\$ 100 million.

58. The increasing fishing power and efficiency CPUE of both skipjack and yellowfin tuna are increasing. Skipjack CPUE has increased almost consistently in the recent years; from about 270 kg/day in 1997 to over 600 kg/day during 2006. Yellowfin CPUE has been also being increasing from 50 kg/day in 2000 to over 100 kg/day in 2006. The latter may be explained due to increased targeting of yellowfin.

59. The export business of fresh large yellowfin tuna is growing with increasing investments and availability of ice in the outer atolls. Catches are made exclusively from handline method and targets dolphin-associated schools. During 2006 the total volume exported was over 8,000 mt fetching and export value of over US\$ 29 million.

60. Data collection, processing and reporting needs to be strengthened. Given the changing outlook of the Maldivian tuna fishery this is of high importance. Lack of trained people at the Statistics Unit at the Ministry is the limiting factor in improving the data collection, compilation and dissemination. Despite these shortcomings, efforts are being made at introducing log book systems.

61. Tuna size sampling is conducted by fishermen-field officers in 11 islands. Re-establishing of the regional sampling programme was helped by the OFCF/IOTC assistance during 2003-2005. The data are being compiled by MRC. Estimates of average weights from these size samples shows the size of the skipjack may be declining in the Maldives fishery. This decline is more apparent for fish sampled during northeast monsoon season.

62. Maldives has been actively taking part in the Indian Ocean Tuna Tagging Programme (IOTTP). During 2004/2005 a Small Scale Tagging Program released 5,000 skipjack and yellowfin tuna. Over 6% has been recovered so far. Preparations have been complete to release further 12,000 skipjack and yellowfin tuna. Initially the plan was to release these tags whilst the Regional Tuna Tagging Programme (RTTP) vessels were operating close to the Maldives.

3.7 ENVIRONMENT

Highlights of climate trends and interannual variability in the Indian Ocean (IOTC-2007-WPTT-15)

63. A review of the climate trends in the Indian Ocean summarised from three recent scientific publications was presented. Data covering the period 1960-1999 indicates a net ocean warming with the largest increase occurring in the subtropics (+1° to +2°C). Warming has extended down to 800 m at 40°S-50°S. Models suggest that a strengthening of westerly winds has shifted the subtropical gyre 0.5° southward. In the tropics, the warming is trapped above the thermocline, while below a subsurface cooling can be observed around depth of 100-200 m. This depicts a shoaling of the thermocline and an increase in vertical stratification. It is suggested that the recent weakening of the Pacific Ocean trade winds has reduced the intensity of the Indonesian throughflow leading to a reduced the flow of warm water in to the Indian Ocean and the enhanced the shoaling of the thermocline. An examination of the El Niño and Indian Ocean dipole mode zone indices illustrated the effect of decadal variability in the relative intensity sea surface temperature and rainfall anomalies over the period 1876-1999. The effects of climate trends over the period 1999-2004 was also presented. For 74% of the permanently stratified ocean (tropics and subtropics), the changes in net primary production and sea surface temperature are inversely related. The equatorial region of the Indian Ocean is one of the few regions in the world where sea surface temperature and net primary production have increased in phase, while the other areas of the Indian Ocean (East and south tropical gyre) have experienced an increase in sea surface temperature and a concomitant decrease in net primary production.

Physical and biological patterns in the Indian Ocean during the last decade, with emphasis on their consequences on tuna fisheries (IOTC-2007-WPTT-16)

64. This paper investigated the relevancy of environmentally-driven fluctuations of catchability in the West Indian Ocean purse seine fishery for the period 1997-2007. The trend of catch rates during the last 10 years is characterized by very low catches at the end of 1997, two years of record catches, 2003 and 2004, mainly driven by yellowfin catches, and a significant decline of catch in the first semester of 2007. Three environmental variables are analysed: sea surface temperature (SST), mixed layer depth (MLD) and sea surface chlorophyll (SSC). High SST anomalies (+1.0 to +1.6°C) stretched over the whole western region in 1997-98, when the El Niño reached its peak phase. Another episode of warm anomalies was observed from November 2006 to March 2007, but with a lesser magnitude compared to the 1997-98 ENSO. The oceanic features associated to these

anomalous warm events were a deeper mixed layer and a reduced primary productivity in the West Indian Ocean. During the 1997-98 ENSO, the purse seine fleet left the Western basin to find better fishing conditions east of 80°E whilst during the 2006-2007 event, the fleet remained in the Western basin but experienced very low catch rates. Between these two warm events, opposite oceanic patterns prevailed during the northwest monsoon (December to February) notably a shallower than normal mixed layer for the period 2001-2005 and enhanced primary productivity in 2003-2004. These features tend to support the hypothesis that favourable environmental conditions have enhanced the catchability of the yellowfin stock during the years 2003-2004 and that ENSO events reduce the vulnerability of tuna to surface gears.

4. STOCK ASSESSMENT FOR YELLOWFIN TUNA

4.1 ABUNDANCE INDICES

65. Document IOTC-2007-WPTT-10 presented the standardised Japanese longline CPUE for yellowfin tuna (1960 to 2005) derived using GLM (CPUE-Log Normal error structured model) in which Sea Surface Temperature was included in the model as an oceanographic factor and NHF (Number of Hooks between Float), which was divided into six classes, was applied in the model as fishing gear information. In the early 1990's, a rapid shift of the longline gear configuration to a greater NHF occurred. This appears to have happened at the same time as Nylon material began to be used in longline gears. In order to remove the effect of this gear shift, information of main line materials was also used in the standardisation model. The main fishing grounds of the Japanese longline fishery were divided into a tropical area (sub-areas 2 and 5) and an areas covering the entire Indian Ocean (sub-areas 0-5) – Figure 19). The annual CPUE indices were variable but generally declined steeply from 1960 until the late 1970's. From the late 1970's to the early 1990's the index stabilised. From the mid 1990's to 2005 the index was at lower levels than previously, but again relatively stable (Figure 20).

66. Document IOTC-2007-WPTT-19 described the standardization of CPUE for yellowfin tuna caught in the Taiwanese longline fishery in the Indian Ocean for the period 1968 to 2005 using generalized linear model (GLM) and generalized linear mixed model (GLMM) approaches. The main effects considered in the analysis were year, season, area, and catch ratio for albacore and bigeye tunas – as a proxy for targeting, sea surface temperature and mixed layer depth. In this study, Area 1 in previous studies was further divided into a new Area 0 and Area 1 to accommodate the fishing dynamics of the Taiwanese longliners in a specific region of the new Area 1 (see Figure 19). Interactions for the main effects are also included into the model. Overall, the indices have been variable from year to year, but relatively stable since the late 1970s. The catch rate has shown a slowly increasing trend since 1997 (Figure 21).

67. The WPTT noted that since the early 1990's the Taiwanese fleet has concentrated its operation in the Arabian Sea area whereas the Japanese fleet has operated more in the central and western Indian Ocean. The WPTT concluded that the Japanese and Taiwanese longline fisheries are now spatially distinct and both indices of abundance need to be viewed and modelled separately.

68. Furthermore, the WPTT agreed that further work on the CPUE indices needs to be undertaken, including: analyses to better understand the influence of the variables included in the standardization procedures that produce the final indices of abundance; and given the spatial concentration the Japanese operations, a new standardized CPUE index for the Japanese LL fleet should be produced for an area combining, area 3-north of 30°S, area 2 and area 5. Scientists should use information criteria approaches to compare the various model options and identify the most significant factors of influence in these analyses and eliminate where possible those variables not affecting the final index.

4.2 STOCK ASSESSMENT

69. Four stock assessment models were applied to the Indian Ocean yellowfin tuna stock in 2007. In this meeting, the results obtained from the models were inspected and discussed and extra runs were carried out during the meeting to explore various scenarios.

ASPM

70. An implementation of an Age Structured Production Model (ASPM; Restrepo, 1997) that had been used in previous assessments was presented (IOTC-2007-WPTT-12). The model used the input values common to all models: catch, M vector, growth curve. It also applied a set of selectivity curves by fleet obtained from a Separable Population Analysis (SPA). Runs were conducted using the Japanese LL CPUE only. To examine an

assumed increasing efficiency of the Japanese fleet over time i.e. an increasing q (catchability), the model was run using three time series of data, 1960-2005, 1968-2005 and 1980-2005. The steepness parameter for the stock-recruitment relationship was not estimated but assumed fixed at a value of 0.7, as previous analyses indicated that it was not possible to obtain a good estimate of it.

71. The ASPM was re-run (IOTC-2007-WPTT-12-add1) using a higher value of steepness, 0.8 (as this was the value used in the other models) and three CPUE indices (Japanese only, Taiwanese only and a combined index).

STOCK SYNTHESIS 2

72. An assessment using Stock Synthesis 2 (Methot, 2005) was presented in document IOTC-2007-WPTT-11. SS2 is a length-based integrated modelling approach. To assist in its interpretation, the SS2 model was run using the similar conditions / assumptions used in the ASPM and CASAL analyses.

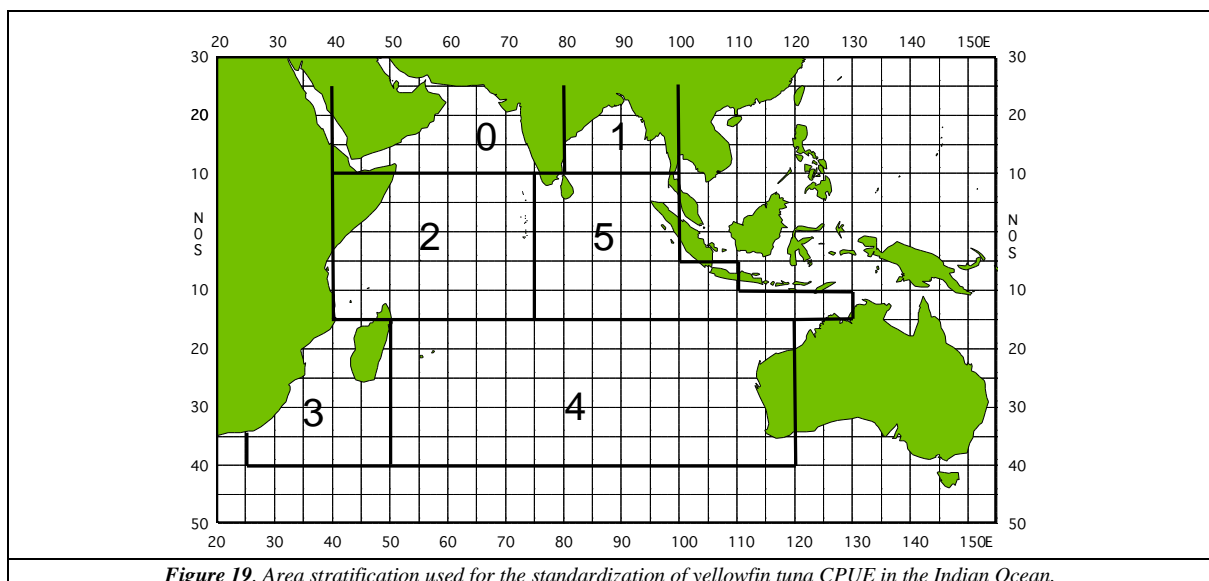
SPBAYES – BAYESIAN PELLA-TOMLISON

73. A Bayesian Pella-Tomlison model, on which the shape parameter is not estimated, as implemented in the FLR library⁴ was applied to the yellowfin data during the meeting (IOTC-2007-WPTT-27). Given the difficulty of estimating both r and K parameters using one-way-trip indices of abundance, a strong prior pdf for r was estimated using biological data.

74. The model fitted well to the CPUE data, especially to the downward trend started in the early 1990s. Similar to the other models, biomass depletion levels were estimated to be around the 50% level. The confidence intervals obtained through Bayesian analysis give an indication of the uncertainties associated with estimating absolute levels, even when using simple models such as this one.

BAYESIAN TWO-AGE DELAY-DIFFERENCE MODEL

75. Document (IOTC2007-WPTT-32) described the results of some exploratory runs of a Bayesian two-age delay-difference model which was first applied to this stock in 2005. It has a stock-recruit relationship relating the mature adult stock biomass to the recruiting juvenile fish, as well as catches split on this rough basis. It does not in this case estimate recruitment variations, it is basically an assessment model that is half-way between the more basic production model applied in IOTC-WPTT-2007-27, and the more complex age/length-structured integrated assessment models such as SS2 or CASAL.



⁴ <http://flr-project.org/>

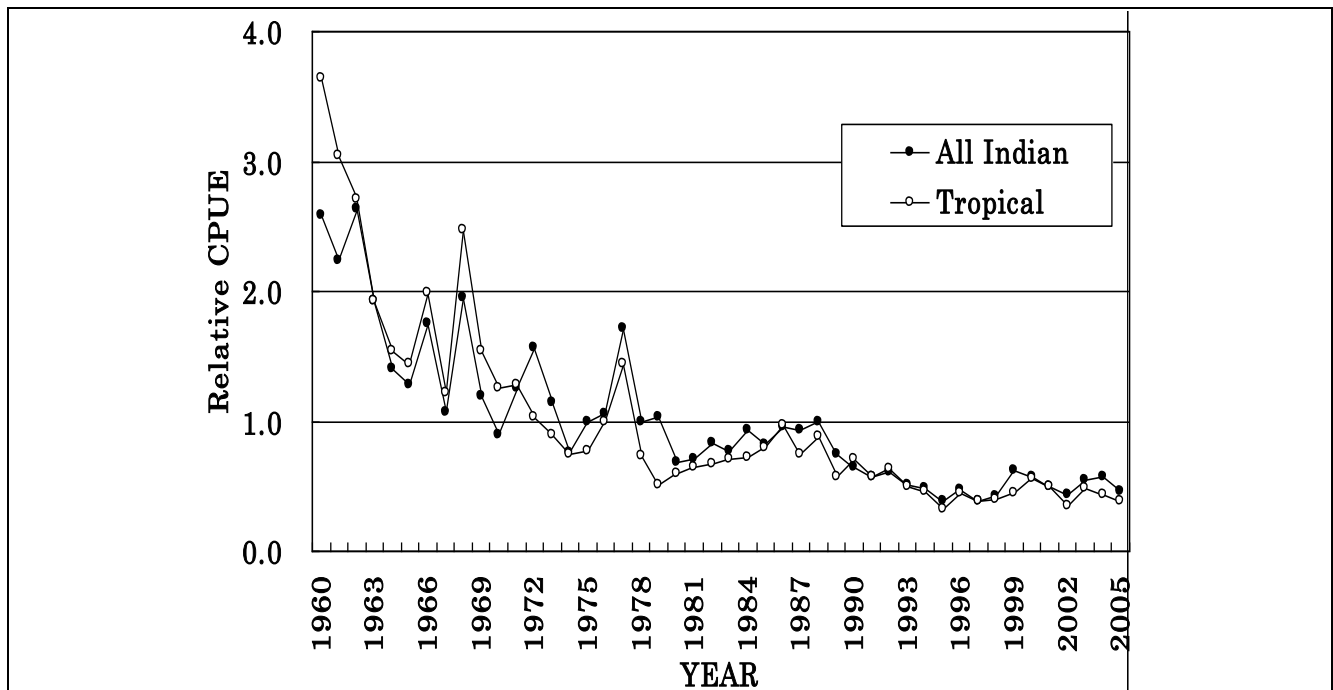


Figure 20. Standardised CPUE index for the Japanese longline fleet from 1960 to 2005 for the entire Indian Ocean area and the tropical area

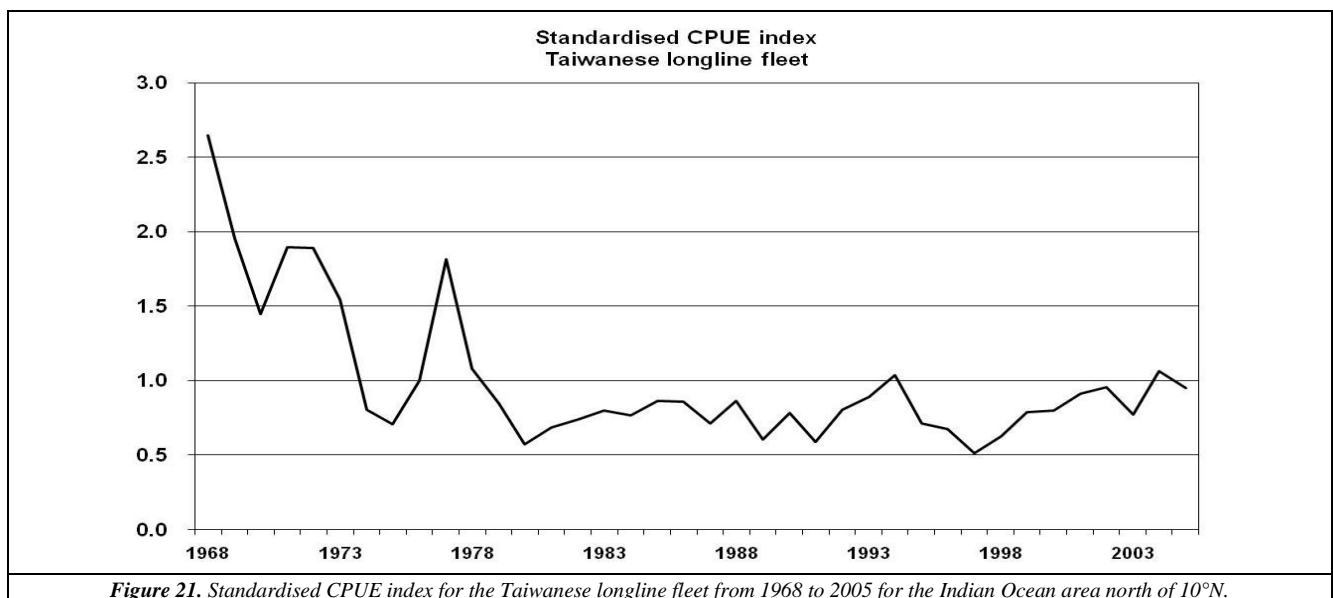


Figure 21. Standardised CPUE index for the Taiwanese longline fleet from 1968 to 2005 for the Indian Ocean area north of 10°N.

Summary of model results

76. The analyses presented in the original documents, and the additional runs conducted during the meeting, allowed the WPTT to identify a number of issues with the current assessment of yellowfin tuna.

77. First, runs conducted with the Taiwanese CPUE series tended to be more optimistic than those based on the Japanese CPUE, primarily as a consequence of the more optimistic trend in recent years present in the Taiwanese CPUE. A combination of both indices produced, as expected, intermediate results, depending on the weight given to the indices.

78. Analyses that used the CPUE and catch data since 1980 produced more optimistic results than those based in the whole series (since 1960), or the reduced series (since 1968). This highlights the difficulties that these methods encounter when trying to explain, at the same time, the large decrease in CPUE apparently caused by small catches during the earlier years in the fishery, and the relatively smaller decrease, or no decrease, in the CPUE when the catches increase several fold after the 1980's.

79. These difficulties were evident in the extreme estimates of biomass ratios or the variability apparent in the F-ratios. In fact, both integrated methods (SS2 and CASAL) found great difficulty in estimating virgin biomass

when the parameter was unconstrained. The SS2 runs required virgin biomass to be constrained for the optimizer to reach a solution

80. In summary, despite the considerable work undertaken, there remained strong uncertainties in each of the assessments conducted. In particular, none of the assessments were 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. Also, the trends observed in recent years are not fully consistent with those of total catches and the models had great difficulty at combining these contradictory sources of information.

81. Consequently, the WPTT agreed on the following work plan to be undertaken to further examine some of the problematic aspects of the yellowfin stock assessment inputs using the most up to date data. It is intended that the WPTT would work intersessionally to provide advice on the status of yellowfin tuna to the Scientific Committee in November 2007.

82. A feature of this work will be the inclusion, for the first time of data from the RTTP-IO. The tagging data are expected to improve the estimates of the growth parameters used in the assessments and provide more information, e.g. exploitation rates, which will be used to improve model performance and outputs including absolute values of SSB and fishing mortality.

4.3 INTERSESSIONAL WORK PLAN

83. Co-ordination of this work is to be carried out by the chairman of the Working Party, and a number of scientists have volunteered to carry out sections of this work over the next few months. The WPTT will then submit an updated management advisory on yellowfin tuna to the Scientific Committee in 2007 no later than two weeks prior to the meeting provided the proposed analyses improve the understanding of the status of the resource.

Data updates

- The secretariat will make a special request for the most up-to-date fisheries data available from member data coordinators. WPTT scientists should work internally to encourage their organisations to provide these data. The Secretariat will process these data as soon as possible and provide complete catch datasets including separate catches for purse seiner on free schools and logs.
- Purse seine data to be identified by set type, i.e. free school or FAD
- Longline data to be identifiable by fleet i.e. Japanese and Taiwanese
- Available 2007 data to be considered in the context of the assessment results.

[National scientists / Secretariat]

Indices of abundance – using the above most up-to-date data

- A new standardized CPUE index for the Japanese LL fleet is to be produced for an area combining, area 3 north of 30°S, area 2 and area 5 (see Figure 13). [T. Nishida]
- Further exploration of the influence of the variables included in the standardization procedures that produce the final indices of abundance will be undertaken. Scientists should use information criteria approaches to compare the various model options and identify the most significant factors of influence. [T. Nishida]
- A rerun of the standardised CPUE analysis for the Taiwanese fleet should be undertaken, outputting both quarterly and annual indices for use in the stock assessments [E. Chang]

Growth and Catch-at-age

- A new growth curve using all available tagging data should be derived, or an alternative length/age transition table to be generated. [Secretariat]
- Update, if necessary, the catch-at-age matrix for yellowfin based on revised growth curve or transition table. [Secretariat]

Stock assessment

- Estimate exploitation rate using tuna tagging data for input into integrated assessment models. [Secretariat]
- Run of CASAL with revised CAA matrix, estimates of harvest rate and other parameters from tagging data

and the revised CPUE indices for the Japanese and Taiwanese fleets. [R. Hillary]

- Run of SS2 using both indices of abundance, Taiwanese and Japanese LL, and on both yearly and quarterly time steps. [H. Shono].
- Run of ASPM using new CAA, revise CPUE indices and selectivity curves [T. Nishida]

Advice

- Management advice will be developed by email and provided to the Scientific Committee no later than 2 weeks prior to the SC meeting in November 2007.

4.4 TECHNICAL ADVICE ON YELLOWFIN TUNA

84. Given the difficulties encountered in the stock assessment of the yellowfin tuna stock, and the possibility of providing substantially improved scientific advice once the intersessional work is carried out, the WPTT decided to defer its advice on yellowfin tuna until October when the results of the assessments in the above work plan become available.

85. In the mean time the WPTT considers that the current management advice is not inappropriate.

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.

5. MANDATORY FISHERIES STATISTICS

86. At its 11th Session, the Commission requested that the Scientific Committee examine the recent proposal on mandatory statistical requirements for IOTC Members (IOTC-2007-S11-PropE-rev1) and provide advice on which data are required for scientific purposes. In support of this, the WPTT examined the document and made the following technical-based recommendations for the Scientific Committees deliberations:

Paragraph 3 (a)

Surface fisheries should be identified with high seas areas. Thus, the first sentence should read:
For surface fisheries on the high seas.

Paragraph 3 (b)

The WPTT agreed that the provision of catch data according to numbers and weight is desirable; however either numbers or weight was acceptable. The provision of more precise information on fishing locations is required to understand the dynamics and status of highly migratory species. Thus, the longline data should be provided by 1° grid area and month strata, rather than 5° grid area. This change would also bring the data resolution in line with that submitted by the Purse seine fleets. The WPTT acknowledged that for non-technical reasons some members may have reservations about the proposed level of spatial precision. Thus, paragraph 3b should read:

Longline fisheries: catch by species, in numbers or weight, and effort as the number of hooks deployed shall be provided by 1° grid area and month strata. Documents describing the extrapolation procedures (including raising factors corresponding to the logbook coverage) shall also be submitted routinely.

Paragraph 3 (c)

The reference to artisanal, small scale and sport fisheries can be better described as 'coastal fisheries'. Thus the first sentence should read:
For coastal fisheries.

Paragraph 5. Opening sentence.

Improve the clarity of the opening sentence

Existing text

Data from fishing for tunas in association with floating objects including Fish Aggregating Devices (FADs):

Suggested revision [using a paragraph from the preamble...]

Given that the activities of supply vessels and the use of Fish Aggregating Devices (FAD) are an integral part of the fishing effort exerted by the purse seine fleet, the following data shall be provided:

Paragraph 5 (a)

Existing text

The number and characteristics of supply vessels: (i) operating under their flag, (ii) assisting purse seine vessels operating under their flag, or (iii) licensed to operate in their exclusive economic zones, and that have been present in the IOTC Area.

The WPTT agreed that given the complexities of the operations of the current fleets, more time was needed for consideration of the technical issues associated with this paragraph. To this end, the WPTT requested the Scientific Committee to examine this matter at its next meeting.

Paragraph 5 (b)

The current text does not specify precisely what information is required.

Existing text

Levels of activity of supply vessels: including number of days at sea by 1° grid area and month.

Suggested revision

Number of days at sea by supply vessels by 1° grid area and month.

Paragraph 5 (c)

Aggregation of the data by quarter is considered to be adequate

Existing text

The total number and type of FADs set by the fleet per month.

Suggested revision

The total number and type of FADs set by the fleet per quarter.

6. MINIMUM DATA REQUIREMENTS FOR THE LONGLINE FLEET

Background: In 2006 the Scientific Committee 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. In 2007, the Commission agreed that with the proposal and adopted Resolution 07/03 Concerning the recording of catch by fishing vessels in the IOTC Area. In the same vein, the Commission requested the Scientific Committee to provide a minimum data requirements for the longline fleet.

87. The WPTT briefly discussed several matters relating to this item then agreed that this matter should be deferred for further consideration by the Scientific Committee.

7. MINIMUM INFORMATION REQUIREMENTS FOR IOTC STOCK ASSESSMENTS

Background: At its 11th Session the IOTC agreed to a set of performance criteria and a process for review. Under the area of conservation and management, there is a desire to review the quality and provision of scientific advice to the extent to which the Commission receives and/or produces the best scientific advice relevant to the fish stocks and other living marine resources under its purview, as well as to the effects of fishing on the marine environment.

88. The WPTT briefly discussed several matters relating to this item before the Chair agreed to work interessionally with the WPTT to develop a set of guidelines (e.g. *to identify what type and detail of stock assessment information should be provided to working parties in order for them to be able to provide defensible and robust technical advice to the Scientific Committee*) for submission to the Scientific Committee. The WPPT was made aware of relevant ICCAT documents that might assist in this matter.

8. RESEARCH RECOMMENDATIONS AND PRIORITIES

1. Further collaboration with Yemen (such as that proposed by the IOTC-OFCF project) to improve the quality of fisheries information.
2. Regular analysis and reporting of the results of biological sampling programmes undertaken at tuna canneries.
3. The differences between the current longline indices of abundance, and the relative effects of the various factors introduced in the standardization procedures should be further explored. The dependency of all the assessment methods on these indices makes this work of critical importance.
4. Given the availability new data from the Maldives fisheries and tagging data from the RTTP-IO scientists are encouraged to carry out research on the dynamics and biology of skipjack tuna with a view to providing advice on the current status of this resource during the 2008 meeting of WPTT.
5. Tagging programmes have shown their usefulness in the assessment of tuna resources in the Indian Ocean. The Working Party recommended that the possibility of a continuing tagging programme, including both small and medium scale activities, be further explored. The networks associated with the tag recovery phase developed by the RTTP-IO should be further utilized. Furthermore, the possible use of localised tagging platforms, such as the Maldives, should be considered. The use of alternative tagging techniques, such as RFID or PIT tags, should be considered for future programmes.
6. Scientists are encouraged to continue their work on the use of integrated statistical assessment models. Such models make use of a wide range of information, such as that obtained from tagging, and proficiency with such models will be required to make the best use of this valuable information.
7. Noting the newly available ocean circulation and biogeochemical models, further exploration of the ecosystem and environmental factors influencing Indian Ocean fisheries is encouraged.
8. Exploration of the possible impacts of extraordinary events such as the recent high 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 are invited to report on their developments.
9. Recognising that the best opportunities for obtaining accurate fisheries data are likely to come from observer programmes, the WPTT strongly encourages the expansion and implementation of new observer programmes in the Indian Ocean. Furthermore, like the WPEB, the WPTT strongly recommended that a high level of regional coordination be provided by the Commission covering data collection, data exchange, training and the development of guidelines for the operational aspects of such programmes.

9. ITEMS PUT FORWARD BY THE WPTT FOR CONSIDERATION BY THE SCIENTIFIC COMMITTEE IN 2007

1. Guidelines on the information requirements for science being presented to IOTC technical fora for endorsement (to be developed intersessionally).
2. Technical recommendations on Mandatory Statistics for endorsement.
3. Research recommendations and priorities for endorsement.

10. OTHER BUSINESS

10.1 UPDATE ON TUNA TAGGING ACTIVITIES IN THE INDIAN OCEAN

89. Document IOTC-2007-WPTT-24 provided an update in the Regional Tuna Tagging project in the Indian Ocean. The RTTP-IO started its tagging operation in May 2005 and will finish them in September 2007. After more than two years, 135,108 tuna have been tagged and released in the Western Indian Ocean (Seychelles, Mozambique Channel, Tanzania & Kenya and Northern Arabian sea, Oman) including 47,129 yellowfin (35%), 24,718 bigeye (18%) and 62,706 skipjack (46%). Importantly, a good sample of yellowfin and bigeye have been tagged. A publicity and tag recovery scheme is in place to manage the return of the tagged tuna caught by the fisheries in most of the Indian Ocean countries and most of the Distant Water Fishing Nations. 13,576 tagged tuna have been recovered and reported to the project headquarters to date, mostly by the purse-seine fishery (98%). Recoveries have been reported from more than 15 countries. The average time-at-liberty for the recovered fish is around 6 months and scientists are optimistic that this should enable a good level of mixing between the tagged tuna and the wider population.

90. Preliminary results of an analysis using the tagging data to estimate the growth of yellowfin were presented (IOTC-2007-WPTT-INF10) and consequently the WPTT requested that a new growth curve using all available tagging data be derived as part of the planned intersessional work (above).

91. The WPTT congratulated the RTTP-IO on its work to-date; and encouraged all working party members to rally as much support for the project as possible among their national bodies. In particular, the WPTT requested national scientists whose countries have longline fleets to do what they can to improve the levels of tag recoveries from these vessels. To this end, scientists and technicians should visit vessels whenever possible and encourage skippers to assist in the recovery of tags.

10.2 TUNA ATLAS TO BE PRODUCED

92. The WPTT was informed that the French Government has agreed to support the publication of a tuna atlas covering both the Indian and Atlantic Oceans. IRD is to lead the project with cooperation from the respective Secretariats of IOTC and ICCAT.

10.3 REPORT ON THE FISHING CAPACITY WORKSHOP

93. The WPTT was given an overview of the outcomes from the *Workshop to Further Develop, Test and Apply a Method for the Estimation of Tuna Fishing Capacity from Stock Assessment-Related Information held in La Jolla, USA* in May, 2007. The report from this workshop is being edited and will be available on the FAO website soon.

11. ADOPTION OF THE REPORT

94. The Report of the Ninth Session of the Working Party on Tropical Tunas was adopted by correspondence.

APPENDIX I

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 Nishan Sugathadasa

APPENDIX II

AGENDA OF THE MEETING

1. REVIEW OF THE DATA

Review of the statistical data available for the tropical tuna species (Secretariat)

2. NEW INFORMATION ON BIOLOGY AND STOCK STRUCTURE OF TROPICAL TUNAS

Review new information on the biology, stock structure of tropical tunas, their fisheries and associated environmental data

- Papers as provided by Members

3. REVIEW OF NEW INFORMATION ON THE STATUS OF YELLOWFIN

Data for input into stock assessments:

- Catch and effort
 - LL and other gears
 - How to treat [lack of] artisanal and other data in Stock assessment
- Catch at size
- Growth curves and age-length key
- Catch at age
- CPUE
 - Raw CPUE indices / Standardised CPUE indices (LL and other major gears)
 - factors influencing CPUE — such as change of targeting practices, environment and technology

Stock assessments

Selection of Stock Status indicators

4. REVIEW OF STOCK STATUS INDICATORS FOR SKIPJACK

Review of data:

- Catch and effort
 - PS, gillnet and other gears
- Catch at size
- CPUE
 - Raw CPUE indices / Standardised CPUE indices
 - factors influencing CPUE — such as change of targeting practices, environment and technology

Selection of Stock Status indicators

5. REVIEW OF NEW INFORMATION ON THE STATUS OF BIGEYE

Update the stock status indicators for bigeye [Secretariat]

6. DEVELOP TECHNICAL ADVICE ON THE STATUS OF THE STOCKS

Yellowfin tuna

Skipjack tuna (*not achieved at this meeting*)

7. EXAMINATION OF THE MANDATORY STATISTICAL DATA REQUIREMENTS

8. MINIMUM DATA REQUIREMENTS FOR THE LONGLINE FLEET

9. MINIMUM INFORMATION REQUIREMENTS FOR IOTC STOCK ASSESSMENTS

10. RESEARCH RECOMMENDATIONS AND PRIORITIES

11. OTHER BUSINESS

- Update: Regional Tuna Tagging Programme – Indian Ocean

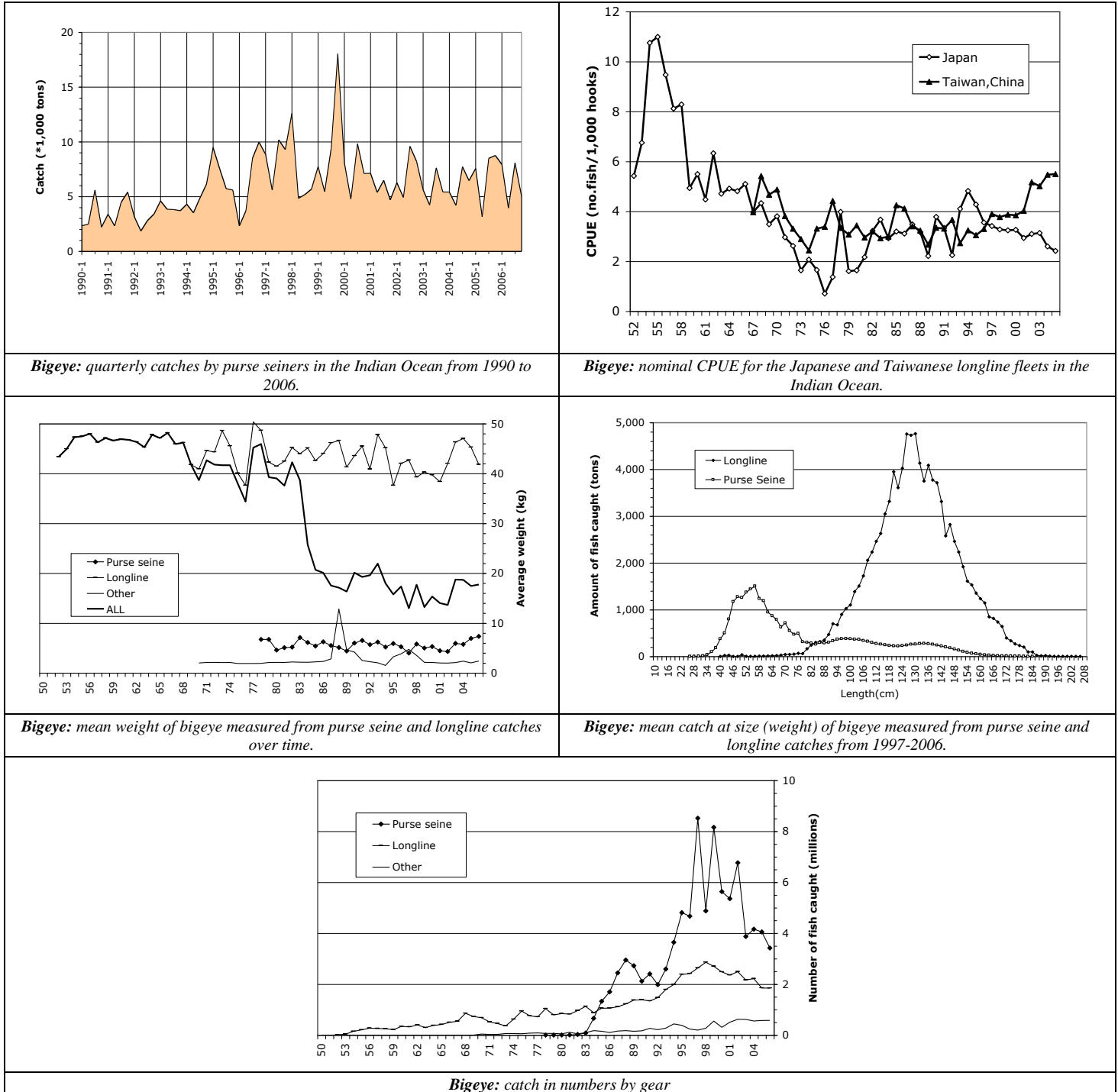
APPENDIX III

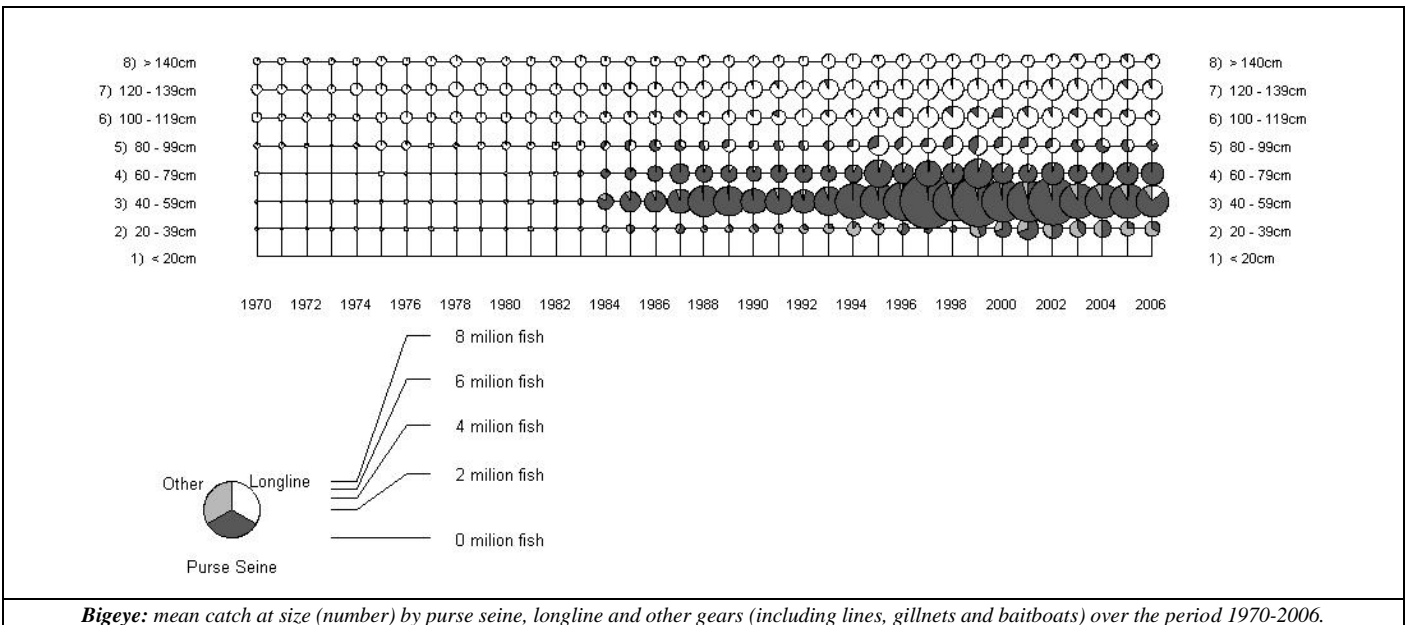
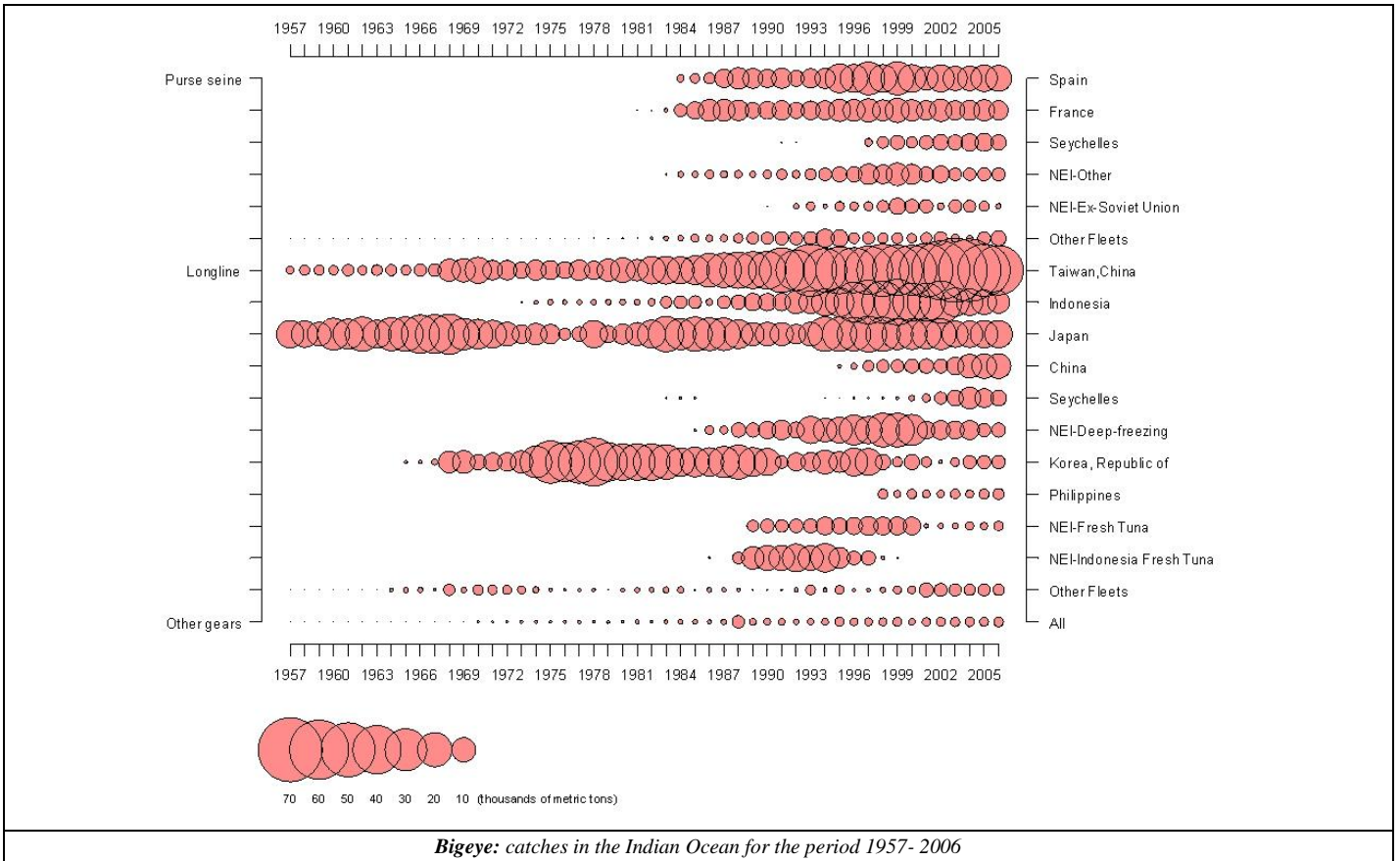
LIST OF DOCUMENTS PRESENTED TO THE MEETING

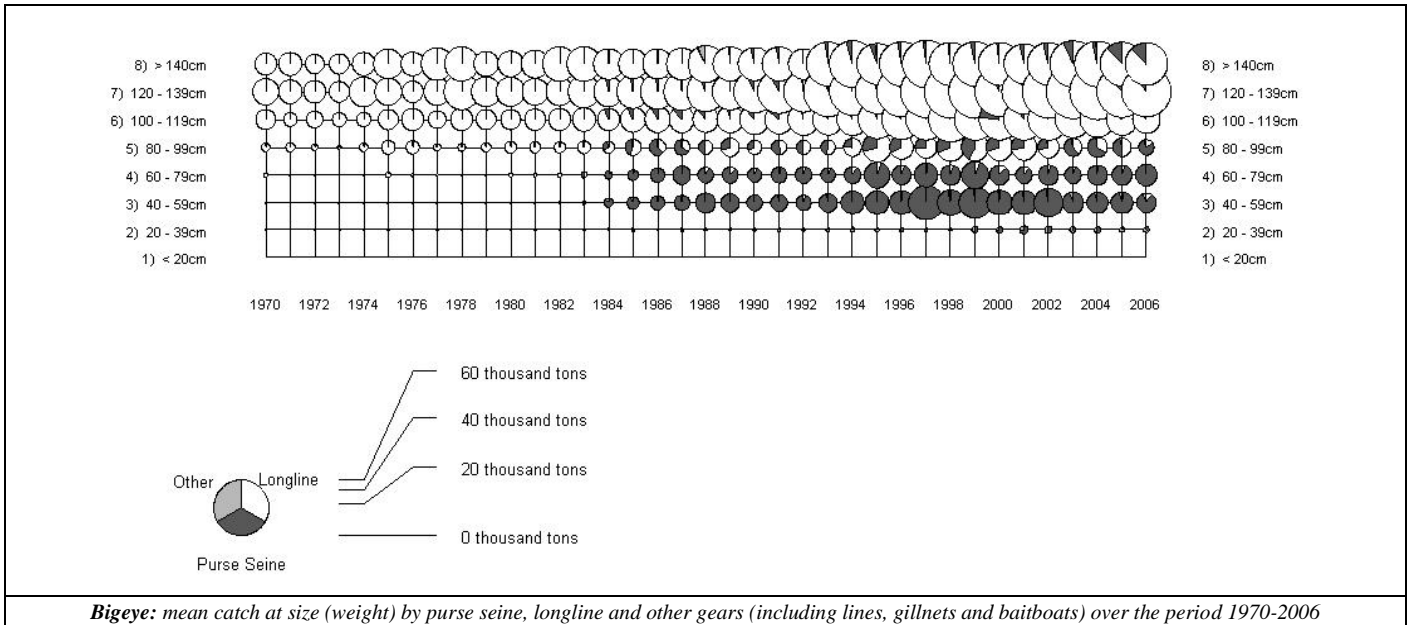
Document	Title
IOTC-2007-WPTT-01	Draft agenda of the Working on Tropical Tunas
IOTC-2007-WPTT-02	WPTT List of documents
IOTC-2007-WPTT-03	Status of the IOTC databases for tropical tunas – <i>IOTC Secretariat</i>
IOTC-2007-WPTT-04	Results obtained from the biological sampling of large bigeye tuna caught on free schools by purse seiners in the Indian Ocean. - <i>Michel Potier, Nanet Bristol and Alain Fonteneau</i>
IOTC-2007-WPTT-05	Species composition of FAD and free swimming schools fished by purse seiners in the Western Indian Ocean during the period 1991-2006. - <i>Alain Fonteneau, Javier Ariz, Alicia Delgado de Molina, Juliette Dorizo, Vincent Lucas and Renaud Planet</i>
IOTC-2007-WPTT-06	Time and space diagrams of the Indian Ocean purse seine fisheries during the period 1982-2006. - <i>Alain Fonteneau</i>
IOTC-2007-WPTT-07	Preliminary data obtained from Supply logbooks implemented by the Spanish fleet since 2004. - <i>Sarralde Roberto, Alicia Delgado de Molina, Javier Ariz and Jose Carlos Santana</i>
IOTC-2007-WPTT-08	Statistics of the purse seine Spanish fleet in the Indian ocean (1984-2006). - <i>Alicia Delgado de Molina, Juan José Areso and Javier Ariz</i>
IOTC-2007-WPTT-09	Estimation of catch at size, catch at age and total catch by area. - <i>IOTC Secretariat</i> .
IOTC-2007-WPTT-10	Japanese longline CPUE for yellowfin tuna in the Indian Ocean up to 2005 standardized by GLM. - <i>Hiroaki Okamoto, Hiroshi Shono and Tom Nishida</i>
IOTC-2007-WPTT-11	Preliminary Stock Assessment for Yellowfin Tuna in the Indian Ocean using Stock Synthesis II (SS2). - <i>Hiroshi Shono, Keisuke Satoh and Hiroaki Okamoto</i>
IOTC-2007-WPTT-11-add1	<i>Extra analyses</i>
IOTC-2007-WPTT-12	Stock assessment of yellowfin tuna (<i>Thunnus albacares</i>) in the Indian Ocean by the age structured production model (ASPM) analyses. - <i>Tom Nishida and Hiroshi Shono</i>
IOTC-2007-WPTT-13-rev1	Modelling the hook depth of tuna longline in the tropical areas of the Indian Ocean. - <i>Song Liming, Zhou Ji, Gao Panfeng, Xu Liuxiong.</i>
IOTC-2007-WPTT-14-rev1	The relationship between the thermocline and the catch rate of <i>Thunnus obesus</i> in the tropical areas of the Indian Ocean. - <i>Song Liming Zhang Yu Zhou Yingqi.</i>
IOTC-2007-WPTT-15	Highlights of climate trends and interannual variability in the Indian Ocean. - <i>F. Marsac. A Power Point summary mostly based on INF03 and INF04.</i>
IOTC-2007-WPTT-16	Physical and biological patterns in the Indian Ocean during the last decade, with emphasis on their consequences on tuna fisheries. - <i>Francis Marsac. A Power point presentation.</i>
IOTC-2007-WPTT-17	French purse-seine tuna fisheries statistics in the Indian Ocean, 1981-2006. - <i>Renaud Planet, P. Bretaudeau, Viveca Nordstrom and A. Hervé</i>
IOTC-2007-WPTT-18	Statistics of the main purse seine fleets fishing in the Indian Ocean (1981-2006). - <i>Renaud Planet, Alicia Delgado de Molina, Juliette Dorizo, Viveca Nordstrom, A. Hervé and Javier Ariz</i>
IOTC-2007-WPTT-19	Catch rate standardisation runs for yellowfin tuna caught by Taiwanese longline fishery in the Indian Ocean using generalized linear models and generalized linear mixed models. - <i>Hung Liu, Shu-Ting Chang and Shui-Kai Chang</i>
IOTC-2007-WPTT-20	Preliminary analysis of tuna catches by Purse Seiners fishing in the Western Indian Ocean over the period January to April 2007. - <i>Juliette Dorizo, Vincent Lucas and Alain Fonteneau</i>
IOTC-2007-WPTT-21	Tuna longline landings in Phuket, Thailand, from 1994 to 2006. - <i>Praulai Nootmorn, Supachi Roopradit and Kannokwan Kawises</i>
IOTC-2007-WPTT-22	Some Scientific Information of Tunas Harvested by Thai Purse Seiners. - <i>Reangchai Sujittosakul</i>
IOTC-2007-WPTT-23	The Maldivian Tuna Fishery – An Update. - <i>M. Shiham Adam</i>
IOTC-2007-WPTT-24	Summary Of The Data Already Collected By The Regional Tuna Tagging Project In The Indian Ocean. - <i>Jean-Pierre Hallier</i>
IOTC-2007-WPTT-25	Tuna Purse Seine Landings in Phuket, Thailand, from 1993 to 2006. - <i>Praulai Nootmorn, Sampan Panjarat, Sichon Hoimuk, Thumawadee Jaiyen and Wanlee Singlongyam</i>
IOTC-2007-WPTT-26	Optimum sample number for estimating shark by-catch in the Spanish Purse Seiners in the Western Indian Ocean. - <i>S. Sánchez, H. Murua, I. González & J. Ruiz</i>
IOTC-2007-WPTT-27	Exploratory assessment models for Indian Ocean Yellowfin tuna using a Bayesian Pella-Tomlinson framework. - <i>R.M. Hillary and I Mosqueira</i>
IOTC-2007-WPTT-28	Capture depths of longline targeted species (yellowfin, bigeye, swordfish): preliminary results obtained from experimental longline fishing carried out in Seychelles' oceanic waters. - <i>Caroline Gambin, Pascal Bach and Vincent Lucas</i>
IOTC-2007-WPTT-29	Thai tuna longline in Indian Ocean from 2000 to 2006. - <i>Praulai Nootmorn and Sampan Panjarat</i>
IOTC-2007-WPTT-30	Indices of yellowfin and skipjack tunas caught by long lining in north-eastern Arabian Sea and Andaman & Nicobar waters. - <i>V.S. Somvanshi and S. Varghese.</i>
IOTC-2007-WPTT-31	AZTI Discard Sampling Programme in the Spanish Purse-Seine fleet in the Western Indian Ocean (2003-2006). - <i>I. González, J. Ruiz, G. Moreno, H. Murua & I. Artetxe</i>
IOTC-2007-WPTT-32	Exploratory assessment models for Indian Ocean Yellowfin Tuna using a Bayesian two-age delay-difference model. - <i>R. M. Hillary and Mosqueira</i>
IOTC-2007-WPTT-INF01	Compendium of fisheries catch data and indicators. - <i>IOTC Secretariat</i>
IOTC-2007-WPTT-INF02	Report on Yemen. Power point presentation (electronic copy only). - <i>IOTC Secretariat</i>
IOTC-2007-WPTT-INF03	The Years of El Niño, La Niña, and Interactions with the Tropical Indian Ocean. Abstract only. - <i>Gary Meyers, Peter McIntosh, Lidia Pigot and Mike Pook</i>
IOTC-2007-WPTT-INF04	Observed temperature trends in the Indian Ocean over 1960–1999 and associated mechanisms. Abstract only. - <i>Gaël Alory, Susan Wijffels and Gary Meyers</i>
IOTC-2007-WPTT-INF05	Plan of the Research Cruise of R/V. Shoyo-Maru. - <i>Fisheries Agency of Japan</i>
IOTC-2007-WPTT-INF06	FLR: an open-source framework for the evaluation and development of management strategies. - <i>L. T. Kell, I. Mosqueira, P. Grosjean, J-M. Fromentin, D. Garcia, R. Hillary, E. Jardim, S. Mardle, M. A. Pastoors, J. J. Poos, F. Scott, and R. D. Scott</i>
IOTC-2007-WPTT-INF07 Withdrawn	Implications of the Japanese Overcatch of Southern Bluefin Tuna for Data Collection and Assessments of Tropical Tuna. - <i>Tom Polacheck and Campbell Davies</i>
IOTC-2007-WPTT-INF08	Fuzzy logic analyses for the spawner-recruitment relationship of bigeye tuna (<i>Thunnus obesus</i>) in the Indian Ocean incorporating the environmental regime shift. - <i>Tom Nishida, Ding-Geng Chen and Masahiko Mohric</i>
IOTC-2007-WPTT-INF09	Tuna longline catch rates in the Indian Ocean: Did industrial fishing result in a 90% rapid decline in the abundance of large predatory species? - <i>Tom Polacheck</i>
IOTC-2007-WPTT-INF10	Growth on tropical tunas – on the otolith, tagging and other data. <i>A. Anganuzzi</i>
IOTC-2007-WPEB-12	Japanese longline observer activity in the Indian Ocean in 2006. - <i>Okamoto, Semba, Matsunaga and Tanabe</i>
IOTC-2006-SC-R	Executive Summaries for tropical tunas
IOTC-2007-S11-PropE-rev1 [E]	Proposed amendments to Mandatory statistical requirements for IOTC

APPENDIX IV ADDITIONAL INFORMATION ON THE FISHERIES, BIOLOGY, ECOLOGY AND OCEANOLOGY RELATING TO TROPICAL TUNAS (FROM IOTC-2007-WPTT-INF01)

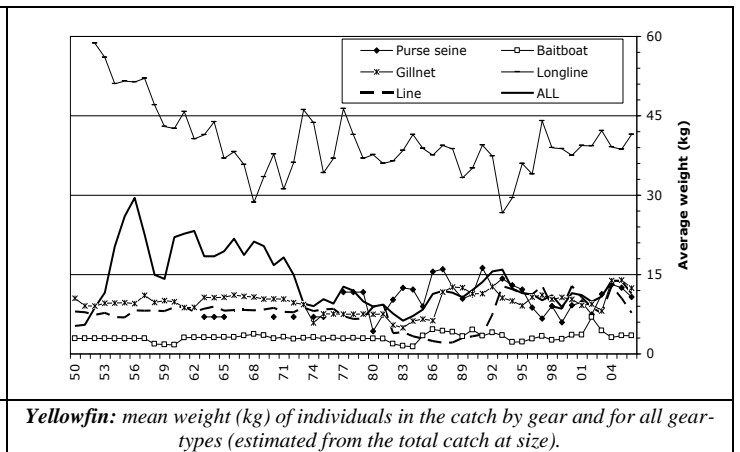
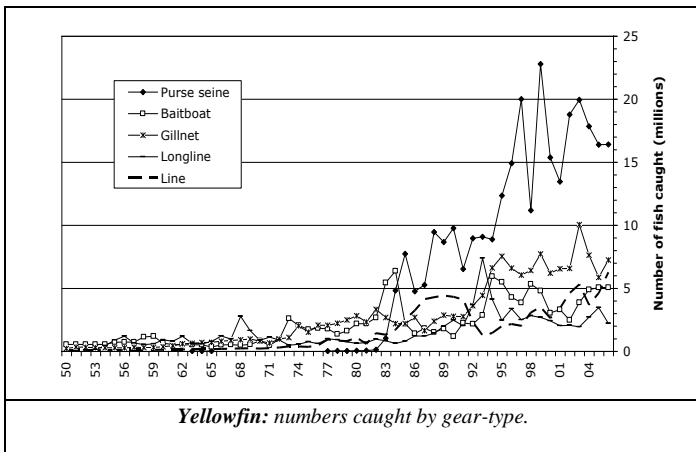
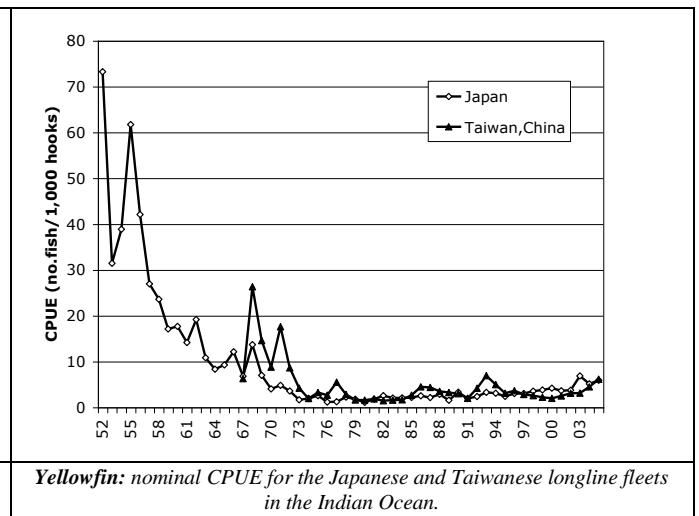
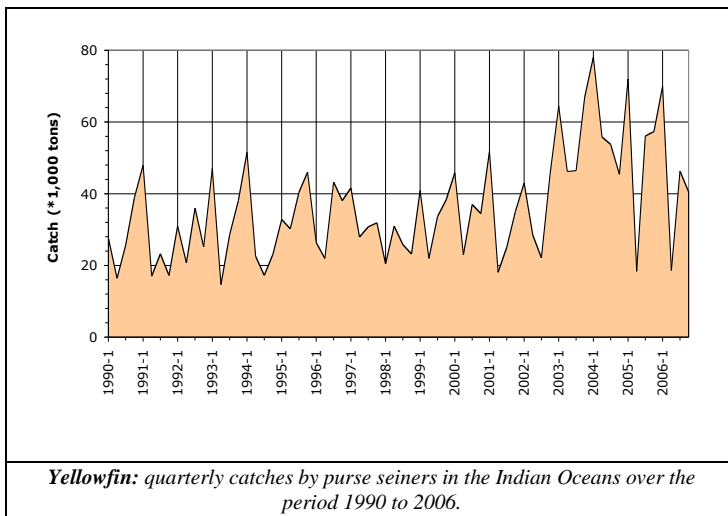
1 THE FISHERIES FOR BIGEYE TUNA

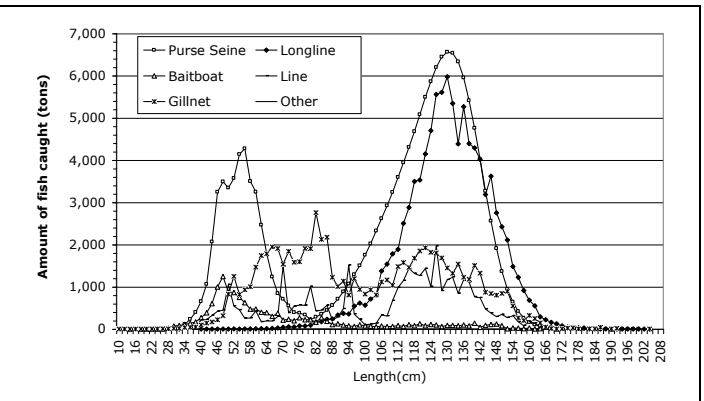
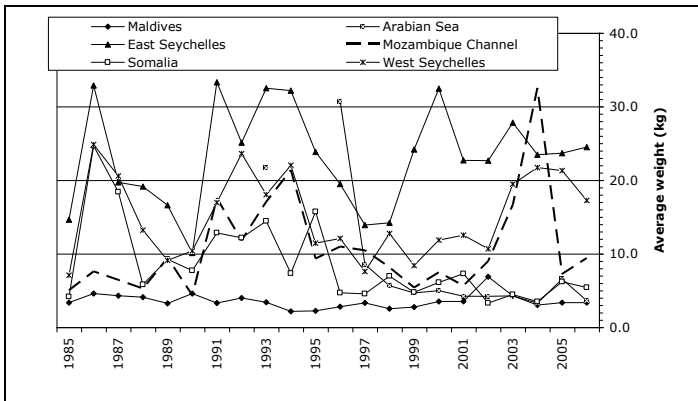
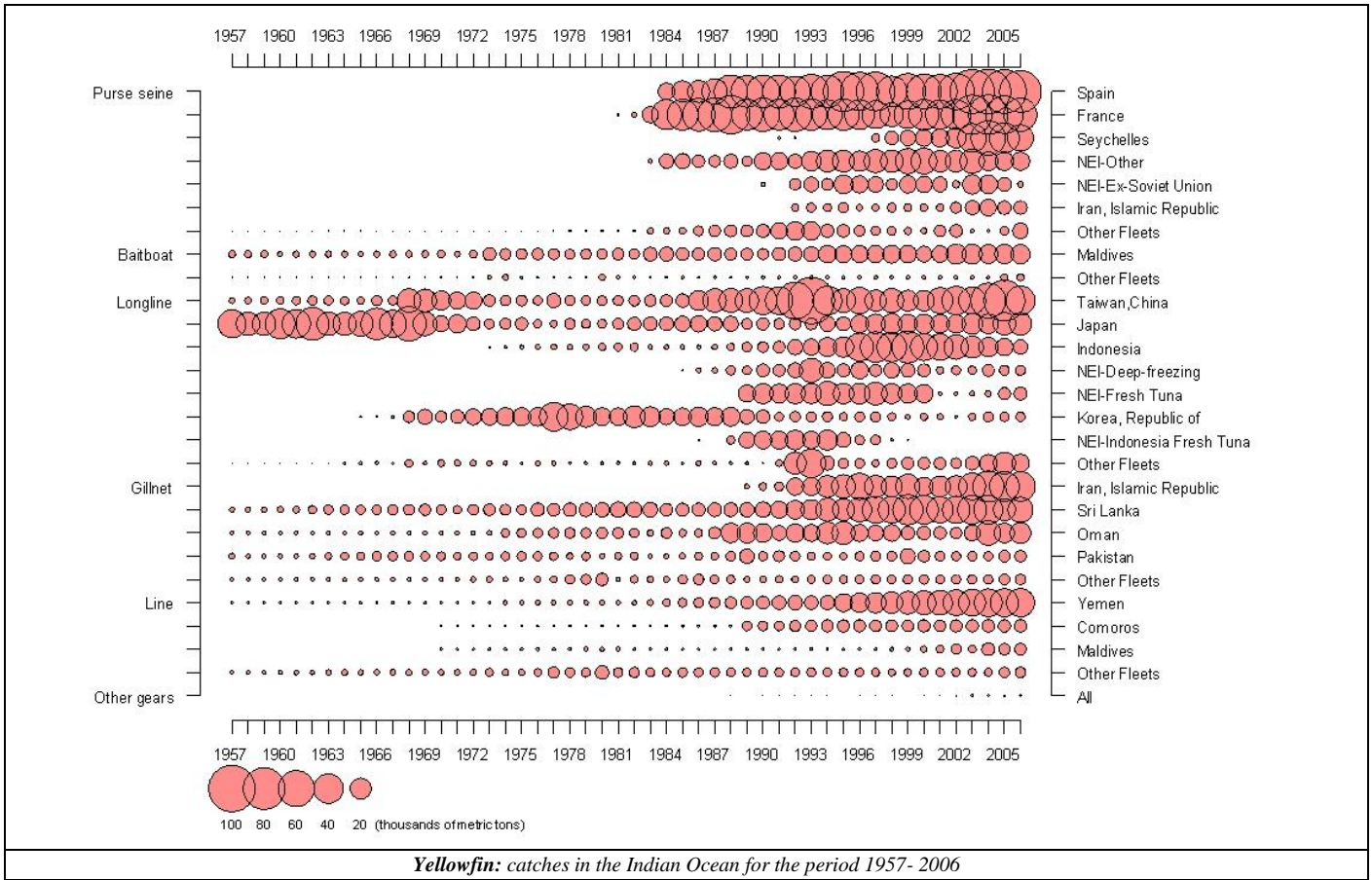






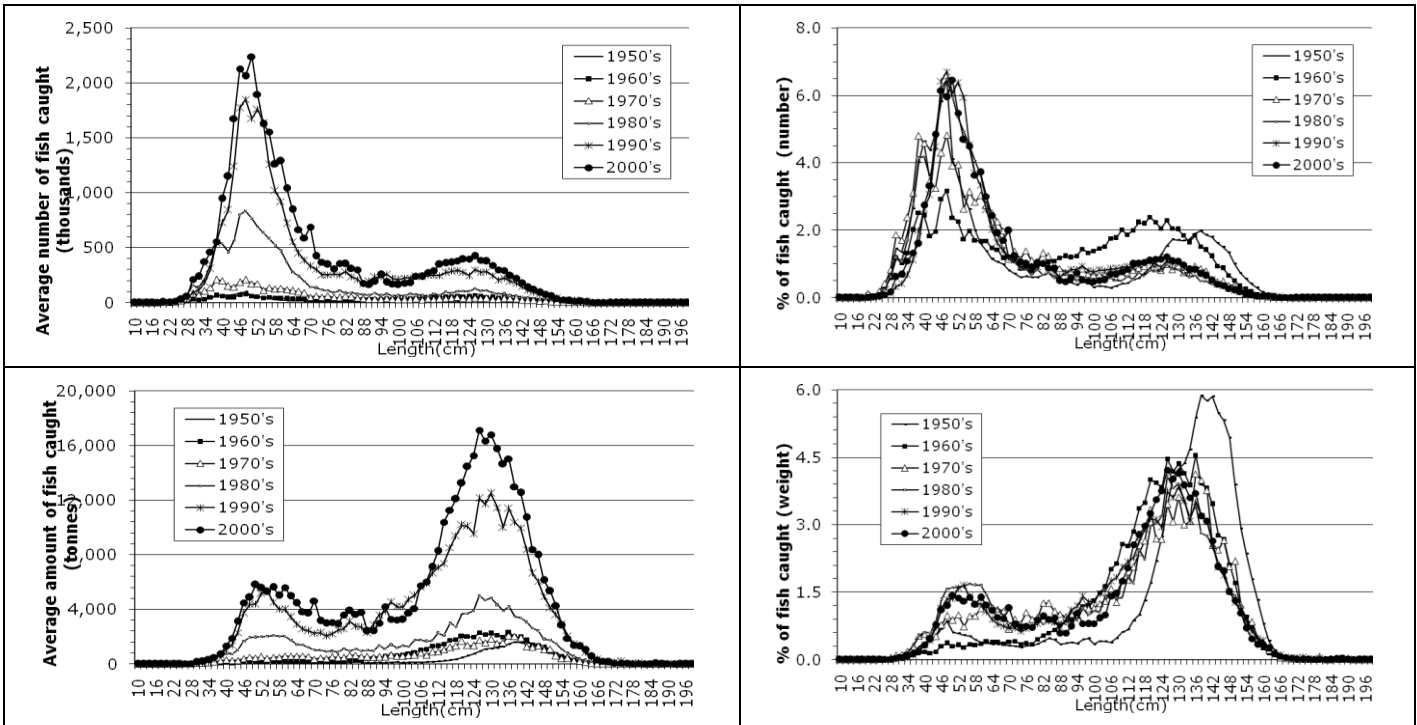
2 THE FISHERIES FOR YELLOWFIN TUNA



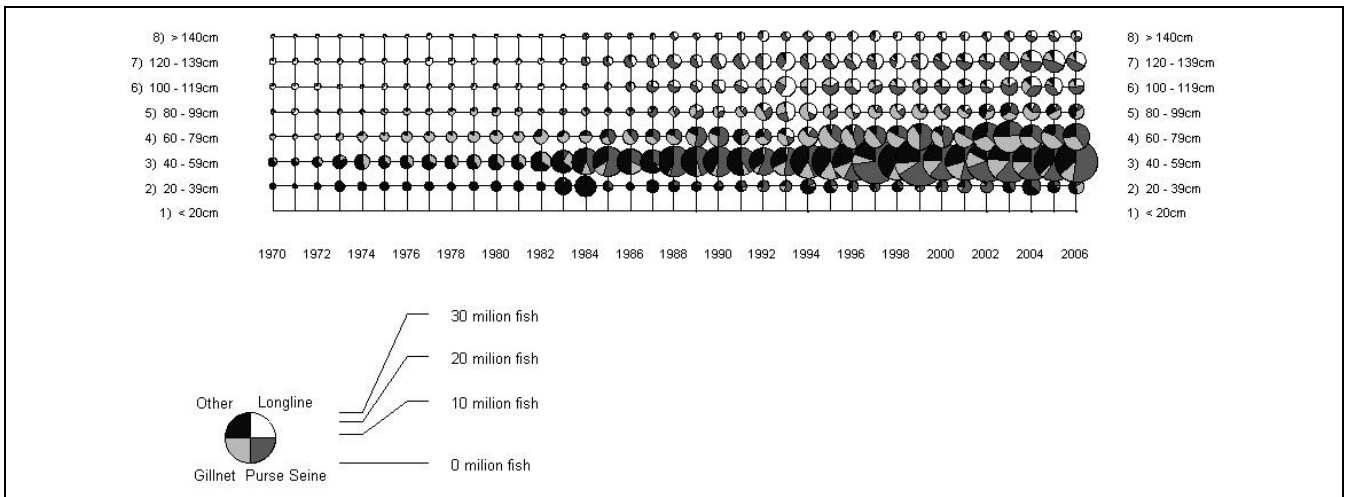


Yellowfin: average weight of yellowfin tuna caught by the purse seine and baitboat fisheries by major areas. (1985-2006).

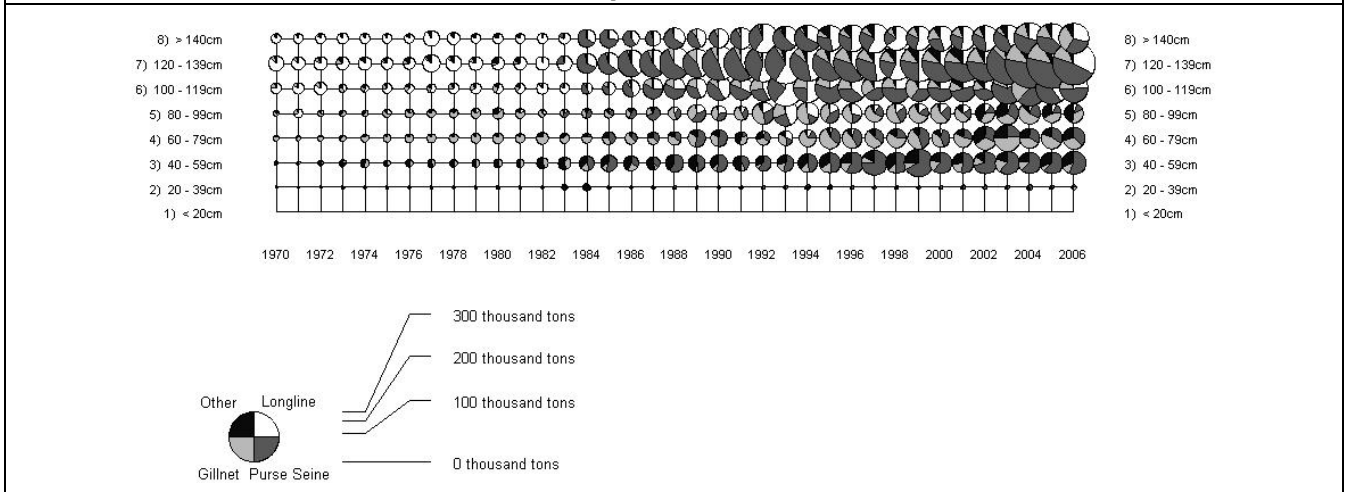
Yellowfin: mean catch at size (weight) of yellowfin tuna measured from purse seine, longline, baitboat, line (hand line and troll line), gillnet and other gears catches from 1997-2006.



Yellowfin: 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 2000-2006. Left panels are actual numbers and right panels are in proportions.

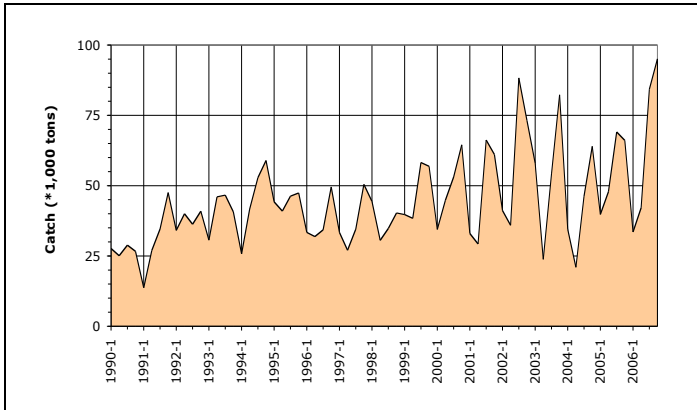


Yellowfin: mean catch at size (number) of yellowfin tuna in purse seine, longline, gillnet and other gears (including baitboats and lines) catches over the period 1970-2006

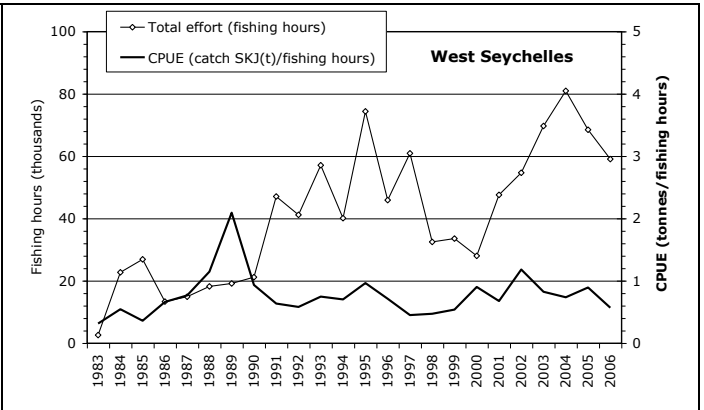


Yellowfin: mean catch at size (weight) of yellowfin tuna in purse seine, longline, gillnet and other gears (including baitboats and lines) catches over the period 1970-2006

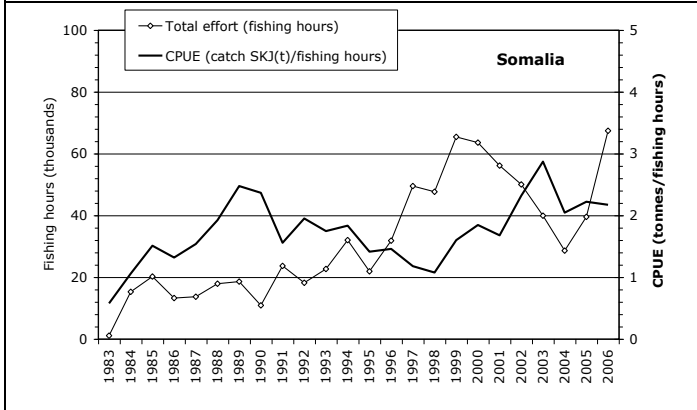
3 THE FISHERIES FOR SKIPJACK TUNA



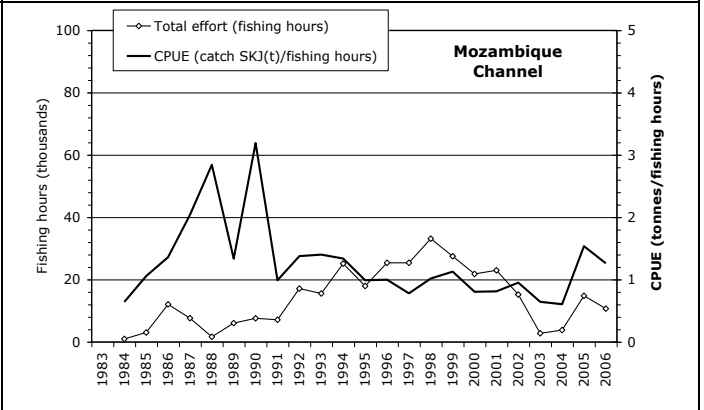
Skipjack: quarterly catches by purse seiners in the Indian Oceans over the period 1990-2006.



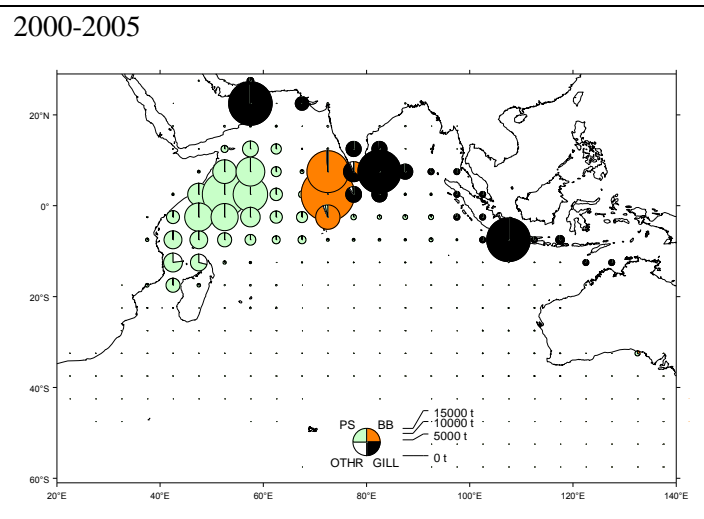
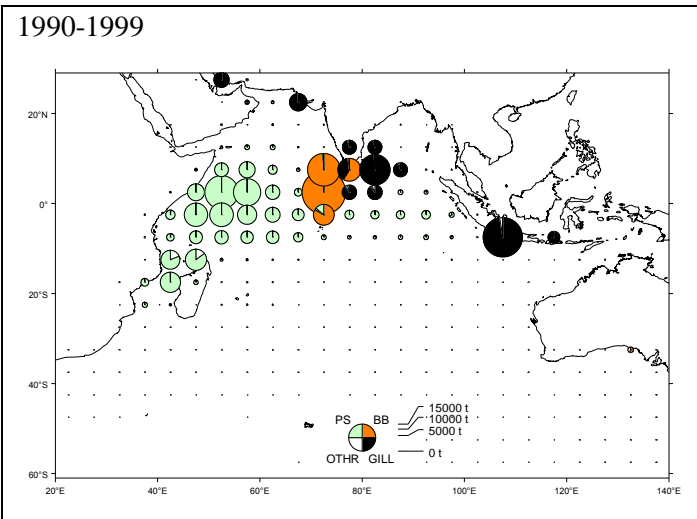
Skipjack: nominal CPUEs for three important purse seine fishing ground areas: Mozambique Channel



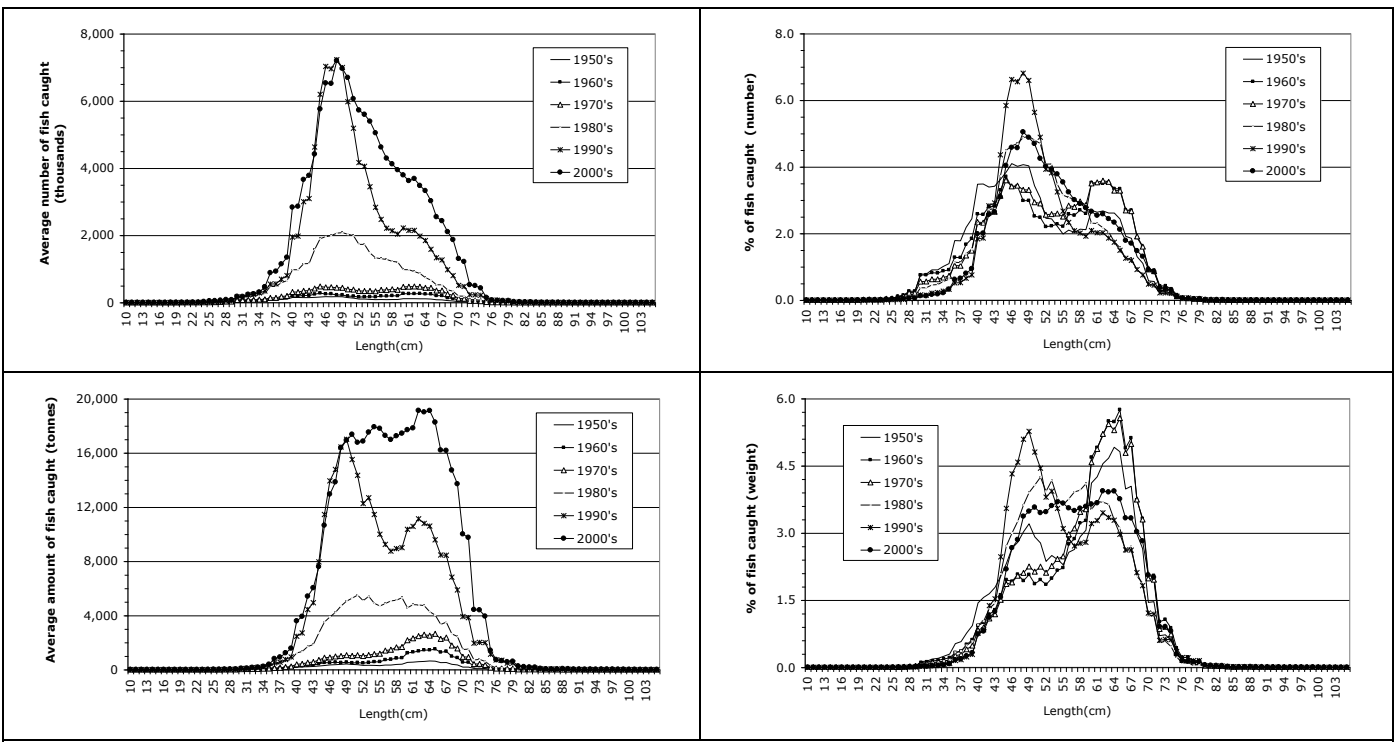
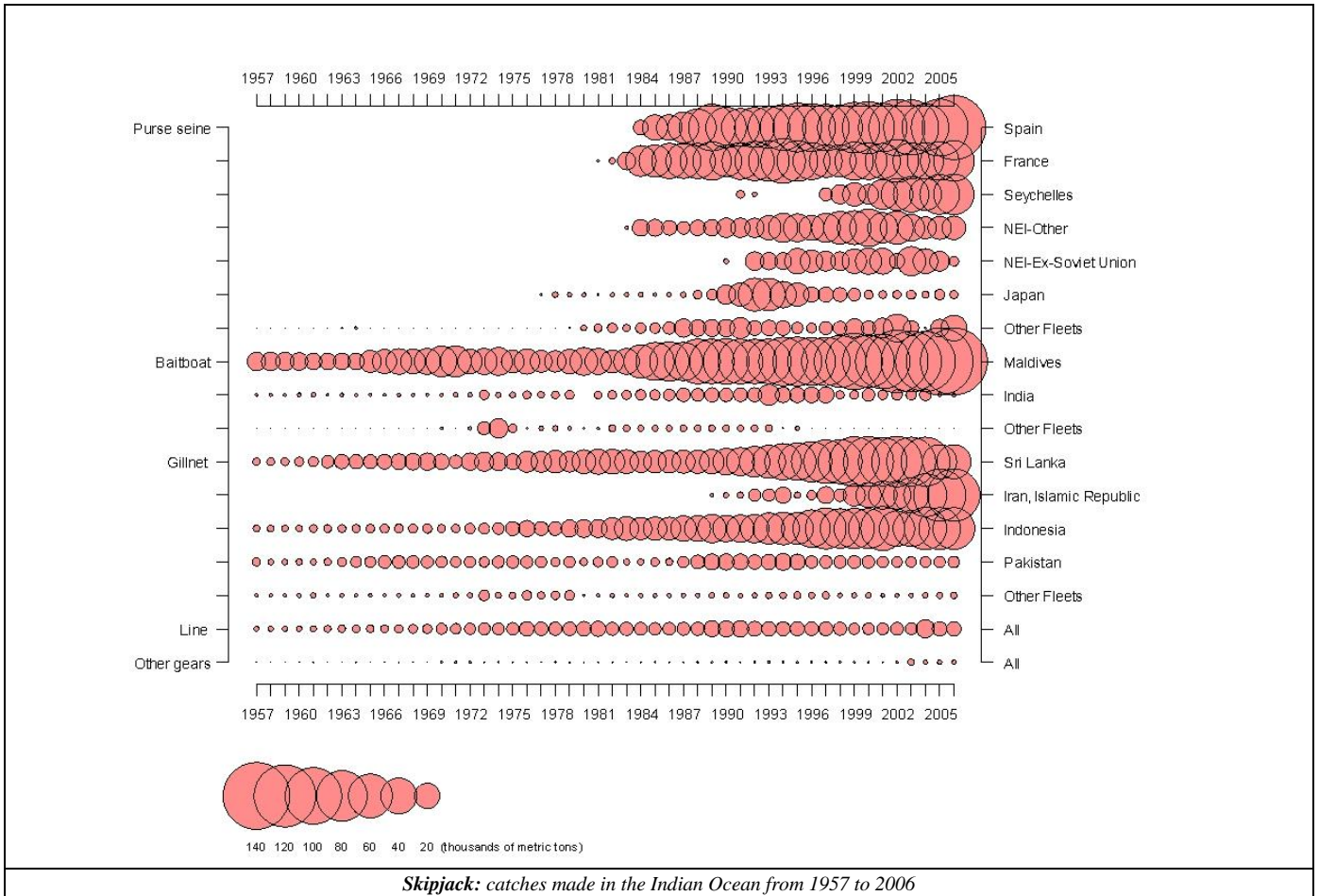
Skipjack: nominal CPUEs for three important purse seine fishing ground areas: Somalia



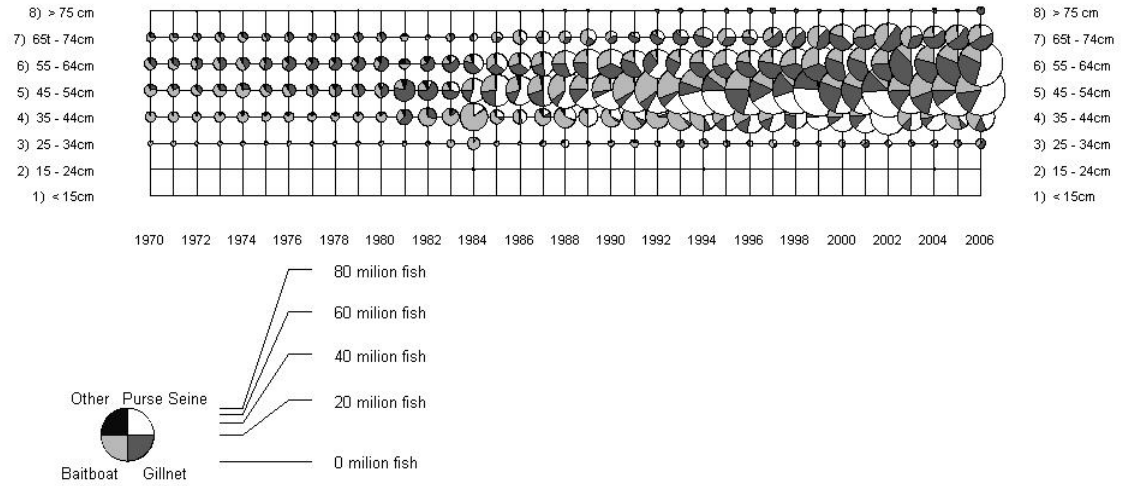
Skipjack: nominal CPUEs for three important purse seine fishing ground areas: Seychelles



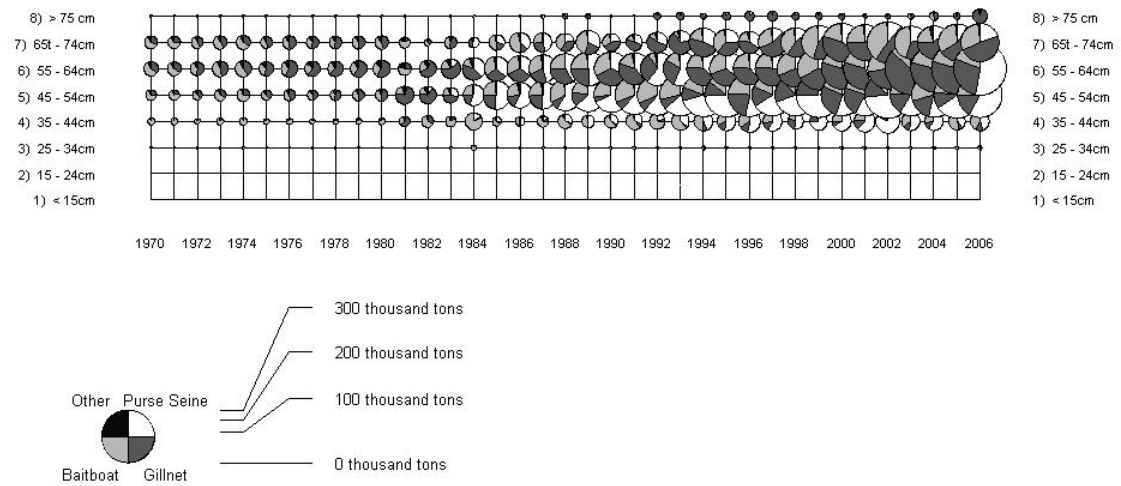
Skipjack: mean spatial distribution of catches in the Indian Ocean by gear type, 1990-1999 (left) and 2000-2006 (right). BB = bait boat (pole and line); GILL = gillnet; LL = longline; PS = purse seine.



Skipjack: 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 2000-2006. 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.



Skipjack: mean catch at size (number) from purse seine, baitboat, gillnet and other gears (including lines and longlines) over the period 1970-2006



Skipjack: mean catch at size (weight) from purse seine, baitboat, gillnet and other gears (including lines and longlines) over the period 1970-2006