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

Report of the Twelfth Session of the Scientific Committee

Victoria, Seychelles, 30 November-4 December 2009

DISTRIBUTION:

Participants in the Session,
Members of the Commission
Other interested Nations and International Organizations
FAO Fisheries Department
FAO Regional Fishery Officers

BIBLIOGRAPHIC ENTRY

IOTC. Report of the Twelfth Session of the Scientific Committee. Victoria, Seychelles, 30 November-4 December, 2009. *IOTC-2009-SC-R[E]. 190 pp.*

EXECUTIVE SUMMARY

The Twelfth Meeting of the Scientific Committee (SC) was opened on 30 November 2009 Victoria, Seychelles, by the Chairperson Dr. Francis Marsac (EU). Representatives from 11 members of the Commission, one Cooperating Non-contracting Party, FAO and six observers attended the meeting.

The SC noted that 14 of the 31 IOTC CPC's were represented at the meeting, and 15 national reports were presented, an improvement relative to previous years, although still far from ideal.

The SC expressed its satisfaction to the Secretariat for the amount and quality of the work undertaken during the year, in particular the work of the Data Section and the contributions of experts to the assessment work. However, it considers that the staffing level is insufficient and reiterated its past recommendations to provide additional resources to the Secretariat

Five working party meetings were held in 2009 (Billfish, Ecosystems and Bycatch, Tropical Tunas, Fishing Capacity and Data Collection and Statistics). Complete stock status and technical advice for all IOTC species is provided in the main body of the report, and a summarised version is provided in a table on the following page. The SC adopted in 2009 for the first time an executive summary report on seabirds.

Revised stock assessments for yellowfin tuna, bigeye tuna and swordfish were received and the following advice is provided:

> For bigeye tuna: The results of the stock assessments conducted in 2009 were broadly similar to previous work. The preliminary estimate of catches in 2008 (107,000 t) is below the current estimate of MSY (110,000 t), catches in the past (1997-1999) have significantly exceeded MSY. The SC recommended that catches of bigeye tuna should not exceed the estimated MSY of 110,000t
>
> For yellowfin tuna: The SC considers that the stock of yellowfin has recently been overexploited and is probably still being overfished. Management measures should be considered that allow an appropriate control of fishing pressure to be implemented. The current estimate of MSY is 300,000 t, lower than the average catches sustained over the 1992-2002 period of around 343,000 t. The high catches of the 2003-2006 period appear to have accelerated the decline of biomass in the stock, which might be currently unable to sustain the 1992-2002 level of catches. The SC recommended that catches of yellowfin tuna should not exceed the estimated MSY of 300,000 t.
>
> For swordfish: Given the general recent declining trend in all the CPUE series, and the fully exploited status of the stock, the WPB expects that abundance will likely decline further at current effort levels, especially considering that the issue of increases in efficiency has not been fully addressed in the current standardization. When combined with the uncertainty in the assessment, the WPB considers that there is a reasonably high probability that common target and limit reference points (*e.g.* B_{MSY}, $0.4B_0$) may be marginally exceeded, and this probability will increase over time if effort remains at current levels or increases further. Precautionary measures such as capacity control or catch limits will reduce the risk of creating an overcapacity problem or increasing the risk of exceeding common biomass limit reference points. The SC recommended that catches of swordfish should not exceed the estimated MSY of 33,000t.

The SC recommended modifications to three Resolutions: 09/04 "On observer regional scheme"; 08/01"Mandatory statistical requirements for IOTC CPCs" and 07/03 "On the recording of catch by fishing vessels" in order to clarify technical points concerning the collection of data.

The SC recommended also a schedule of Working Party meetings for 2010 and 2011.

STOCK STATUS SUMMARY FOR THE IOTC SPECIES

Stock	Average annual catches / Status ratios		Year[1]	Stock status	Scientific Committee advice to the Commission in 2009
Albacore	Average catch 2004-2008: Catch 2008: MSY: $F_{2007}F_{MSY}$: $B_{2007}B_0$:	27,900 t 32,900 t 28,300 t - 34,400 t 0.48-0.91 > 1	2006	Stock size and fishing pressure are considered to be within acceptable limits. Catches, mean weight and catch rates of albacore have been stable for over 20 years.	The status of the stock is not likely to change markedly over the next 1-2 years and if the price of albacore remains low compared to other tuna species, no immediate action should be required.
Bigeye	Average catch 2004-2008: Catch 2008: MSY: $F_{2008}F_{MSY}$: SB_{2008}/SB_{MSY}	121,700 t 107,000 t 110,000 t (100-115,00) 0.90 1.17	2008	Stock size and fishing pressure are close to the optimal indicating that the stock is fully utilized. Stock size indicators have gradually declined since 1970s.	Catches should not exceed the MSY level (110,000 t).
Skipjack	Average catch 2004-2008: Catch 2008: MSY: $F_{2008}F_{MSY}$: SB_{2008}/SB_{MSY}	499,900t 447,100 t - - -		Skipjack is a highly productive species and robust to overfishing. Catches have increased with increasing fishing pressure, but the trend of some indicators suggests that the stock status should be closely monitored. Stock size and fishing pressure are considered to be within acceptable limits.	There is no need for immediate concern, but the situation of the stock should be closely monitored
Yellowfin	Average catch 2004-2008: Catch 2008: MSY: $F_{2007}F_{MSY}$: SB_{2007}/SB_{MSY}	410,800 t 318,400 t 300,000 t 1.16 1.12	2008	Stock size is close to or has possibly entered an overfished state recently. Fishing pressure has been too high in recent years resulting in a decline of the population to levels below the optimal. Currently, the population might not be able to sustain the 1992-2002 level of catches.	Catch and fishing pressure should not exceed MSY levels (300,000 t).
Swordfish	Average catch 2004-2008: Catch 2008: MSY: $F_{2007}F_{MSY}$: SB_{2007}/SB_{MSY}:	29,900 t 22,300 t 33,000 t (32-34,000) 0.79 (0.58-0.84) 1.31 (1.13-1.46)	2007	The overall stock size and fishing pressure are estimated to be within acceptable limits, although there is a possibility that certain limit reference points have been marginally exceeded. Also, it cannot be discounted that localised declines took place in some areas.	Precautionary measures, such as capacity control or catch limits will reduce the risk of creating an overcapacity problem or increasing the risk of exceeding common biomass limit reference points.
Blue marlin	Average catch2004-2008: Catch 2008:	9,500 t 7,100 t		No quantitative stock assessment is currently available for black marlin in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern.	Stock status is uncertain
Black Marlin	Average catch 2004-2008: Catch 2008:	4,900 t 5,900 t		No quantitative stock assessment is currently available for black marlin in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern.	Stock status is uncertain

[1] This is indicate the latest year taken into account for the assessment

Stock	Average annual catches / Status ratios	Year[1]	Stock status	Scientific Committee advice to the Commission in 2009
Striped marlin	Average catch 2004-2008: 3,100 t Catch 2008: 2,500 t		No quantitative stock assessment is currently available for black marlin in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern.	Stock status is uncertain
Sailfish	Average catch2004-2008: 24,500 t Catch 2008: 20,100 t		No quantitative stock assessment is currently available for black marlin in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern.	Stock status is uncertain
Bullet tuna	Average catch 2004-2008: 3,500 t Catch 2008: 3,700 t		No quantitative assessment is available. No reliable indicators	Stock status is uncertain
Frigate tuna	Average catch 2004-2008: 32,500 t Catch 2008: 33,900 t		No quantitative assessment is available. No reliable indicators	Stock status is uncertain
Spanish mackerel	Average catch 2004-2008: 116,800 t Catch 2008: 124,600 t		No quantitative assessment is available. No reliable indicators	Stock status is uncertain
Kawakawa	Average catch 2004-2008: 113,100 t Catch 2008: 126,700 t		No quantitative assessment is available. No reliable indicators	Stock status is uncertain
Longtail tuna	Average catch 2004-2008: 94,800 t Catch 2008: 104,400 t		No quantitative assessment is available. No reliable indicators	Stock status is uncertain
King mackerel	Average catch 2004-2008: 36,200 t Catch 2008: 43,200 t		No quantitative assessment is available. No reliable indicators	Stock status is uncertain

TABLE OF CONTENTS

ACRONYMS AND CODES

ALB	Albacore (*Thunnus alalunga*)
BET	Bigeye tuna (*Thunnus obesus*)
B_{MSY}	Biomass at MSY
BLM	Black marlin (*Makaira indica*)
BUM	Blue marlin (*Makaira nigricans*)
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CPCs	Contracting parties and cooperating non-contracting parties
COFI	FAO`s Committee on Fisheries
CPUE	Catch per unit of effort
EU	European Union
EEZ	Exclusive Economic Zone
ENSO	El Niño-southern oscillation
F	Fishing mortality; F_{2008} is the fishing mortality estimated in the year 2008
FAD	Fish-aggregating device
FAO	Food and Agriculture Organization of the United Nations
F_{MSY}	Fishing mortality at MSY
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of AtlanticTunas
IOTC	Indian Ocean Tuna Commission
LL	Longline
LOA	Overall length
LSTLV	Large-scale tuna longline fishing vessel
MLS	Striped marlin (*Tetraturus audax)*
MSY	Maximum sustainable yield
NGO	Non-governmental organization
NPA/NPOA	National plan of action
OFCF	Overseas Fishery Cooperation Foundation of Japan
PS	Purse-seine
RFMO	Regional Fishery Management Organization
RTTP-IO	Regional Tuna Tagging Project of the Indian Ocean
SBT	Southern bluefin tuna (*Thunnus maccoyii*)
SC	Scientific Committee of the IOTC
SKJ	Skipjack tuna (*Katsuwonus pelamis*)
SSB	Spawning stock biomass
SSB_{MSY}	Spawning stock biomass at MSY
SWIOFC	South West Indian Ocean Fisheries Commission
SWIOFP	South West Indian Ocean Fisheries Project
SWO	Swordfish (*Xiphias gladius*)
UNCLOS	United Nations Convention on the Law of the Sea
VPA	Virtual population analysis
WCPFC	Western and Central Pacific Fisheries Commission
WPB	Working Party on Billfish of the IOTC
WPEB	Working Party on Ecosystems and Bycatch of the IOTC
WPM	Working Party on Methods of the IOTC
WPN	Working Party on Neritic Tunas of the IOTC
WPTDA	Working Party on Tagging Data Analysis of the IOTC
WPTe	Working Party on Temperate Tunas of the IOTC
WPTT	Working Party on Tropical Tunas of the IOTC
YFT	Yellowfin tuna (*Thunnus albacares*)

1. Opening of the Session

1. The Twelfth Meeting of the Scientific Committee (SC) was opened on 30 November 2009 Victoria, Seychelles, by the Chairperson Dr. Francis Marsac (EU).

2. A list of the meeting participants is provided in Appendix I.

3. The SC noted that 14 of the 31 IOTC CPCs were represented at the meeting. The SC acknowledged that the participation has been higher than the previous Session of the SC but that still more than half of the CPCs were not present.

2. Adoption of the Agenda and Arrangements for the Session

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

3. Admission of Observers

5. Pursuant to Rule XIII.9 of the Rules of Procedure, the SC acknowledged the presence of observers from the Republic of Maldives, the ISSF, Birdlife International, MCSS, SWIOFC, SWIOFP, the special observer from FAO and invited experts from Taiwan,China.

4. Progress Report from the Secretariat

6. The Chairman presented the main outcomes of the 13th Session of the Commission held in Bali in March 2009, noting that the recommendations of the previous Session of the SC resulted in various resolution proposals, although no agreement was reached on conservation and management measures, The Chairperson indicated that the Commission endorsed the recommendations of the Performance Review Panel, including twelve recommendations addressed to the Scientific Committee, further noting that five of these recommendations had already been acted on.

7. The Chairman reminded the SC that it should provide clear positions to be presented to the Commission based on a scientific and objective approach.

8. The Executive Secretary described the activities of the Secretariat in 2009 in support of the scientific and compliance activities of the Commission and its subsidiary bodies.

9. The SC noted that no written report of the Secretariat activities was available for the meeting. The SC recommended that such report be produced at the next sessions of the SC.

10. The SC acknowledged the administrative difficulties faced by the Secretariat in the recruitment of the Stock Assessment Expert as part of the permanent staff of the Secretariat, and the redistribution of the responsibilities following the departure of the Deputy Secretary last April.

11. However, despite the lack of staff, the SC congratulated the Secretariat and expressed its satisfaction to the Secretariat for the amount and quality of the work undertaken. However, considering the still insufficient staff level of the Secretariat and the clear recommendations of the Performance Review Panel, the SC reiterates its recommendations from the past two years that funding be provided for two additional professional staff members, in order to bring the Secretariat to a staff level comparable to that of other similar organizations.

12. The SC noted the support provided by the Secretariat in arranging for several external scientific experts to participate in the meetings of the 2009 IOTC Working Parties, in particular regarding contributions to the assessment of billfish and tropical tunas.

13. The SC recognised the valuable contribution that these experts made to the outcomes of the meeting and recommended that similar arrangements be continued in the future.

14. The SC also acknowledged the initiative of the Secretariat to support the participation of scientists from the region in the meetings of the Working Parties and the SC, through accumulated funds and voluntary contributions of the government of Japan, noting the increase in the level of participation.

5. PRESENTATION OF NATIONAL REPORTS

15. National Reports were presented by Australia (IOTC-2009-SC-INF01), China (IOTC-2009-SC-INF19), European Union (IOTC-2009-SC-INF02), India (IOTC-2009-SC-INF05), Japan (IOTC-2009-SC-INF07), Kenya (IOTC-2009-SC-INF09), Korea (IOTC-2009-SC-INF16), Madagascar (IOTC-2009-SC-INF04), Maldives (IOTC-2009-SC-INF06), Mauritius (IOTC-2009-SC-INF17), Seychelles (IOTC-2009-SC-INF21), Thailand (IOTC-2009-SC-INF20), United Kingdom (IOTC-2009-SC-INF08) and South Africa (IOTC-2009-SC-INF12). Abstracts of these reports are given in Appendix V. From these reports the SC noted the following matters in particular:

16. The SC noted that more reports were made available in 2009 (14) in comparison with 2008 (11), but expressed its concerned that this still represents less than half of the 31 CPSs. The SC recalled that it was agreed at the 4th session that all CPCs would provide written national reports to the SC (following the guidelines set out by the SC – and available on the IOTC website) even when not attending the meeting. The SC has now modified the guidelines to include information on bycatch and mitigation measures implemented by the fleets, and also information from sport fisheries when relevant. Furthermore, the SC requested the SC Chairperson to again present a report on the numbers and completeness of national reports to the Commission at its annual session.

17. Australia informed the SC that, in addition to their report, information regarding Australia's *Threat Abatement Plan for the incidental catch (or by-catch) of seabirds during oceanic longline fishing operations*, that includes mitigation measures to avoid incidental catches of seabirds, is available through the internet. The SC noted that the life status of discarded sharks is not currently being recorded in logbooks. The SC noted that the sharp decline in swordfish catches by Australia since 2003 was closely linked to a sharp reduction in the number of vessels targeting swordfish rather than a localised depletion. However, in the case of striped marlin, the low catches since 2000 is thought to be a reflection of both localised depletion and changed targeting practices..

18. The SC noted that after the seizure of a longline vessel from China by Somali pirates, some vessels suspended their operations in the western Indian Ocean and shifted to other oceans.

19. The SC noted a lot of heterogeneity in the report of the EU and requested that for the next Session, the report should be more consistent and that summarized information is presented. The SC noted discrepancies regarding the level of catches of bigeye on free and log schools by the EU purse-seine fleet, *ie.* bigeye catch on free school is over-estimated, and was informed that this statistical problem is in the process of being corrected.

20. The SC was informed that the European observer program onboard the purse-seine fleet had to be suspended due to the piracy acts in the western Indian Ocean and in particular around Seychelles. By contrast, the observer program implemented on the EU longline fleet based in Reunion can be pursued as not impacted by piracy acts. The SC encouraged that EU scientists continue to provide estimates of bycatch and discard levels using a different approach.

21. The SC noted that Kenya will be implementing an observer program. The SC also noted that a sport fisheries data series of more than 20 years from Kenya is now available in the IOTC database.

22. The SC noted that there was not information regarding the observer coverage onboard Korean longliners and that catches of sharks in 2007 seemed to be very low for this fleet, particularly in the area south-west of Australia. The SC recommended that size frequency distribution of the Korean tuna catch be distributed by 2cm instead of 5cm interval, and that this data be separated when coming from onboard observers or port samplers. Korea informed the SC that additional information would be added to their National Report and that estimates of bycatch would be included next year.

23. The SC noted that all data reported by Mauritius includes high-resolution longline data and logbook data, and is reported to the Secretariat every year. The SC was informed that sport fishery data and FAD fishery data are collected and compiled and will be transmitted to the Secretariat in the near future.

24. The SC noted that there were differences in the size frequency distribution of skipjack between Thai and EU purse-seiners while the vessels are fishing in the same area, and recommended that Thai and EU scientists cooperate to identify the cause of these discrepancies.

25. The SC expressed its concern regarding the poor resolution of the data submitted by India, being a major fishing nation in the Indian Ocean. The SC recalled that the indian longline fleet (60 longliners) licensed to operate in the EEZ, is not fully reported in the statistics. India informed the SC that its data quality should improve in the next few years as enumerators are being hired, and that effort will be made so that historical size frequency data would be made available to the Secretariat.

26. On the issue of the development of the tuna fishery in India, the SC was informed of a development plan for more than 1000 vessels (mainly converted shrimp trawlers from 13-24 OAL) to enter the tuna fleet. The SC expressed its concern and worry regarding this plan and the rationale behind it. As India has unilaterally defined an MSY level for tuna resources in its waters, the SC reminded that MSY levels can only be estimated at a regional, and not at a national level. Discrepancies were also noted between the number of active vessels in the national report of India and in the IOTC positive list.

27. The SC reiterated its concern regarding the very low samples for size frequency data collected since 2002 by Japan which is detrimental to stock assessments. Japan informed the SC that more effort will be made regarding this matter, especially through their onboard observer program.

28. The SC noted that Japan do not report on non-IOTC species such as sharks, turtles and seabirds. Japan explained that shark catch data in weight were not of good quality but that the number of individuals would be provided in the future, as sharks are supposed to be declared in the logbooks. Information on other species, *ie.* sea turtles and sebiards would be collected through other means.

29. The SC expressed its concern regarding the low level of tag recovery coming from Japanese longliners (but also from other major longline fleets) and explain that it will affect seriously stock assessments, especially for the bigeye, for which large individual are caught in their vast majority by longliners. The SC also noted that FAO data for Japanese shark catches should be used with caution. Japan informed the SC that bycatch reduction and mitigation studies for the purse-seine fisheries in the Pacific ocean will be presented at the WCPFC and IOTC in 2010.

30. The SC noted that UK has currently stopped its observer program in the Chagos area due to funding problems, but that a request to resume the program in the near future is being considered as this area is located at the frontier of the two basins of the Indian Ocean.

31. The SC was informed that UK is launching a consultation on whether to establish a Marine Protected Area in the Chagos archipelago (British Indian Ocean Territory). The principle of such consultation gave rise to an objection by Mauritius which stated that the setting up of any MPA in the Chagos archipelago should be dealt under the ongoing bilateral talks between Mauritius and the UK.. Both parties made a statement on their respective position, those statements are presented in Appendix VII. No further discussion took place on this issue as it was not related to scientific matters

32. The SC expressed its satisfaction regarding the request of the Republic of Maldives to become a Cooperating non-Contracting Party of the IOTC, and its effort to become a full member before the next Session of the Commission. The SC recommended that effort be made in the identification of bigeye tuna which is not separated from yellowfin at the moment, and was informed by Maldives that new logbook following IOTC standard are being developed at the moment to address this matter.

33. The SC noted that shark finning activities were still occurring in the semi-industrial longline fishery of Seychelles. The SC was informed that the Seychelles NPOA-Sharks will be addressing the issue of finning from the local fleet as per Resolution 05/05. However, through elimination of fuel subsidies for vessel targeting sharks, several vessels have reverted to tuna and swordfish resulting in a reduction of shark fishing.

34. The SC acknowledged that yellowfins caught South of Cape Town are believed to be native of the Indian Ocean but are reported to the ICCAT because located outside the area of competence of the IOTC. The SC was informed that genetic studies are in progress to determine the origin of this fish. The SC also noted the need to verify albacore landings of South Africa and Namibia to avoid double reporting since part of fleet is chartered from Namibia.

35. The SC noted that few countries reported on incidental bycatch of seabirds and reminded that it is mandatory that all members report on non-IOTC species, including seabirds and marine turtles.

6. Reports on the 2009 Working Party Meetings

6.1 Report of the Working Party on Billfish

36. The Seventh Meeting of the Working Party on Billfish (WPB) took place in Seychelles, 6-10 July 2009. The Chairman of the WPB (Mr Jan Robinson) introduced the 2009 WPB report (IOTC-2009-WPB-R). The meeting focussed on swordfish, and noted that in 2009 there had been no major changes in catches or spatial patterns

compared to the previous years. The meeting also examined the status of istiophorids (marlins and sailfish) and noted significant uncertainty in the data available as in the previous meetings.

37. The SC noted that more data was required from certain members on their longline activity and catches of billfish . It was also noted that additional data from sport fisheries would particularly help address lack of data on marlins and sailfish. The SC also recalled that driftnets are operating illegally in the region and are also likely to catch substantial amount of billfishes.

38. The SC appreciated that the recommendation made last year to use fine scale data (1 degree or set by set) for standardizing swordfish longline CPUE was followed by Japan in the 2009 assessment. In addition, environmental data were incorporated. However, there remained conflicting trends between CPUE series of Japan and Taiwan,China prior to 2000. Differences in targeting likely explain some of the uncertainty and robust methods for correcting this need to be applied. It was not unanimously agreed that hooks per basket was an appropriate correction factor and that catch ratio may also have some value in this respect.

39. The SC noted that despite uncertainties, standardised data showed that there was a generally decreasing trend in abundance indices, and that this was not just confined to the South Western Indian Ocean but also included the South East and North West Indian Ocean. The possibility that localised depletion was occurring, in some areas could not be discounted and the situation must be monitored carefully.

40. Four stock assessment methods for swordfish were applied in 2009 and a range of results was produced, among those a spatially disaggregated model as recommended at the last session of the SC. However this latter approach did not provide consistent area-specific population estimates and needs to be improved. The results obtained by an age-aggregated production model were considered as the most plausible for the moment.

41. The SC recommended that the WPB continues its work on standardisation of abundance indices and in particular undertakes an in-depth spatial analysis of biomass and fishing intensity patterns, as concentration of effort can occur on productive fishing grounds, producing high catches and low CPUE. The SC also recommended that more detailed analyses on the large decline in the south-west area be undertaken.

42. The SC reiterated its recommendation that work on stock indicators of other billfish species such as marlins and sailfish be continued as no stock assessments or robust CPUE indices are available. The SC recognised that further work is needed on this matter and recommended that a programme of research be initiated to address this issue.

43. The SC reiterated its recommendation that more information on billfish from sport and artisanal fisheries be collected and encourages the Commission to find a mechanism to achieve this.

44. Kenya informed the SC that tag release data for billfish is available at the billfish foundation. A report on billfish will be made available to the WPB in 2010. It was also noted that a new swordfish tagging project was starting in 2010 under the SWIOFP, using pop-up tags to look at migration and fidelity at sites. Together with this project, current genetic studies undertaken under the IOSSS project will help explore the question of stock structure and whether different stocks occur in discrete regions. The SC called on as many members as possible to contribute to this genetic research by providing samples and data.

45. The SC endorsed the WPB's data and research recommendations (reproduced in Appendix IV) and commended it for its work in 2009.

6.2 REPORT OF THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH

46. The Fifth Meeting of the Working Party on Ecosystems and Bycatch (WPEB) took place in Mombasa from 12-14 October 2009. In the absence of the WPEB Chairperson Mr. Julien Million reviewed the major outcomes and recommendations outlined in the 2009 WPEB report (IOTC-2009-WPEB-R).

47. It was noted that a general lack of data hampers progress on the estimation of Bycatch and ecosystem effects and that despite recommendations each year to improve the situation, no improvements have been observed. The SC urges the Commission to consider appropriate mechanisms to encourage members to comply with reporting requirements, and to provide historical data.

Sharks

48. It was noted that despite it being a requirement from 2008, only Seychelles reported on its National Plan of Action for Sharks during the WPEB. The SC expressed its interest to obtain more reports from members that have a NPOA-Sharks in 2010.

49. Following from the Commission's request in 2008 for more information on the technical aspects of IOTC Resolution 05/05 Concerning the conservation of sharks caught in association with fisheries managed by IOTC, specifically the '5% rule', and the recommendations made by SC in 2008, the WPEB in 2009 proposed a refinement to the 2008 recommendation that 'the fin-body weight ratio measure be replaced with a resolution that requires shark fins to be landed attached to the body, either naturally, or by other means'. In 2009 WPEB recommended that this should read 'fins naturally attached'.

50. Most CPCs supported such a recommendation as it was agreed that the best way to reduce or avoid the pratice of shark finning, ensure accurate catch statistics, and facilitate the collection of biological information is to ensure that all sharks are landed with fins naturally attached to the body. However the oriental longline countries (Japan, China, Korea) were opposed to it indicating that the 5% rule was already well established amongst tuna RFMOs and serving the purpose even if not fully, although it was noted there was a lack of evidence supporting that percentage due to the large variability in the fin:body weight ratio among sharks species. The oriental longline countries, *ie.* Japan, China, Korea and invited experts recommended to investigate this issue further.

51. The SC unanimously recognized that there was a need to collect more biological information on sharks and more detailed species composition information, and agreed with the principle that shark fins should be matched to a specific carcass for such biological research, as agreed at SC11 (paragraph 27, 28). However it was considered that the mechanism for solving the shark fin problem was a matter for consideration by the Compliance Committee..

52. The SC also noted that the WPEB should explore mitigation methods for reducing shark Bycatch on longlines, such as the use of monofilament trace rather than wire.

53. South Africa expressed an interest in participating in any pelagic shark study that would be undertaken to improve the development of mitigation measures on sharks.

54. With respect to the recommendation to improve species identification in reporting shark bycatch, the SC highlighted the fact that the list of the 3 shark species (blue shark, portbeagle shark and mako shark) to be reported in the logbooks under Resolution 08/04 "*concerning the recording of catch by longline fishing vessels in the IOTC area*" was too short, and to some extent inadequate, *eg.* the porbeagle having very low probability of being caught by longliners in the IOTC area of competence compared to other shark species..

55. The WPEB had proposed to have an extended list of groups or species of sharks to be declared in the logbooks, replacing the initial list of the Resolution 08/04, provided that those groups or species of the new list are easily distinguishable from each other.

56. Australia proposed that such a list should also include the species scientific name when possible. Those additional details could be used as an option for the logbook declaration. The resulting table is presented in Appendix VIII.

57. Several CPS's supported those amendments. However Japan, China and Korea expressed their concern into the practical implementation of such frequent amendments and additional burden would reduce the accuracy of reporting. Thus, they did not support the proposal of an extended list of shark species for logbook declaration.

58. With respect to recommendations on stock assessment, whilst simpler indicators could be useful, SC preferred to move towards assessments and recommended that other institutions currently working on shark assessments should be invited to assist with this.

59. However, the SC reiterated that in absence of reliable catch statistics on sharks, the interest of conducting such formal assessments is questionable.

Seabirds

60. The SC noted that the northerly range of vulnerable seabirds was greater than previously acknowledged, and endorsed the WPEB's recommendations on seabirds particularly highlighting the recommendation to extend the area in which longliners are required to use mitigation measures further north to latitude 25°S (reproduced in Appendix IV).

61. Consequently, the SC recommends that the Resolution 08/03 “On reducing the incidental bycatch of seabirds in longline fisheries” be slightly amended in its paragraph 3 to include this new latitudinal limit. Therefore, the proposed paragraph 3 should read : *CPCs shall ensure that all longline vessels fishing south of 25°S use at least two of the mitigation measures in Table 1 below, including at least one from Column A. Vessels shall not use the same measure from Column A and Column B.*

62. The SC regretted that no update on National Plans of Action – Seabirds from IOTC members were presented at the WPEB meeting. The SC expressed its interest to obtain more reports from members that have a NPA-Seabirds in 2010.

Turtles

63. The SC noted the measures to mitigate against turtle bycatch in purse seine FAD fisheries and lonline fisheries presented by WPEB.

64. The SC did not endorse the recommendation for the use of circle hooks at the present time, but accept the principle of the resolution, and consider that more research is required to determine their effectiveness and impact on other species such as sharks. It was also suggested that IOTC members participate in existing ICCAT working groups on this matter, including the study of devices to release turtles alive once they have been caught.

Marine mammals

65. The SC noted that there was little interaction between purse seiners and marine mammals in the Indian Ocean. However, the SC expressed its concern on the driftnets operating in the North Indian Ocean that could induce a large mortality of marine mammals.

66. The SC suggested that logbook and observer data collected on purse seiners could be used to investigate the spatial distribution of whales that can be associated to tuna schools.

Depredation

67. The SC acknowledged that depredation of fish caught on longlines was a significant issue, as it represents a cryptic fishing mortality and induces large economic loss to the operators.

68. The WPEB recommended that, through an amendment of Resolution 08/04 “Concerning the recording of catch by longline fishing vessels in IOTC area “, occurrences and number of fish damaged be reported on logbooks. Several CPS’s supported this amendment. However Japan, China and Korea expressed that they could not accept the proposal due to the legal problems in keeping such frequent changes in measures and to the additional burden that would reduce accuracy of reporting. Furthermore, such information could be provided through large-scale observer programmes. The SC noted that it should only consider scientific necessity to estimate accurate fishing mortality..

69. Another proposal set by WPEB was a voluntary reporting of depredation events in artisanal fisheries through a reporting form. This proposal was endorsed by the SC (Appendix IX).

Ecosystem approaches

70. The SC noted that the GEF project on Ecological Risk Assessment (ERA) has proposed collaboration with IOTC on pelagic assessments in future.

71. The SC reiterated the need to incorporate modelling approaches of the ecosystem functioning in the work of the WPEB to better understand the interaction with the fisheries.

Other matters

72. SC noted that the ISSF has launched an initiative on Bycatch in tuna fisheries and will look at mitigation methods and current and proposed new research. Within 18 months ISSF plan to have a vessel based research platform that will undertake research into Bycatch over a two year peiod. The SC welcomed this initiative and would be interested in participating in it, and urged the ISSF to make any reports available from ISSF meetings available to the Secretariat.

Recommendations

73. The SC endorsed the WPEB's data and research recommendations (reproduced in Appendix IV), with amendments and reservations (stated in Para 50, 51, 64 and 68) and commended for its work in 2009. (paragraph 73).

6.3 REPORT OF THE WORKING PARTY ON TROPICAL TUNAS

74. The Eleventh Meeting of the Working Party on Tropical Tunas (WPTT) took place in Mombasa, from 15-23 October 2009. The Chairman of the WPTT (Dr Iago Mosqueira) introduced the 2009 WPTT report (IOTC-2009-WPTT-R). The key objectives of the meeting were to undertake a major review of the stock status of yellowfin tuna.

75. The SC noted the following:

- that a lack of compliance with reporting requirements has limited the work possible by the WPTT and draw this to the attention of the Commission for further action
- that new information regarding the RTTP-IO was presented during the WPTT and that new tag-release data sets were prepared for the yellowfin and bigeye assessments.

76. The SC acknowledged that considerable work had been carried out by the WPTT intersessionally in 2009 in preparation to the WPTT meeting and thanked all the scientists involved, and the Secretariat.

Yellowfin tuna

77. The SC concurred with the WPTT that the assessment of yellowfin tuna stock in the Indian Ocean is difficult because of the conflicting trends between total annual catches and abundance index (based on the longline CPUE) if data in 1950s and 1960s are included. These trends are not consistent with production-model dynamics, or any known theory of fishing because for any fished stock, dramatic and continuous increase in catches should be accompanied by a decline in abundance. For yellowfin, this is clearly not the case and suggests that there are some major unknown factors influencing the abundance index that need to be accounted for.

78. The SC also noted that only one stock assessment model was used in 2009 for yellowfin tuna, *i.e*. the integrated and statistical model Multifan-CL. This was the second consecutive year that this approach was used on the yellowfin stock in the Indian Ocean. Multifan-CL allows the incorporation of a wide range of the available data from various sources, but the underlying complexity of the model leads to unexpected and not fully understandable results. For instance: mixing rates across areas estimated by the model were not in agreement with the patterns emerging from the tagging data and surprising large biomass declines were observed in areas where catches remained low. Moreover, the lack of size data from the longline and gillnet fisheries may cause a bias in the size structure of the stock in the recent years then lead to an exaggerated decline of the adult biomass and a very pessimistic diagnosis of the status of the stock. In particular it was noted that the estimate for 2008 should only be regarded as provisional, and that the recommendations of the WPTT were based on 2007, which was considered more reliable.

79. The SC noted that the inability of the WPTT to conduct projections was due to the uncertainty from various sources that affected the assessment of yellowfin tuna..

80. The SC recalled the necessity of establishing a well-agreed growth curve combining information from the tagging data in conjunction with otolith analyses (when available), prior to the runs of the different models, in order to use common reference when those information are to be used as inputs.

81. The SC debated whether a precautionary management recommendation was appropriate rather than the WPTT recommendation related to MSY. Given the uncertainty in the model outputs it was considered that SC needed to additionally draw on its collective experience in making its recommendation.

82. The range of MSY estimates presented was discussed. It was noted that the range does not describe the uncertainty in the outputs. It reflects three different point estimates based on alternative values for the steepness parameter of the stock recruitment relationship (0.6, 0.7 and 0.8). Noting that a value of 0.8 was considered as the most appropriate from an expert point of view, the majority of SC was comfortable recommending this value of

0.8 for yellowfin, and thus an estimate of MSY of 300,000 t, although Australia, Kenya and Maldives preferred a more conservative estimate given the continue decline in adult biomass since 1975 and recent levels of overfishing.

83. The SC pointed out that such an MSY level is consistent with the fact that the catch has been sustained at a level of 340 000 t for 11 consecutive years (*i.e.* more than the duration of a single cohort) and that the recent catches resulting from a lesser fishing effort were at 320 000 t.

84. The SC noted that only one assessment model had been applied to yellowfin tuna yet 5 were applied to bigeye tuna. It recommended that alternative models (preferably in a Bayesian context) should be applied in order to better explore and understand any uncertainties and behaviour of the models. It also recommended greater use of the tagging information, whilst noting that specialised ad-hoc models may be necessary in order to do so.

85. It was noted that a dedicated stock assessment expert would be joining the Secretariat shortly and would be in a position to assist.

Bigeye tuna

86. Five stock assessment models were applied to bigeye tuna during 2009. It was noted that the stock recruitment parameter has yet to be estimated and a value of 0.8 was considered appropriate. The bigeye stock is considered to be fully exploited.

87. It was noted that the range of MSY estimates for bigeye tuna derived from the different models was similar, and that the coefficient of variation of the point estimate was less than 10% suggesting that it would be acceptable in this case to recommend a mid point value within the range.

88. The SC emphasized that tag and release data on bigeye have still be poorly exploited for the assessment and recommended that integrated approaches (SS3, Multifan-CL) that can accommodate tagging data, be developed on this species in the future.

89. The SC noted that, for further assessments, it would also be necessary to use corrected figures from fisheries that are not currently identifying bigeye (*e.g.* Maldives) and to include data on gillnet fisheries, currently lacking, as this could considerably affect the yield per recruit and the overall productivity of the stock.

90. The SC endorsed the recommendation that catches of BET should not exceed MSY levels of 110,000 t..

Skipjack tuna

91. It was noted that the analyses conducted on skipjack tuna were limited in scope and that no formal stock assessment was conducted. No new recommendations were made by the WPTT in 2009.

92. The SC took note of the declining trend of the mean weight of skipjack taken by purse seiners during the last 3 years, considering however that those smaller fish are still above the size at first maturity. The SC was informed by Kenya that the catch rates of skipjack by the sport fishery have gone down in the recent years.

93. The SC noted that that, with the access to the whole Maldivian data series, together with the tagging data available in great numbers, on skipjack and all other data from the purse seine fleets, formal stock assessment should now be attempted. The SC acknowledged the potential difficulties that will be met because of the complex issue of establishing reliable CPUE indices from the the FAD purse seine fishery. Standardized CPUE indices should also be computed from the Maldivian baitboat fishery.

94. The SC recognised the challenging issue of assessing the interactions between pole and line fisheries and purse seine fishing that need to be examined in detail. It was noted that whilst no RFMO has yet achieved a good skipjack assessment, yield per recruit assessments elsewhere suggest that fishing mortality does not affect abundance at the current size of first capture, which is greater than the size at first maturity.

Other matters

95. The WPTT also examined issues related to piracy that are the subject of a separate agenda item for SC.

96. The group thanked the RTTP-IO, its project leader and the whole team, for its valuable work and the inputs provided that has greatly informed the work of the WPTT.

Recommendations

97. The Scientific Committee endorsed the WPTT's data and research recommendations (reproduced in Appendix IV, with amendments as indicated below) and commended it for its work in 2009.

98. A number of the recommendations are particularly highlighted for the attention of the Commission.

- The lack of complete and good quality data limits the work of the WPTT and SC particularly highlights this recommendation. There is an urgent need to address the requirement for member states to provide complete information.
- The SC endorsed the need to pursue the work implemented with a statistically integrated model for yellowfin tuna and the need to apply a number of assessment models in 2010
- The SC endorsed the recommendation to compile and undertake skipjack tuna stock assessments during 2010
- The SC recommends that assessments on yellowfin and skipjack tuna are made in priority. Given the current situation of the bigeye stock, a lower priority for 2010 is assigned to that species.
- The outputs of tagging projects are invaluable and it is recommended that the possibility of continuing this type of activity be investigated.
- The SC additionally strongly recommends that in-depth analysis of the data of the RTTP-IO is undertaken, and reiterate the need for a dedicated symposium to encourage this research and to generate scientific papers using those data.
- Further investigation of juvenile catches taken around FADs should be undertaken and SC considered that this should include both yellowfin tuna and bigeye tuna. SC also noted the need to undertake research to investigate mitigation of juvenile bycatch around FADs.

6.4 REPORT OF THE WORKING PARTY ON FISHING CAPACITY

99. The Chairperson of the WPFC, Dr. Hilario Murua, presented the report of the first session of this working party which met in Mombasa, Kenya the 22 October 2009, following a request from the Commission in 2009.

100. After having reviewed the approaches used by other tuna RFMOs (ICCAT, WCPFC and IATTC), it was noted that input based measures of fishing capacity are more useful for management purposes.

101. A study to estimate the level and type of fishing capacity for all the fishing fleets operating in the IOTC competence area from 2006 to 2008, in particular in terms of number of vesels, was conducted on extra-budgetary funds from the Australian government. The final report will be presented to the next Session of the Commission.

102. Based on the conclusion of this study, the WPFC considered that, in order for estimates of total fishing pressure directed at tuna resources, estimates of fishing capacity should include consideration of the fishing boats under 24 meters operating exclusively inside the EEZ of participating countries fleets..

103. The SC acknowledged the improvements made since the first request from the Commission, which allow preliminary estimates of the current fishing capacity. However, at the present stage, the SC cannot produce any advice on the optimal level of fishing capacity as requested by the Commission.

104. The SC recalled the particularly difficult case of the Indian Ocean where many different fisheries and gears operate with a substantial component of catch due to artisanal fisheries. The industrial vessels are also highly mobile and can shift from one ocean to others within the same year. This is the reason why any significant improvement in the management of the fishing capacity will require a global assessment of this capacity.

105. In this perspective, the SC was informed that a world meeting on fishing capacity should be organized by the middle of 2010. The SC requested that the Secretariat participate to this meeting with possibly other scientists of the IOTC working parties.

106. The SC endorsed the recommendations made by the WPFC that are reproduced in Appendix IV and commended for its work in 2009.

6.4.1 REVIEW OF THE DRAFT OF THE REPORT ON THE CONSULTANCY FOR ESTIMATING CURRENT FISHING CAPACITY

107. Preliminary results of the consultancy on the estimation of fishing capacity of the tuna fleet in the IOTC competence area were presented by the Secretariat.

108. This study showed that fishing capacity based on effort estimated from 2006 to 2008 was around 9000 fishing vessels (3000 for which data are available at the Secretariat, and 6000 for which the information is incomplete). However, vessels not accounted for in the study, by lack of detailed information, make 30% of the catches.

6.5 *REPORT OF THE WORKING PARTY ON DATA COLLECTION AND STATISTICS*

109. Following a recommendation of the IOTC Performance Review Panel (February 2009), the 6th Session of the WPDCS was held in Victoria (Seychelles) on the 26-27 November 2009. The Chairperson, Mr. Miguel Herrera presented to the SC the report of the WP.

110. Noting that a significant number of recommendations on data and statistics are made every year by the IOTC WPs, and they are often redundant or duplicated, le WPDCS was supposed to integrated this information to facilitate the work of the SC, in particular regarding the availability and quality of the information used for stock assessment. The majority of the work concerned the analysis of the Secretariat report on availability of statistics for 2008 and on the general stat of the IOTC databases.

111. The SC recommended to Iran, Pakistan and Sri Lanka to improve statistics by reinforcing port sampling, implementing logbook scheme and report catch and effort data to the IOTC.

112. The SC congratulated the Secretariat for the sending of questionnaires on data collection, management and distribution to the countries fishing in the area of competence of the IOTC, and encouraged all countries to fill and return them. A summary should be presented to the next session of the WPDCS.

113. The SC expressed its satisfaction after the success of the working party on "Specific Composition of purse-seine catches, derived from observer and port sampling data" organised by IRD in 2009, and recommended the venue of a follow-up working party in the framework of the collaboration between tuna RFMOs.

114. The WPDCS reviewed three Resolutions (09/04, 08/01 and 07/03), identified several problems and recommended modifications in the text.

115. The SC reviewed and agreed the proposals of amendments on Resolution 09/04 "*On observer regional scheme*" and recommended the following changes (proposed changes are in bold):

Paragraph 3*: When purse seiners are carrying an observer as stated in paragraph 1, this observer shall also monitor the catches* ***at unloading*** *to identify the composition of bigeye catches. The requirement for the observer to monitor catches* ***at unloading*** *is not applicable to CPCs already having a* ***sampling scheme****, with at least the above mentioned coverage.*

Paragraph 4*: The number of artisanal fishing vessel landings shall also be monitored at the* ***landing place by field samplers****. The indicative level of the coverage of the artisanal fishing vessels should progressively increase towards 5% of the total* ***levels of vessel activity (e.g. total number of vessel trips or total number of vessels active)****.*

Paragraph 7*: The* ***sampling*** *scheme referred in paragraph 4 will be covered by the Commission's accumulated funds and voluntary contribution on a provisional basis. The Commission will consider at its 14th Annual meeting an alternative for the financing of this scheme.*

Paragraph 9*: CPCs shall provide to the Executive Secretary and the Scientific Committee annually a report of the number of vessels* ***monitored*** *and the coverage achieved by gear type in accordance with the provisions of this Resolution.*

New paragraph to insert after paragraph 12*:* ***Field samplers shall monitor catches at the landing place in order to estimate catch-at-size by type of boat, gear and species, or carry out scientific work as requested by the IOTC Scientific Committee.***

Paragraph 13*: The funds available from the IOTC balance of funds may be used to support the implementation of this programme in developing States, notably the training of observers* ***and field samplers****.*

116. The WPDCS had noted that Paragraph 4 of Resolution 08/01 "*Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPCs)*" was making reference to guidelines set out by the IOTC Scientific Committee regarding random sampling schemes.

117. The SC acknowledged that it had never elaborated those guidelines, in particular there is no mention of minimum levels of sampling. Following the proposal made by the WPDCS, the SC recommended to use a ratio of at least one fish measured per ton of fish unloaded (frequently used in other organisations) for the main species, and recommended the following modification to the text of Resolution 08/01 (proposed changes are in bold):

Paragraph 4*: Size data shall be provided for all gears and for all species covered by the IOTC mandate according to the guidelines set out by the IOTC Scientific Committee. Size sampling shall be run under strict and well described random sampling schemes which are necessary to provide unbiased figures of the sizes taken.* ***Sampling***

coverage shall be set to at least one fish measured by ton caught, by species and type of fishery, with samples being representative of all the periods and areas fished*. Length data by species, including the total number of fish measured, shall be submitted by a 5° grid area by month, by gear and fishing mode (e.g. free swimming schools or schools in association with floating objects for the purse seiners).* ***Documents covering sampling and raising procedures shall also be provided, by species and type of fishery.***

118. Paragraph 5(c) of the same Resolution mentions that the following data should be provided: "*The total number and type of FADs set by the supply vessel and purse seine fleet per quarter*".

119. This requirement is unclear and difficult to implement, and the SC recommended that the best solution would be to incorporate this information to the logbook, including a record for each FAD deployed, similarly to what is being done for the fishing sets. This would require a modification of the Resolution 07/03 "*on the recording of catch by fishing vessels in the IOTC area*" (changes proposed are in bold):

*POSITION (each set or midday): Use one line for each set (including negative ones)****, or each FAD deployed,*** *and note its position. If no set have been made and* ***FADs have not been deployed during the day****, note the position around midday. If necessary, information for one set can use several lines, without changing the general information (date and position).*

*SET/****DEPLOYMENT OF*** *FAD (Time): Indicate the time at the beginning of the set* ***or at the time the FAD was deployed****; if necessary, precise the time used on board (TU+ ??).*

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

120. The SC emphasized that the preparation of the Statistic summary should be considered as a priority and recommended that the corresponding costs are evaluated and incorporated to the next budget proposal for the Commission.

121. The SC expressed its satisfaction for the cooperation of the Secretariat with the SWIOFP and the IOC on their projects related to tuna and recommended that similar cooperation be explored in the Eastern Indian Ocean.

122. The recent activities of the IOTC-OFCF[2] Project during 2009 were described in the document IOTC-2009-SC-INF10.

123. The SC acknowledged the IOTC-OFCF Project for its ongoing contribution to the improvement of the quality of data collected in several countries of the region and noted that the project was supposed to come to an end in March 2010. The SC stressed the need for resources to be made available to continue this programme to improve data collection processes in the Indian Ocean fisheries and encouraged Japan to extend its funding.

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

7. EXAMINATION OF THE EFFECTS OF PIRACY ACTS ON TUNA FISHERIES IN THE WESTERN INDIAN OCEAN

124. Paper IOTC-2009-SC-10 presented various analysis in relation to the effects of piracy on the tropical tuna fishery. The paper shows that the piracy threat in the West Indian Ocean (WIO) has exhibited a dramatic and worrying increasing trend during the last 5 years, with numerous piracy acts and aggressions reported against numerous vessels. The situation culminated in 2008 with 115 events and will likely be worsen in 2009.The activities of industrial fleets have been severely affected after several hijacks of tuna fishing vessels. The mitigation has been of various forms, one of those being a spatial shift of fishing grounds to the east, in order to reduce the probability of getting in contact with Somali pirate vessels. Paper IOTC-2009-SC-10 is addressing this issue in comparing the trends of effort and yield for 3 fleets (longline Japan, longline Taiwan,China and European and Seychelles purse seine) in three distinct areas, the east African EEZs, a buffer zone and the rest of the west Indian Ocean region up to 75°E. Indeed, fishing activities that were undertaken in the East African EEZ have ceased and the fishing effort was redistributed progressively to the buffer zone and then more to the East.

125. The paper also shows a huge decline of fishing effort for Taiwan,China (-70% for 2005-2007) was observed in the region, whereas the decline was moderate for the purse seine fleet (-16% for 2007-2008) and the Japanese longline fleet (-18% for 2007-2008). For Japan, recent YFT CPUE decline is mostly due to decrease in catches and not a result of spatial shifts induced by piracy. The situation is very different for Taiwan,China, where the YFT CPUE decline is the result of a dramatic decline of fishing effort. The fleet has been reduced in size as the a result of the vessel reduction programme. For the purse seine fleet, a significant impact of piracy is noted as the fishing effort was redistributed to the east in 2008, but without any significant differences on CPUEs.

126. The SC acknowledged that the problem of Somali Piracy since 2007 has resulted in displacement of fishing vessels, reducing the effort but without a major reduction in catch rates. However, the SC noted that the piracy acts has seriously affected the scientific programs in the IO area; which has hampered the observers program actually in place in the EU fleet and various experiments expected under different project as well as SWIOFP activities.

127. Information was presented about the piracy situation in the Indian Ocean in relation to the purse seine fishery (IOTC-2009-SC-Info 23). Up to November 30th, more than 115 attacks have occurred in the Somali Basin, with 25 being successful. Compared to the situation in 2008 when most attacks concerned the Gulf of Aden, current attacks occur mainly in the Somali Basin, up to 900 miles of the coast and some within the EEZ of Seychelles. Since 2008, 24 attacks have concerned tuna fishing boats; 2 Spanish and 2 Thai purse seiners and one Taiwanese longliner have been hijacked. To face this danger and because the deployment of international forces cannot provide sufficient protection, fishing boats first fished outside a 500 miles zone of the Somali coast but since piracy spread across the EEZ of Seychelles, some purse seiners left the Indian Ocean and the remaining ones (including the supplies) are now embarking military (France) or private (Spain and Seychelles) protection teams. As a consequence there are problems of space and safety in the boats; which make impossible to send observers onboard. Protection teams are expected to stay onboard for some more months, until the piracy threat is substantially reduced, with a high probability this will not happen shortly.

128. A presentation to the SC by Seychelles attempted to summarise the changes in the fishing activities of EU and Seychelles purse seiners over the last few years and explore how much of that pattern could be related to the threat of piracy. Regardless the effects of the piracy in the fisheries, Seychelles stated that the piracy has negatively affected Seychelles economy by disrupting industrial fishing activity in the region. Tuna vessels are unloding in other ports thus, the material available for canneries in Seychelles were scarce. Moreover, 5 purser seiners have left the Indian Ocean in 2009 and fewer licenses for LL fishing vessels have been sold. The fishing activity of the semi-industrial fleet have also been impaired by piracy threat. Finally, the cost of Seychelles surveillance has greatly increased due to piracy activity around Seychelles waters.

129. The presentation was based on YFT catches and effort statistics during January to September of Seychelles based purse-seiners (EU and Seychelles flags). The number of fishing vessels as well as the number of fishing days decreased in 2009, from 51 to 46 PS and 8 % of fishing days, respectively. The total catches for YFT between January and September in 2009 were at lower levels similar to the levels of 2007-2008 and historical years. The length frequencies of 2009 catches show reduction in large yellowfin and an increase in small yellowfin. In the traditional YFT fishing area between 0-10°S, the catches were very low in comparison to previous years which may be not solely explained by piracy threats.

130. The change in the activity of the purse seiners due to piracy led them to unload in ports where less sampling is conducted and, therefore, this has had an negative impact in the level of sampling of catches from that fleet for that

period. Seychelles also stated that piracy acts has impeded to carry out some scientific surveys and experiments that were planned.

131. Kenya informed the SC that the piracy activity in Western Indian Ocean area has negatively affected the research and fishing activity of the country. The number of licenses for longliners and purse-seiners has reduced drastically lately..

132. Mauritius stated that although Mauritius is also greatly concerned about piracy activity in the West Indian Ocean the economy of the country has not been affected. In fact, the change of LL and PS activity led to increased port calls in Port Louis, Mauritius.

133. Thailand informed the SC that piracy activities had impacts on a Thai tuna purse-seiner while fishing in Seychelles waters in 2009 and that this vessel was hijacked.

134. China has also informed that it has been directly affected by Piracy especially when one of its vessel was hijacked. China also stressed that the observer program to be set up in 2010 might be affected by Piracy acts.

135. The SC was also informed that the Taiwan,China longliner fleet was affected by the piracy acts since many hijacking attempts were suffered. Fishing activities that were undertaken in the east African EEZ have decreased due to piracy. The number of vessels fishing in the whole IO has decreased due vessel reduction programmes, together with an earlier decrease in 2008 due to very high oil prices.

136. The SC was informed about the perception by the public media that piracy could play a positive role for the conservation of tuna resources, acting like an MPA. However, the issue of piracy is not only a matter related to fishing activities and conservation but mostly a worrying matter from the humanitarian point of view. Moreover, there are not clear signs that the piracy acts have been beneficial for the status of the stocks. Therefore, the SC agreed to make a strong statement highlighting the huge problem that IO is facing in relation to piracy and hopes that efficient political measures could emerge to mitigate this situation shortly.

8. STATUS OF IOTC STOCKS AND ASSOCIATED SPECIES

137. A table summarising the status and management advice relating to the IOTC species is provided in the Executive Summary of this report (Page 4).

8.1 MANAGEMENT ADVICE FOR TUNAS

138. The Executive Summaries for bigeye and yellowfin were adopted by the SC (Appendix VI), noting they have been modified to include the results of stock assessments undertaken in 2009 and the advice and recommendations have changed.

139. The Executive Summary for skipjack was adopted by the SC (Appendix VI), noting they have been amended slightly to reflect the latest available catch data, and the advice and recommendations have changed to concerns of the SC.

140. The Executive Summary for albacore was adopted by the SC (Appendix VI), noting it has been amended slightly to reflect the latest available catch data, but the advice and recommendations remained unchanged

8.1.1 ALBACORE TUNA (*Thunnus alalunga*)

Current status

141. Based on the preliminary analyses undertaken in 2008 there are no indications that that the albacore stock is over-fished (B2007/Bmsy >1) and overfishing is currently likely not occurring for the scenarios envisaged. Point estimates of MSY ranged from 28,260 t to 34,415 t. This indicated that continuous annual catches at a level approaching 38,000 t (equivalent to the historically high level of catch experienced over the period 1998 to 2001) may not be sustainable in the long term.

142. Albacore catches have been around 27,900 t annually over the past five years (2004-2008) and this level is only slightly higher than the historical average annual catch taken for the past 50 years (22,800 t). Other fisheries-based indicators show considerable stability over long periods. The mean weight of albacore in the catches has remained relatively stable over a period of more than 50 years. Furthermore, the average weight of albacore in the

Indian Ocean is higher than that reported in the other oceans and is likely to result in a higher yield per recruit. The catch rates of albacore have also been stable over the past 20 years.

143. Because of the low value and, as a likely result, low profitability of the albacore longline fishery compared to the fisheries for other tuna species, there is likely to be very little incentive for an increase in fishing effort on this species in the immediate future.

144. On balance of the information available, albacore is not considered to be overfished and overfishing is not occurring.

Recommendation

145. The SC acknowledges the preliminary nature of the albacore tuna assessment in 2008, but on balance of the available stock status information considers that the status of the stock of albacore is not likely to change markedly over the next 2-3 years and if the price of albacore remains low compared to other tuna species, no immediate action should be required on the part of the Commission.

146. The SC recommended that a new albacore tuna assessment be presented to the Scientific Committee at the latest in 2011.

8.1.2 BIGEYE TUNA (*Thunnus obesus*)

Current status

147. The results of the stock assessments conducted in 2009 were broadly similar to previous work. The preliminary estimate of catches in 2008 (107,000 t) is below the current estimate of MSY (110,000 t), catches in the past (1997-1999) have significantly exceeded MSY.

148. Estimated values of fishing mortality and SSB for 2008 are also close to MSY-related values, indicating a fully exploited stock.

Outlook

149. Recent changes in the areas fished by purse seiners do not appear to have had an effect on mortality for juvenile bigeye, despite the decrease in effort in the Somali basin where fishing on FADs usually caught the majority of juvenile bigeye.

Recommendation

150. The indices of abundance from two longline fleets available for this stock present divergent trends over the last few years, the differences observed in targeting are not fully explained.

151. The SC recommended that catches of bigeye tuna should not exceed the estimated MSY of 110,000t.

8.1.3 SKIPJACK TUNA (*Katsuwonus pelamis*)

Current status

152. The high productivity and life history characteristics of skipjack tuna suggest this species is resilient and not easily prone to overfishing. However, the analysis of some indicators of stock status for recent years suggests that the situation of the stock should be closely monitored in 2010.

Recommendation

153. Given the limited nature of the work carried out on the skipjack in 2009, no new advice is provided for the stock.

8.1.4 YELLOWFIN TUNA (*Thunnus albacares*)

Current status

154. Estimates of total and spawning stock (adult) biomass continue to decline (figure 12), probably accelerated by the high catches of 2003-2006. It appears that overfishing occurred in recent years, and the effect on the standing stock is still noticeable as biomass appears to be decreasing despite catches returning to pre-2003 levels.

155. The MSY has been estimated to be 300,000 t, if steepness of the stock recruitment relationship is assumed to be 0.8. The preliminary estimate of 2008 catch (322,000 t) is above the current estimate of MSY while annual catches over the period 2003-2006 (averaging 464,000 t) were substantially higher than all estimated values of MSY.

156. The most recent estimate of biomass (2007), noting that the 2008 estimate was considered uncertain to base this year's management advice, is above the MSY-related reference value, while fishing mortality levels are estimated to be above those linked to MSY catches. Preliminary estimates for 2008 show the stock could be below the SSB at MSY value and the fishing pressure might be even higher than in 2007.

157. Various indicators of catch rates for different fleets and areas appear to confirm this downward trend in abundance. Catches in 2008 for longliners operating in the Arabian Sea, for example, are at a historic low.

158. Two hypotheses have been put forward in the past to explain the very high catches in the 2003-2006 period: (i) an increase in catchability by surface and longline fleets due to a high level of concentration across a reduced area and depth range, and (ii) increased recruitment over the 1999-2001 period. Recent analyses of environmental and oceanographic conditions appear to be consistent with the first hypothesis, which would mean that the catches probably resulted in stock depletion. Environmental anomalies also appear to be a factor linked to the lower catches in 2007.

Outlook

159. The preliminary catch estimates for 2008 (318,400 t) is slightly lower than the average catch taken in the 1998-2002 period (336,000 t) i.e. preceding the 2003 to 2006 period when extraordinarily high catches of yellowfin were taken. While there is uncertainty about future catches, recent events in 2008 and 2009 where some vessels have left the fishery, together with fleets avoiding the historically important fishing grounds in the waters adjacent to Somalia for security reasons, may reduce catches in the short-term to below the pre-2003 levels. The SC noted that a return to a normal fishing scenario may result in increased effort levels, leading to catches above MSY.

160. Fishing mortality has recently exceeded the MSY-related level (figure 13) therefore some reduction in catch or fishing effort would be required to return exploitation rates to those related to MSY. The SC considers that the stock of yellowfin has recently been overexploited and is probably still being overfished. Management measures should be considered that allow an appropriate control of fishing pressure to be implemented.

Recommendation

161. The current estimate of MSY is 300,000 t, lower than the average catches sustained over the 1992-2002 period of around 343,000 t. The high catches of the 2003-2006 period appear to have accelerated the decline of biomass in the stock, which might be currently unable to sustain the 1992-2002 level of catches.

162. The SC recommended that catches of yellowfin tuna should not exceed the estimated MSY of 300,000 t.

163. The SC recommends that monitoring and data collection be strengthened over the coming year to be able to more closely follow the stock situation.

8.1.5 SOUTHERN BLUEFIN TUNA (*Thunnus maccoyii*)

164. The SC noted the contents of a report on the biology, stock status and management of southern bluefin tuna (IOTC-2009-SC-INF11) and thanked CCSBT for providing it.

8.2 *MANAGEMENT ADVICE FOR BILLFISH*

165. The Executive Summary for swordfish was adopted by the SC (Appendix VI), noting that it has been modified to include the results of stock assessments undertaken in 2009. Therefore, the advice and recommendations have changed.

166. Executive Summaries for black marlin, blue marlin, striped marlin and Indo-Pacific sailfish were adopted by the SC (Appendix VI), noting that it has been slightly modified to reflect the latest available catch data, and the advice and recommendation have been slightly modified.

8.2.1 SWORDFISH (*Xiphias gladius*)

Current status

167. The longline Japanese and Taiwanese CPUE series have conflicting trends, with the Japanese (by-catch) fleet suggesting substantial decline in abundance prior to ~2000, and the Taiwanese (targeted) fleet suggesting stable abundance over this period.

168. The stock status reference points from the range of models vary considerably, but a number of general consistencies were evident. Given the limitations identified for each model, and the uncertainties associated with

the data inputs, the SC felt that restricting the management advice to a single model would lead to an understatement of the uncertainty. This summary attempts a qualitative summary across models and data-based indicators.

169. The annual average sizes of swordfish in the respective Indian Ocean fisheries are variable but show no trend. It was considered encouraging that there are not yet clear signals of declines in the size-based indices, but these indices should be carefully monitored. It was noted that since females mature at a relatively large size, a reduction in the biomass of large animals could potentially have a strong effect on the spawning biomass.

170. When the current stock status estimates are compared among models, it is evident that there is a large degree of uncertainty. In recognition of the fact that MSY-related reference points are often difficult to quantify reliably, a number of management agencies prefer to use depletion-based biomass stock status indicators. Most approaches suggest that MSY could reasonably be in the range of ~28-34,000 tonnes, though this is the lower end of the range for some models and the upper end of the range for others. Similarly, all approaches suggest that depletion could be in the range of B_{2007}/B_0=0.4 – 0.5, though again this may be an upper or lower end of the plausible range depending on the model. Comparison across models suggest that current catches are probably near MSY (and F is probably near F_{MSY}), but could be somewhat above or below.

171. The apparent fidelity of swordfish to particular areas is a matter for concern as this can lead to localised depletion. The CPUE of the Japanese fleet in the south west IO has the strongest decline of the four areas examined in 2009; furthermore, the La Reunion CPUE series shows a declining trend in this area over the last 10 years. In previous years, localised depletion was inferred on the basis of decreasing CPUEs following fine-scale analyses of the catch and effort data. Therefore the SC cannot discount the possibility that localised depletion is still occurring in some areas. Localised depletion has occurred in other parts of the world where swordfish have been heavily targeted

Recommendation

172. Given the general recent declining trend in all the CPUE series, and the fully exploited status of the stock, the WPB expects that abundance will likely decline further at current effort levels, especially considering that the issue of increases in efficiency has not been fully addressed in the current standardization. When combined with the uncertainty in the assessment, the WPB considers that there is a reasonably high probability that common target and limit reference points (*eg.* B_{MSY}, $0.4B_0$) may be marginally exceeded, and this probability will increase over time if effort remains at current levels or increases further. Precautionary measures such as capacity control or catch limits will reduce the risk of creating an overcapacity problem or increasing the risk of exceeding common biomass limit reference points.

173. The SC recommended that catches of swordfish should not exceed the estimated MSY of 33,000t.

8.2.2 BLACK MARLIN (*Makaira indica*)

Current status

174. No quantitative stock assessment on black marlin in the Indian Ocean is known to exist and no such assessment has been undertaken by the IOTC Working Party on Billfish. However, a preliminary estimation of stock indicators was attempted on the longline catch and effort datasets from Japan and Taiwan,China that represent the best available information. Nominal CPUE exhibited dramatic declines since the beginning of the fishery in two major fishing grounds (West Equatorial and north-west Australia) and the catches in the initial core areas also decreased substantially. However, there is considerable uncertainty about the degree to which these indicators represent abundance as factors such as changes in targeting practices, discarding practices, fishing grounds and management practices are likely to interact in the depicted trends.

175. Further work must be undertaken to derive some stock indicators for this species, because in the absence of a quantitative stock assessment, such indicators represent the only means to monitor the status of the stock and assess the impacts of fishing.

Recommendation

176. No quantitative stock assessment is currently available for black marlin in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

8.2.3 BLUE MARLIN (*Makaira nigricans*)

Current status

177. No quantitative stock assessment on blue marlin in the Indian Ocean is known to exist and no such assessment has been undertaken by the IOTC Working Party on Billfish. However, a preliminary estimation of stock indicators was attempted on the longline catch and effort datasets from Japan and Taiwan,China that represent the best available information. Nominal CPUE exhibited dramatic declines since the beginning of the fishery in two major fishing grounds (West Equatorial and north-west Australia) and the catches in the initial fishing grounds areas also decreased substantially (Figures 3, 4 and 5). There is considerable uncertainty about the degree to which those indicators represent abundance as factors such as changes in targeting practices, discarding practices, fishing grounds and management practices are likely to interact in the depicted trends.

178. Further work must be undertaken to derive some stock indicators for this species, because in the absence of a quantitative stock assessment, such indicators represent the only means to monitor the status of the stock and assess the impacts of fishing.

Recommendation

179. No quantitative stock assessment is currently available for blue marlin in the Indian Ocean, and due to a lack of data for several gears, only preliminary stock indicators can be used. . Therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

8.2.4 STRIPED MARLIN (*Tetrapturus audax*)

Current status

180. No quantitative stock assessment on striped marlin in the Indian Ocean is known to exist and no such assessment has been undertaken by the IOTC Working Party on Billfish. However, a preliminary estimation of stock indicators was attempted on the longline catch and effort datasets from Japan and Taiwan,China that represent the best available information. Nominal CPUE exhibited dramatic declines since the beginning of the fishery in two major fishing grounds (West Equatorial and north-west Australia) and the catches in the initial core areas also decreased substantially (Figures 3, 4 and 5). There is considerable uncertainty about the degree to which those indicators represent abundance as factors such as changes in targeting practices, discarding practices, fishing grounds and management practices are likely to interact in the depicted trends.

181. Further work must be undertaken to derive some stock indicators for this species, because in the absence of a quantitative stock assessment, such indicators represent the only means to monitor the status of the stock and assess the impacts of fishing.

Recommendation

182. No quantitative stock assessment is currently available for striped marlin in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used .Therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

8.2.4 INDO-PACIFIC SAILFISH (*Istiophorus platypterus*)

Current status

183. No quantitative stock assessment on Indo-Pacific sailfish in the Indian Ocean is known to exist and no such assessment has been undertaken by the IOTC Working Party on Billfish.

Recommendation

184. No quantitative stock assessment is currently available for Indo-Pacific sailfish in the Indian Ocean, and due to a paucity of data there a no stock indicators that are considered to be reliable, therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

8.3 MANAGEMENT ADVICE ON THE STATUS OF NERITIC TUNAS

185. The Executive Summaries for narrow-barred Spanish mackerel, kawakawa, bullet tuna, longtail tuna, frigate tuna and Indo-Pacific king mackerel were adopted (Appendix VI), noting that they have been amended slightly to reflect the latest available catch data, but the advice and remains unchanged.

8.3.1 BULLET TUNA (*Auxis rochei*)

Current status and recommendation

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

187. The SC recommended that bullet tuna be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

8.3.2 FRIGATE TUNA (*Auxis thazard*)

Current status and recommendation

188. No quantitative stock assessment is currently available for the frigate tuna in the Indian Ocean, therefore the stock status is uncertain. This species is a relatively productive species with high fecundity and rapid growth and this makes it relatively resilient and not prone to overfishing. Nevertheless, frigate tuna appears to be an important prey species for other pelagic species including the commercial tunas.

189. The SC recommended that frigate tuna be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

8.3.3 INDO-PACIFIC KING MACKEREL (*Scomberomorus guttatus*)

Current status and recommendation

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

191. The SC recommended that indo-pacific king mackerel be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

8.3.4 KAWAKAWA (*Euthynnis affinis*)

Current status and recommendation

192. No quantitative stock assessment is currently available for kawakawa in the Indian Ocean, therefore the stock status is uncertain. The SC notes the decline in the catches since 2002. However, the reasons for this are not clear: it may be problem related to reporting, or it may be a normal fluctuation in the fishery — a similar decline occurred in the early 1990's.

193. The SC recommended that kawakawa be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

8.3.5 LONGTAIL TUNA (*Thunnus tonggol*)

Current status and recommendation

194. No quantitative stock assessment is currently available for longtail tuna in the Indian Ocean, therefore the stock status is uncertain. The SC notes the catches of longtail tuna are increasing.

195. The SC recommended that longtail tuna be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

8.3.6 NARROW-BARRED SPANISH MACKEREL (*Scomberomorus commerson*)

Current status and recommendation

196. No quantitative stock assessment is currently available for narrow-barred Spanish mackerel tuna in the Indian Ocean, therefore the stock status is uncertain. The SC notes that Spanish mackerel is a relatively productive species with high fecundity and this makes it relatively resilient and less prone to overfishing.

197. The SC recommended that narrow-barred Spanish mackerel be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

8.4 MANAGEMENT ADVICE ON SHARKS

198. Executive Summaries for blue, silky, oceanic whitetip, shortfin mako, and scalloped hammerhead sharks were adopted, noting that they have been amended slightly to reflect the latest available biological information, however, the stock status and management advice remains unchanged. (Appendix VI).

199. Following a proposal of amendment to Resolution 08/04 "Concerning the recording of the catch by longline fishing vessels in the IOTC area", on the modification of the list of sharks species to be recorded in the logbooks, the SC noted that, if new species are added to the Resolution, the respective executive summaries should be developed by the WPEB.

8.5 MANAGEMENT ADVICE ON SEA TURTLES

200. An Executive Summary for marine (sea) turtles (green, hawksbill, leatherback, loggerhead, olive ridley and flatback turtles) was adopted, noting that they have been amended slightly to reflect the latest available biological and general historical information on exploitation patterns, as well as the addition of the key elements of Resolution 09/06 relating to data collection and reporting, handling and mitigation measures, however, the stock status and management advice remains unchanged. Executive Summaries for sea turtles have been slightly modified to include new information (Appendix VI).

Current status and recommendation on sea turtles

201. While the status of sea turtles is affected by a range of factors such as degradation of nesting beaches and targeted harvesting of eggs and turtles, the level of mortality of sea turtles due to capture by gillnets and to a lesser extent purse seine fishing and longline is not known. Notwithstanding this, it is acknowledged that the impact on sea turtle populations from fishing for tuna and tuna-like species may increase if fishing pressure increases, or if the status of the sea turtle populations worsens due to other factors such as anthropogenic or climatic impacts.

Other matters on sea turtles

202. Noting that in Resolution 09/06 'on marine turtles' the term 'hard shelled' turtle is used when outlining recommendations on handling practices for marine turtles, concern was raised that this term could potentially be read to exclude leatherback turtles, given that they are described both in the scientific literature and the Executive Summary on Marine Turtles as a 'soft shelled' turtle.

203. The SC agreed that Resolution 09/06 does apply to leatherback turtles, in its entirety. Consideration was given to modifying Resolution 09/06, however, the SC recommended that although the term 'hard shelled' needs to be removed from resolution 09/06, this should be left until the next major revision of the Resolution.

8.6 MANAGEMENT SEABIRDS

204. An Executive Summary for seabirds was adopted by the SC for the first time in 2009 (Appendix VI), outlining the current state of knowledge for seabird distributions, the current understanding of interactions between IOTC fisheries and seabirds, current management concerns, management measures currently in place by the IOTC to enhance the conservation of seabirds, and gaps in our knowledge of fishery impacts with seabirds.

Other matters on seabirds

205. The SC reiterated its support for extending the area in which longliners are required to use mitigation measures further north to latitude 25°S, based on the new information on the distribution of juvenile albatrosses and petrels, as outlined in the Executive Summary for seabirds.

206. BirdLife International provided the SC with an overview of their 'Mitigation Fact-sheets'. The SC noted that these information sheets have been developed in collaboration with a wide diversity of scientists, fishery managers and fishers. They represent current best practice for major seabird bycatch mitigation measures in demersal and pelagic longline fisheries and in trawl fisheries. Future revisions are anticipated as research demonstrates refinements, improvements, or efficacy of these measures. In addition new technologies for avoiding seabird

bycatch will be included in future versions of the mitigation fact-sheets, once there is strong empirical evidence for their practical utility and effectiveness.

207. The SC discussed the utility of the Mitigation Fact-sheets and encouraged all Members and Cooperating Non-Contracting Parties to ensure that the Fact-sheets are communicated to fishers and fishery managers, so they can better understand how to prevent interactions with seabirds throughout the IOTC area of competence.

9. ACTIVITIES IN RELATION TO THE INDIAN OCEAN TUNA TAGGING PROGRAMME

208. The SC was given an update on the tagging activities supervised by the Secretariat. In 2005, the RTTP-IO started under a funding of the 9th European Development Fund from the European Commission. The tagging activities undertaken onboard the two vessels chartered for the RTTP-IO were completed in September 2007. In total 168,163 fish (32% yellowfin, 21% bigeye, 47% skipjack) were tagged and released in the western Indian Ocean, in the area from the Mozambique Channel to the coast of Oman. This represented more than twice the minimum number initially proposed for the project (80,000) and higher than expected numbers of yellowfin tuna and bigeye tuna (which were the main target species of the programme) were recaptured. To-date 27,505 tunas have been recovered mostly by the purse-seine fleet based in Seychelles (95%) but also by artisanal fishermen in Comoros, Tanzania, Yemen, Oman, South Africa. In total, 250 recoveries have been also reported onboard the different longline fleet operating in the Indian Ocean which represent 1% of the total number of recovery. However, the proportion of recovery by this gear has been increasing from 0.1% in 2006 to 4.7% in 2009. The number of recoveries in 2009 (832) was much lower than those obtained in 2006 (7750), 2007 (14152) and 2008 (4523). Preliminary analysis of the data seems to indicate a rapid and good mixing rate of the tagged fish with the wild population.

209. To complete the RTTP-IO in the Eastern Indian Ocean, the government of Japan funded a range of small-scale projects which ended with a workshop in Maldives in May 2009; including, activities in Indonesia, the Andaman Islands (India) and Maldives.

210. The SC endorsed the recommendation of the WPTT that all tagged yellowfin being recovered from purse-seiner should be made available to scientist in order for them to identify their sex and sample their otoliths. This should allow determining if growth and mortality of male and female yellowfin are identical, as these parameters are important for stock assessment model such as MFCL.

211. The SC was informed that all the tagging data held at the Secretariat, which includes data from the RTTP-IO, from the pilot and small-scale projects and from historical tagging projects in the Indian Ocean (*eg.* Maldives), are in the process of being merge in one database and will be available to all scientists on request to the Secretariat.

212. The SC expressed its congratulations to the team of the RTTP-IO and to the Secretariat for the success of the IOTTP, and for the quality of the tagging data gathered by the project. The SC noted that so far, tagging data was used in the yellowfin stock assessment in 2008 and 2009, recognized that these data was not yet fully analysed and recommended that full utilization of these data is made in the near future.

213. The SC recalled that a symposium dedicated to the IOTTP should be organized in 2011 in order to present a range of advanced analyses of the tagging data.

10. DISCUSSION ON THE IMPLEMENTATION OF THE OBSERVER REGIONAL SCHEME

214. The Secretariat presented a brief summary of the implementation of the observer regional scheme. The Secretariat explained the scope and objectives of the observer regional scheme as outlined in Resolution 09/04, in which the Commission requested that “basing on the experience of other Tuna RFMOs, the Scientific Committee will elaborate an observer working manual, a template to be used for reporting (including minimum data fields) and a training program at its 2009 session”. The SC was informed that IOTC holds the responsibility to elaborate a common framework whereas the implementation of the programme itself is under the responsibility of the CPCs, although some regional initiative may assist. In this regards and through a consultancy, the Secretariat prepared a framework for the development of observer manuals, reporting templates and training programmes (IOTC-SC-2009-08).

215. The SC recognised the high standard of the document but also noted that the work presented was very ambitious and might be difficult to implement practically especially for CPCs that are lacking capacity. The framework also does not pay enough attention to the existing schemes developed on ongoing observers

programmes and this would be an additional difficulty to adjust. The SC also highlighted that piracy activities in the western Indian Ocean will interfere with the implementation of such programmes.

216. Maldives in particular commented that it would be very difficult to meet the requirements of 5% of coverage due to financial limitation as the CPCs are responsible for the implementation of the programme. The SC recognized the unique character of the Maldivian pole-and-line fishery and commented that a well-managed sampling programme could provide the desired information for this particular fishery. However, this issue should be raised at the Commission level.

217. The SC highlighted that cooperation should be developed with other RFMOs that have already gone through this identification process for an regional observer scheme.

218. In this perspective, the SC recommended that CPCs provide comments on the proposed framework to the Secretariat by the 15th January 2010. The Secretariat will then compile and organise those information in a document to be circulated at the latest by the 15th February. The goal is to produce a consolidated document to be submitted to the Commission in March 2010.

219. The SC recommended that, taking into account the time constraints, the comments expected should focus on (i) the nature and scope of the framework proposed and (ii) the minimum set of field to be collected at the start of the regional observer program.

220. The SC also recommended that a technical meeting be held after the Commission meeting if it endorses the proposed process so that practical issues for implementation and training of observers be addressed without delay.

11. Schedule of Working Party meetings in 2010 and preliminary plan for 2011

221. The SC agreed to the following schedule of working party meetings for 2010 and recommended that it be put before the Commission for endorsement.

Working Party	Date and place	Major topics to be covered
Billfish	12 – 16 July (5 days), Seychelles.	• Stock assessment for swordfish • Review stock indicators for marlins and sailfish
Tropical Tunas	18 to 25 October (7 days), Seychelles	• Stock assessment for yellowfin tuna • Stock assessment for skipjack tuna • Stock assessment for bigeye tuna • External analyses from tagging data
Fishing Capacity	26 October (1 day), Seychelles	• Development of input-based capacity measures
Ecosystems and Bycatch	27 to 30 October (4 days), Seychelles	• Review data available at the Secretariat • Review availability of observers data • Analysis of new information on sharks, seabirds, sea turtles and sea mammals • Development of stocks indicators for sharks • Consideration of ecosystem approaches (including ERA)
Data Collection and Statistics	3 to 4 December (2 days), Seychelles	• Review statistics held by the Secretariat • Propose ways of improving statistics quality
Neritic tunas	To be advised (April – May), Iran	-

222. The SC recommended the venue of the technical meeting regarding the Regional Observer Programme scheme to be held between April and May 2010 for 3 to 5 days.

223. For 2011, the SC recommended that the WPB, WPEB, WPTT, WPFC, WPTe, WPDCS and WPN meet.

12. Other matters

12.1 ACTIVITY REPORT ON THE LONGLINE FLEET FROM TAIWAN,CHINA

224. Invited experts summarized recent fisheries by the tuna fleet of the Taiwan,China (IOTC-2009-SC-INF25). There are two fleets in Taiwan China, large-scale and small-scale tuna longline fleets, operating in the Indian Ocean. In 2008, the number of active large-scale longline vessels was 182, reaching the lowest level since 2001, and the average active vessel number of small-scale longliners in 2006 through 2008 was about 460. The annual catches of tuna and tuna-like species declined significantly, to about 40,000-70,000 MT in 2006 and 2008 period. The 2008 bigeye, yellowfin and albacore catches by small-scale longline fishery in the Indian Ocean were about 3,700 MT, 9,500 MT and 12,000 MT, respectively. The port site sampling program has been conducted in Port Louis since 2006 to collect albacore length data. In 2008, there were 14 observers dispatched to fishing vessels in the Indian Ocean. Fisheries Agency established a taskforce to collect fishery data of small scale tuna longline vessels in 2006.

12.2 ACTIVITIES ON TUNA BY FAO

225. The SC was informed that the process of the re-organization of FAO and its Fisheries and Aquaculture Department continues and of recent activities of FAO and particularly of the Fisheries Management and Conservation Service, which are of relevance to tuna and tuna-like species. This includes:

- the re-organization and enhancement of the very scattered information on tuna and tuna-like species in the FAO's Fisheries & Aquaculture Department website to allow an easy access to information on (i) tuna resources, (ii) tuna fisheries and utilizations and (iii) FAO activities on tuna,
- an update of the global data bases of (i) tuna catches by species, FAO statistical area and year, (ii) tuna catches by species, stock, fishing gear and year and (iii) tuna catches by species, fishing gear, 5x5 degree catches, year and quarter,
- the completion of (i) the Proceedings of the Workshop to Further Develop, Test & Apply a Method for the Estimation of Tuna Fishing Capacity from Stock assessment-Related Information (La Jolla, CA, USA, May 2007) and (ii) the related primary publication,
- general reviews on the following subjects (being completed, in progress, initiated or planned):
  - biological characteristics of tuna and tuna-like species,
  - historical perspective on the status of tuna resources,
  - past and future challenges of tuna fisheries management,
  - recent trends in the tuna industry,
  - by-catches of tuna fisheries and
  - marine resources of Pacific islands.

226. The SC noted that the last Session of FAO`s Committee on Fisheries (COFI) was held in early March 2009. The relevant issues to tuna and tuna-like species that were discussed include:

- the implementation of the Code of Conduct for Responsible Fisheries and the related International Plans of Action,
- combating IUU fishing,
- securing sustainable small-scale fisheries and
- the impact of climate change on fisheries & aquaculture.

12.3 DISCUSSION ON IMPROVING/UPDATING FORMATS FOR THE PROVISION OF ADVICE

12.3.1 DATA SUMMARIES, FACT SHEETS

227. The SC was informed by the Secretariat on modifications to improve a range information outputs, including "data summaries". Previous hardcopy document will be replaced by a dynamic information system available from the IOTC website. In 2008, SC recommended the production of facts sheets on each stock available from the website and this work should be included in the new version of the IOTC website in 2010.

12.3.2 ACCESS TO DOCUMENTS (IOTC, IPTP) AND IOTC WEBSITE

228. The Secretariat informed the SC that the IPTP documents for over 20 years were scanned and are available at request to the Secretariat. They should be available on the IOTC website in the near future. In addition,

IPTP/IOTC documents have been included into the ASFA database. The SC requested that update of documents into the ASFA system be made regularly.

229. The SC noted the lack of homogeneity in the National Reports presented this year and recommended that the template for submission of National Reports to the SC should be revised to improve consistency in information presented and simplify reporting requirements by CPCs.. However, it was agreed that such template should have some flexibility to accommodate different situations among countries. The Secretariat will prepare and circulate a draft template for further review and approval, in order to use a new and agreed template for the submission of National Reports at the next SC meeting.

12.4 EU PROJECT TXOTX (TECHNICAL EXPERTS OVERSEEING THIRD COUNTRY EXPERTISE) - UPDATE

230. The SC was presented with an update on the three year TXOTX project that started in 2008. The project is supporting the development of a network of fisheries research initiatives with the aim to improve coordination of research programmes in different areas. The network is expected to increase knowledge on fisheries resources in support to the formulation of scientific and technical advice and should improve dialogue between research communities, policy makers and stakeholders in the concerned geographic areas. One of the case studies is focused on tuna RFMOs, including IOTC, which will help to map the research and funding scheme that is being carried out by different bodies. The first phase of the project, regarding data gathering, will end at the end of 2009 and the synthesis of this data compilation will be presented for discussion during the 1st workshop of the project to be held in January 2010 in London. This workshop will bring together international experts with experience of different RFMOs, international agencies and other stakeholders, who will share with the project partners their knowledge on research, networking, and fisheries management. This workshop will (i) review the data gathered to date and the methodologies applied in collection, analysis, dissemination and management procedures in support of scientific advice to fisheries management, (ii) identify research needs and key issues in the development of regional collaboration/networking.

12.5 EU PROJECT MADE (MITIGATING ADVERSE ECOLOGICAL IMPACTS OF OPEN OCEAN FISHERIES) - UPDATE

231. The SC was updated on the activities/results of the EU MADE project after its first year of implementation in the Indian Ocean: design of ecological FADs, assessment of changes of pelagic habitat due to the release of drifting FADs, spatio-temporal maps of densities of FADs, first electronic tagging on tuna at anchored FADs (Maldives) and sharks (Seychelles), collection of biological data on pelagic sharks, first experimental longline sets, development of ecological based artificial bait. These activities will continue in 2010, but field activities must be adapted to the piracy issue. As a consequence, some activities will be done in the Atlantic ccean.

12.6 IUCN RED LIST WORKSHOP ON TUNA AND BILLFISH (30 NOVEMBER – 4 DECEMBER 2009)

232. The SC was informed that the IUCN is currently holding a red list workshop on tuna and billfish. This evaluation concern tuna and billfish of the Central and Western Pacific and Indian Ocean. The SC regretted that the concerned RFMOs were not notified or invited to this workshop and hoped that they will be invited for further work.

233. The SC was briefed on the criteria used by the IUCN for the red list classification and it noted that those criteria were very different from that used by the tuna RFMOs. IUCN is mainly using the rate of decline of a population while RFMOs are using the status of the stock, which seems to be more pertinent.

12.7 SOUTH WEST INDIAN OCEAN FISHERIES PROJECT - UPDATE

234. . This project is for 5 years with 9 countries involved (the five island countries of the IOC and the east african coastal states) and it has just completed its first year of implementation. SWIOFP encompasses various fisheries, crustacean, demersal and pelagic and also a biodiversity component. IOTC is closely related with the pelagic component of SWIOFP addressing some of the research issues addressed by the SC (*i.e.* movements of swordfish) and also with the biodiversity component with the issue of bycatch. A fisheries atlas is also to be developed and links with IOTC are obvious with respect to pelagic fisheries. Gap analyses were developed in the year 1 of the project and now, those gaps are going to be addressed by surveys at sea using research and commercial fishing vessels. Research grants will also be given to young scientists in the region who will be assisted by senior scientists Training observers will take place and 50 observers will be deployed in the following year. A coordination will be set up with the regional observer scheme of the IOTC. SWIOFP is also financing the participation of regional scientists to the IOTC Working Parties and the SC. Up to now, only limited number of

scientists has been sent due to various confinements. The recent piracy threat is dramatically affecting the workplan of surveys.

12.8 Cooperation with the South West Indian Ocean Fisheries Commission on climate change

235. . Several bodies of the region are tackling the increasing concern of the impact of climate change on coastal and offshore fisheries, and cooperation is needed to produce integrated studies. The SWIOFC held a special session on climate change and fisheries at its last session (September 2009). Presentations on the climatology and oceanography of the West Indian Ocean in a context of changing climate were made. Warmer anomalies are expected in the southern Indian Ocean and shallower thermoclines in the equatorial region. Vulnerability of marine coastal communities to the impact of climate change was also considered in order to assess the potential adaptability of the coastal fisheries. Provided the high variability of the impacts on the habitats, the various marine species and the economic sectors among countries, the SWIOFC sought collaboration with the IOTC SC through a working group that would study climate changes on fisheries.

236. . The SC considers that an understanding of ecosystem dynamics is important in the application of the ecosystem approach to management of tuna fisheries. In particular, the consequences of climate change will manifest globally and, therefore, will require a global effort to understand them. The SC welcomes the invitation to cooperate with scientists from SWIOFC on the subject, recognizing that it is a complex subject that will require the collaborating of all the scientific community interested in Indian Ocean matters.

12.9 Discussion on MPAs in the high seas related to conservation of tuna

237. . A document (IOTC-2009-SC-INF 18) was presented to initiate a discussion on the relevancy of MPAs as management measures for the conservation of tuna. This followed on work initiated at the 2009 WPTT. Given the highly migratory nature of tuna that is particularly highlighted in the Indian Ocean by the results of the IOTC tagging project, MPAs, to be an effective tool for management, have to cover large areas. Some authors consider this would require closing half of the area of distribution of the species. Alternatively, targeted MPAs can be designed with the aim of protecting spawning aggregations, known concentration of protected, endangered or threatened (PET) species or diversity hotspots. In the case of tunas, closure of feeding area or spawning and nursery area might be useful but they would need to be extensive.

238. The SC recommended that IOTC should actively engaged with research initiatives on MPAs.This issue is now common at a global scale amongst various management bodies and research institutions. Furthermore, the SC noted that the context for pelagic MPAs is very different than that of coastal MPAs and requires further research.

239. The SC was informed that several research projects dealing with MPA are underway through European or French funding in the Indian Ocean and outcomes of those projects will contribute to a better understanding of the dynamics of PET or tuna species with respect to area closures.

240. The SC also noted that, if a large MPA in the high sea is implemented, significant enforcement cost will be incurred in order to reach an effective level of surveillance. There will also be significant social and economic factors that should be considered.

241. Mauritius stated that the setting of any MPA should be based on sound scientific evidences and should take into account social and economic aspects as stated by Mauritius in paragraph 31.

242. The SC agreed with the considerations raised in the document presented on this matter.

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

243. The Scientific Committee recommended that its Thirteenth Session be held from 6 to 10 December 2009 in Seychelles and asked the Commission to consider holding its annual session not more than three months after this time in order to be able to receive the most up-to-date advice and implement management measures in a timely fashion.

13. Summary of Recommendations made in 2009

13.1 Recommendations – on data and research

244. The following recommendations relate mainly to data and research the activities of the working parties and national scientists and should be considered as priority items compared to the complete list of data and research activities recommended by the working parties (Appendix IV).

1. The SC noted that no written report of the Secretariat activities was available for the meeting. The SC recommended that such report be produced at the next sessions of the SC. (paragraph 9)

2. The SC recognised the valuable contribution that these experts made to the outcomes of the meeting and recommended that similar arrangements be continued in the future. (paragraph 13)

3. The SC recommended that size frequency distribution of the Korean tuna catch be distributed by 2cm instead of 5cm interval, and that this data be separated when coming from onboard observers or port samplers. (paragraph 22)

4. The SC noted that there were differences in the size frequency distribution of skipjack between Thai and EU purse-seiners while the vessels are fishing in the same area, and recommended that Thai ad EU scientists cooperate to identify the cause of these discrepancies. (paragraph 24)

5. The SC recommended that effort be made in the identification of bigeye tuna which is not separated from yellowfin at the moment, and was informed by Maldives that new logbook following IOTC standard are being developed at the moment to address this matter (paragraph 32)

6. The SC recommended that the WPB continues its work on standardisation of abundance indices and in particular undertakes an in-depth spatial analysis of biomass and fishing intensity patterns, as concentration of effort can occur on productive fishing grounds, producing high catches and low CPUE. The SC also recommended that more detailed analyses on the large decline in the south-west area be undertaken. (paragraph 41)

7. The SC reiterated its recommendation that work on stock indicators of other billfish species such as marlins and sailfish be continued as no stock assessments or robust CPUE indices are available. The SC recognised that further work is needed on this matter and recommended that a programme of research be initiated to address this issue. (paragraph 42)

8. The SC endorsed the WPB's data and research recommendations (reproduced in Appendix IV) and commended it for its work in 2009 (paragraph 45)

9. The SC unanimously recognized that there was a need to collect more biological information on sharks and more detailed species composition information, and agreed with the principle that shark fins should be matched to a specific carcass for such biological research, as agreed at SC11 (paragraph 27, 28). (paragraph 51)

10. The SC also noted that the WPEB should explore mitigation methods for reducing shark Bycatch on longlines, such as the use of monofilament trace rather than wire (paragraph 52)

11. The SC reiterated the need to incorporate modelling approaches of the ecosystem functioning in the work of the WPEB to better understand the interaction with the fisheries. (paragraph 71)

12. The SC endorsed the the WPEB's data and research recommendations (reproduced in Appendix IV), with amendments and reservations (stated in Para 50, 51, 64 and 68), and commended for its work in 2009.

13. The SC recalled the necessity of establishing a well-agreed growth curve combining information from the tagging data in conjunction with otolith analyses (when available), prior to the runs of the different models, in order to use common reference when those information are to be used as inputs. (paragraph 80).

14. The SC noted that only one assessment model had been applied to yellowfin tuna yet 5 were applied to bigeye tuna. It recommended that alternative models (preferably in a Bayesian context) should be applied in order to better explore and understand any uncertainties and behaviour of the models. It also recommended greater use of the tagging information, whilst noting that specialised ad-hoc models may be necessary in order to do so. (paragraph 84)

15. The SC emphasized that tag and release data on bigeye have still be poorly exploited for the assessment and recommended that integrated approaches (SS3, Multifan-CL) that can accommodate tagging data, be developed on this species in the future. (paragraph 88)

16. The SC noted that, for further assessments, it would also be necessary to use corrected figures from fisheries that are not currently identifying bigeye (e.g. Maldives) and to include data on gillnet fisheries, currently lacking, as this could considerably affect the yield per recruit and the overall productivity of the stock. (paragraph 89)

17. The SC noted that that, with the access to the whole Maldivian data series, together with the tagging data available in great numbers, on skipjack and all other data from the purse seine fleets, formal stock assessment

should now be attempted. The SC acknowledged the potential difficulties that will be met because of the complex issue of establishing reliable CPUE indices from the the FAD purse seine fishery. Standardized CPUE indices should also be computed from the Maldivian baitboat fishery. (paragraph 93)

18. The Scientific Committee endorsed the WPTT's data and research recommendations (reproduced in Appendix VI, with amendments as indicated below) and commended it for its work in 2009 (paragraph 97)

19. The SC endorsed the recommendations made by the WPFC that are reproduced in Appendix VI and commended for its work in 2009 (paragraph 106).

20. The SC emphasized that the preparation of the Statistic summary should be considered as a priority and recommended that the corresponding costs are evaluated and incorporated to the next budget proposal for the Commission. (paragraph 120)

21. The SC expressed its satisfaction for the cooperation of the Secretariat with the SWIOFP and the IOC on their projects related to tuna and recommended that similar cooperation be explored in the Eastern Indian Ocean (paragraph 121)

22. The SC endorse the recommendation of the WPTT that all tagged yellowfin being recovered from purse-seiner should be made available to scientist in order for them to identified their sex and sample their otoliths. This should allow to determine if growth and mortality of male and female yellowfin are identical, as these parameters are important for stock assessment model such as MFCL. (paragraph 210).

13.2 RECOMMENDATIONS TO THE COMMISSION - GENERAL

245. The following recommendations are addressed specifically to the Commission and/or relate to the work of the Secretariat.

1. However, considering the still insufficient staff level of the Secretariat and the clear recommendations of the Performance Review Panel, the SC reiterates its recommendations from the past two years that funding be provided for two additional professional staff members, in order to bring the Secretariat to a staff level comparable to that of other similar organizations. (paragraph 11)

2. The SC reiterated its recommendation that more information on billfish from sport and artisanal fisheries be collected and encourages the Commission to find a mechanism to achieve this (paragraph 43)

3. It was noted that a general lack of data hampers progress on the estimation of Bycatch and ecosystem effects and that despite recommendations each year to improve the situation, no improvements have been observed. The SC urges the Commission to consider appropriate mechanisms to encourage members to comply with reporting requirements, and to provide historical data. (paragraph 47)

4. The SC noted that the northerly range of vulnerable seabirds was greater than previously acknowledged, and endorsed the WPEB's recommendations on seabirds particularly highlighting the recommendation to extend the area in which longliners are required to use mitigation measures further north to latitude 25°S (reproduced in Appendix VI). (paragraph 60)

5. Consequently, the SC recommends that the Resolution 08/03 "On reducing the incidental bycatch of seabirds in longline fisheries" be slightly amended in its paragraph 3 to include this new latitudinal limit. Therefore, the proposed paragraph 3 should read : "CPCs shall ensure that all longline vessels fishing south of 25°S use at least two of the mitigation measures in Table 1 below, including at least one from Column A. Vessels shall not use the same measure from Column A and Column B". (paragraph 61)

6. The SC expressed its interest to obtain more reports from members that have a NPA-Seabirds in 2010. (paragraph 62)

7. A number of the recommendations are particularly highlighted for the attention of the Commission. (paragraph 98)

- The lack of complete and good quality data limits the work of the WPTT and SC particularly highlights this recommendation. There is an urgent need to address the requirement for member states to provide complete information.
- The SC endorsed the need to pursue the work implemented with a statistically integrated model for yellowfin tuna and the need to apply a number of assessment models in 2010

- The SC endorsed the recommendation to compile and undertake skipjack tuna stock assessments during 2010
- The SC recommends that assessments on yellowfin and skipjack tuna are made in priority. Given the current situation of the bigeye stock, a lower priority for 2010 is assigned to that species.
- The outputs of tagging projects are invaluable and it is recommended that the possibility of continuing this type of activity be investigated.
- The SC additionally strongly recommends that in-depth analysis of the data of the RTTP-IO is undertaken, and reiterate the need for a dedicated symposium to encourage this research and to generate scientific papers using those data.
- Further investigation of juvenile catches taken around FADs should be undertaken and SC considered that this should include both yellowfin tuna and bigeye tuna. SC also noted the need to undertake research to investigate mitigation of juvenile bycatch around FADs.

8. The SC recommended to Iran, Pakistan and Sri Lanka to improve statistics by reinforcing port sampling, implementing logbook scheme and report catch and effort data to the IOTC. (paragraph 111)

9. The SC congratulated the Secretariat for the sending of questionnaires on data collection, management and distribution to the countries fishing in the area of competence of the IOTC, and encouraged all countries to fill and return them (paragraph 112)

10. The SC expressed its satisfaction after the success of the working party on "Specific Composition of purse-seine catches, derived from observer and port sampling data" organised by IRD in 2009, and recommended the venue of a follow-up working party in the framework of the collaboration between tuna RFMOs (paragraph 113)

11. The SC reviewed and agreed the proposals of amendments on Resolution 09/04 "*On observer regional scheme*" and recommended the following changes (proposed changes are in bold) (paragraph 115)

12. The SC acknowledged that it had never elaborated those guidelines, in particular there is no mention of minimum levels of sampling. Following the proposal made by the WPDCS, the SC recommended to use a ratio of at least one fish measured per ton of fish unloaded (frequently used in other organisations) for the main species, and recommended the following modification to the text of Resolution 08/01 (proposed changes are in bold) (paragraph 117)

13. This requirement is unclear and difficult to implement, and the SC recommended that the best solution would be to incorporate this information to the logbook, including a record for each FAD deployed, similarly to what is being done for the fishing sets. This would require a modification of the Resolution 07/03 "*on the recording of catch by fishing vessels in the IOTC area*" (changes proposed are in bold) (paragraph 119)

14. The SC emphasized that the preparation of the Statistic summary should be considered as a priority and recommended that the corresponding costs are evaluated and incorporated to the next budget proposal for the Commission. (paragraph 120)

15. The SC expressed its satisfaction for the cooperation of the Secretariat with the SWIOFP and the IOC on their projects related to tuna and recommended that similar cooperation be explored in the Eastern Indian Ocean. (paragraph 121)

16. The SC acknowledged the IOTC-OFCF Project for its ongoing contribution to the improvement of the quality of data collected in several countries of the region and noted that the project was supposed to come to an end in March 2010. The SC stressed the need for resources to be made available to continue this programme to improve data collection processes in the Indian Ocean fisheries and encouraged Japan to extend its funding. (paragraph 123)

17. Therefore, the SC agreed to make a strong statement highlighting the huge problem that IO is facing in relation to piracy and hopes that efficient political measures could emerge to mitigate this situation shortly. (paragraph 136)

18. The SC agreed that Resolution 09/06 does apply to leatherback turtles, in its entirety. Consideration was given to modifying Resolution 09/06, however, the SC recommended that although the term 'hard shelled' needs to be removed from resolution 09/06, this should be left until the next major revision of the Resolution. (paragraph 203)

19. The SC discussed the utility of the Mitigation Fact-sheets and encouraged all Members and Cooperating Non-Contracting Parties to ensure that the Fact-sheets are communicated to fishers and fishery managers, so they can better understand how to prevent interactions with seabirds throughout the IOTC area of competence. (paragraph 207)

20. The SC noted that so far, tagging data was used in the yellowfin stock assessment in 2008 and 2009, recognized that these data was not yet fully analysed and recommended that full utilization of these data is made in the near future. (paragraph 212)

21. The SC recalled that a symposium dedicated to the IOTTP should be organized in 2011 in order to present a range of advanced analyses of the tagging data. (paragraph 213)

22. In this perspective, the SC recommended that CPCs provide comments on the proposed framework to the Secretariat by the 15th January 2010. The Secretariat will then compile and organise those information in a document to be circulated at the latest by the 15th February. The goal is to produce a consolidated document to be submitted to the Commission in March 2010. (paragraph 218)

23. The SC recommended that, taking into account the time constraints, the comments expected should focus on (i) the nature and scope of the framework proposed and (ii) the minimum set of field to be collected at the start of the regional observer program. (paragraph 219).

24. The SC also recommended that a technical meeting be held after the Commission meeting if it endorses the proposed process so that practical issues for implementation and training of observers be addressed without delay. (paragraph 220)

25. The SC agreed to the following schedule of working party meetings for 2009 and recommended that it be put before the Commission for endorsement. (paragraph 221)

26. The SC recommended the venue of the technical meeting regarding the Regional Observer Programme scheme to be held between April and May 2010 for 3 to 5 days. (paragraph 222)

27. For 2011, the SC recommended that the WPB, WPEB, WPTT, WPFC, WPTe, WPDCS and WPN meet. (paragraph 223)

28. The SC was informed by the Secretariat on modifications to improve a range information outputs, including “data summaries”. Previous hardcopy document will be replaced by a dynamic information system available from the IOTC website. In 2008, SC recommended the production of facts sheets on each stock available from the website and this work should be included in the new version of the IOTC website in 2010. (paragraph 227)

29. The SC requested that update of documents into the ASFA system be made regularly. (paragraph 228)

30. The SC noted the lack of homogeneity in the National Reports presented this year and recommended that the template for submission of National Reports to the SC should be revised to improve consistency in information presented and simplify reporting requirements by CPCs.. However, it was agreed that such template should have some flexibility to accommodate different situations among countries. The Secretariat will prepare and circulate a draft template for further review and approval, in order to use a new and agreed template for the submission of National Reports at the next SC meeting. (paragraph 229)

31. The SC recommended that IOTC should actively engaged with research initiatives on MPAs.This issue is now common at a global scale amongst various management bodies and research institutions. Futhermore, the SC noted that the context for pelagic MPAs is very different than that of coastal MPAs and requires further research. (paragraph 238)

32. The Scientific Committee recommended that its Thirteenth Session be held from 6 to 10 December 2009 in Seychelles and asked the Commission to consider holding its annual session not more than three months after this time in order to be able to receive the most up-to-date advice and implement management measures in a timely fashion. (paragraph 243)

13.3 RECOMMENDATIONS TO THE COMMISSION – ON THE STATUS OF THE STOCKS

246. The following recommendations were extracted from Section 8 of this report. A table summarising the status and management advice relating to the IOTC species is provided in the Executive Summary of this report (Page 4).

TUNAS

ALBACORE TUNA (*Thunnus alalunga)*

1. The SC acknowledges the preliminary nature of the albacore tuna assessment in 2008, but on balance of the available stock status information considers that the status of the stock of albacore is not likely to change markedly over the next 2-3 years and if the price of albacore remains low compared to other tuna species, no immediate action should be required on the part of the Commission.
2. The SC recommended that a new albacore tuna assessment be presented to the Scientific Committee at the latest in 2011.

BIGEYE TUNA (*Thunnus obesus)*

3. The indices of abundance from two longline fleets available for this stock present divergent trends over the last few years, the differences observed in targeting are not fully explained.
4. The SC recommended that catches of bigeye tuna should not exceed the estimated MSY of 110,000t.

SKIJACK TUNA (*Katsuwonus pelamis)*

5. Given the limited nature of the work carried out on the skipjack in 2009, no new advice is provided for the stock

YELLOWFIN TUNA (*Thunnus albacares)*

6. The current estimate of MSY is 300,000 t, lower than the average catches sustained over the 1992-2002 period of around 343,000 t. The high catches of the 2003-2006 period appear to have accelerated the decline of biomass in the stock, which might be currently unable to sustain the 1992-2002 level of catches
7. The SC recommended that catches of yellowfin tuna should not exceed the estimated MSY of 300,000 t.
8. The SC recommends that monitoring and data collection be strengthened over the coming year to be able to more closely follow the stock situation.

SOUTHERN BLUEFIN TUNA (*Thunnus maccoyii)*

9. Managed by CCSBT.

Billfish

SWORDFISH (*Xiphias gladius*)

10. Given the general recent declining trend in all the CPUE series, and the fully exploited status of the stock, the WPB expects that abundance will likely decline further at current effort levels, especially considering that the issue of increases in efficiency has not been fully addressed in the current standardization. When combined with the uncertainty in the assessment, the WPB considers that there is a reasonably high probability that common target and limit reference points (*eg.* B_{MSY}, $0.4B_0$) may be marginally exceeded, and this probability will increase over time if effort remains at current levels or increases further. Precautionary measures such as capacity control or catch limits will reduce the risk of creating an overcapacity problem or increasing the risk of exceeding common biomass limit reference points.
11. The SC recommended that catches of swordfish should not exceed the estimated MSY of 33,000t.

BLACK MARLIN (*Makaira indica*)

12. No quantitative stock assessment is currently available for black marlin in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted

BLUE MARLIN (*Makaira nigricans*)

13. No quantitative stock assessment is currently available for blue marlin in the Indian Ocean, and due to a lack of data for several gears, only preliminary stock indicators can be used. . Therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on

which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

STRIPED MARLIN (*Tetrapturus audax)*

14. No quantitative stock assessment is currently available for striped marlin in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used .Therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

INDO-PACIFIC SAILFISH (*Istiophorus platypterus*)

15. No quantitative stock assessment is currently available for Indo-Pacific sailfish in the Indian Ocean, and due to a paucity of data there a no stock indicators that are considered to be reliable, therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

Neritic tunas

BULLET TUNA (*Auxis rochei*)

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

17. The SC recommended that bullet tuna be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

FRIGATE TUNA (*Auxis thazard*)

18. No quantitative stock assessment is currently available for the frigate tuna in the Indian Ocean, therefore the stock status is uncertain. This species is a relatively productive species with high fecundity and rapid growth and this makes it relatively resilient and not prone to overfishing. Nevertheless, frigate tuna appears to be an important prey species for other pelagic species including the commercial tunas.

19. The SC recommended that frigate tuna be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

INDO-PACIFIC KING MACKEREL (*Scomberomorus guttatus*)

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

21. The SC recommended that indo-pacific king mackerel be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

KAWAKAWA (*Euthynnis affinis*)

22. No quantitative stock assessment is currently available for kawakawa in the Indian Ocean, therefore the stock status is uncertain. The SC notes the decline in the catches since 2002. However, the reasons for this are not clear: it may be problem related to reporting, or it may be a normal fluctuation in the fishery — a similar decline occurred in the early 1990's.

23. The SC recommended that kawakawa be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

LONGTAIL TUNA (*Thunnus tonggol*)

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

status is uncertain. The SC notes the catches of longtail tuna are increasing.

25. The SC recommended that longtail tuna be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

NARROW-BARRED SPANISH MACKEREL (*Scomberomorus commerson*)

26. No quantitative stock assessment is currently available for narrow-barred Spanish mackerel tuna in the Indian Ocean, therefore the stock status is uncertain. The SC notes that Spanish mackerel is a relatively productive species with high fecundity and this makes it relatively resilient and less prone to overfishing.

27. The SC recommended that narrow-barred Spanish mackerel be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

28. With respect to recommendations on stock assessment, whilst simpler indicators could be useful, SC preferred to move towards assessments and recommended that other institutions currently working on shark assessments should be invited to assist with this. (paragraph 58)

14. ADOPTION OF THE REPORT

247. The Report of the twelfth Session of the Scientific Committee was adopted on Friday 4 December 2009.

APPENDIX I
LIST OF PARTICIPANTS / LISTE DES PARTICIPANTS

IOTC MEMBERS / MEMBRES CTOI

AUSTRALIA/AUSTRALIE

Dr. David WILSON
Senior Scientist
Australian Bureau of Rural Sciences
Department of Agriculture, Fisheries and Forestry
GPO Box 858
Canberra, ACT 2601
AUSTRALIA
Phone: +61 2 62723838
Fax: +61 2 62724018
Email: david.wilson@brs.gov.au

CHINA/CHINE

Pr. Liu Xiong Xu
Dean of Shanghai Ocean University
College of Marine Sciences
998 Hucheng Huan Road
Shanghai 201306
CHINA
Tel : + 86 21 61900301
Fax : + 86 21 61900301
Email : Lxxu@shou.edu.cn

EUROPEAN UNION / UNION EUROPÉENNE

Dr. Alain Fonteneau
Scientist
CRH
BP 171
34200 Sète,
FRANCE
Fax: 33 4 99 57 32 95
E-mail: fonteneau@ird.fr

Dr. Michel Goujon
Director
Orthogongel
11bis rue des sardiniers
29000 Concarneau
FRANCE
Tel: + 33 2 98 97 19 57
Fax: + 33 2 98 50 80 32
Email: orthongel@orthongel.fr

Dr. Francis MARSAC
Chair of IOTC Scientific Committee
IRD University of Cape Town
Dept. Of Oceanography
P. Bag x3
7701 Rondebosch
SOUTH AFRICA
Tel : +27 21 650 4351
Fax: +27 21 650 3979
Email: francis.marsac@ird.fr

Mr. Iago Mosqueira Sánchez
Fisheries Assesment Scientist
Cefas, Lowestoft Laboratory
Pakefield Rd.
Lowestoft NR33 0HT
UNITED KINGDOM
Tel: +44(0)1502558003
Fax: + 44 (0) 15025524511
E-mail: iago.mosqueira@cefas.co.uk

Mr. Renaud Pianet
Scientist
IRD –Centre de Recherche Halieutique
Avenue Jean Monnet - BP 171
34203 Sète Cedex
FRANCE
Tel : +33 (0)4 99 57 32 00
Fax : +33 (0)4 99 57 32 95
Email: renaud.pianet@ird.fr

Mr. Juan José Areso
Spanish Fisheries Office
PO.Box 497, Fishing Port
Victoria
SEYCHELLES
Tel : + 248 324578
Fax : + 248 324578
Email: jjareso@seychelles.net

Dr. Hilario Murua
Researcher
Herrera Kaia, Portualde z/g
20110 Pasaia (Gipuzkoa)
Basque Country,
SPAIN
Tel: + 34 943 004 800 Ext.821
Fax: +34 943 004801
E-mail: hmurua@pas.azti.es

Dr. Laurent Dagorn
Scientist
IRD Seychelles
BP 570
Victoria,
SEYCHELLES:
Tel/Fax: +248 224 742
E-mail: laurent.dagorn@ird.fr

INDIA/INDE

Dr. Maliekal Ephream John
Zonal Director
Fishery Survey of India
Department of Animal Husbandry, Dairying & Fisheries
Mormugao street
Goa 403803
INDIA
Tel : + 91 8322520957
Fax : + 91 8322520957
Email : johnmedr@rediffmail.com

JAPAN/JAPON

Dr. Tsutomu Tom NISHIDA
Scientist
National Research Institute of Far Seas Fisheries
5-7-1 Orido, Shimizu-Ward, Shizuoka-City,
Shizuoka 424 8633
JAPAN
Tel: +81 (0) 54 336 6052
Fax: +81 (0) 54 336 6052
Email: tnishida@affrc.go.jp

Dr. Peter Makoto Miyake
Visiting Scientist
National Research Institute for Far Seas Fisheries, Japan
3-4-3 Shimorenjaku, Mitaka-Shi
Tokyo 181 0013
JAPAN
Email: p.m.miyake@gamma.ocn.ne.jp

Dr. Hiroaki Okamoto
Scientist
National Research Institute of Far Seas Fisheries
Fisheries Research Agency of Japan
5-7-1, Shimizu - Orido
Shizuoka 424-8633
JAPAN
Tel: +81 54 336-6043
Fax: +81 54 335 9642
Email: okamoto@affrc.go.jp

KENYA

Mr. Stephen Ndegwa
Chief Fisheries Officer
Fisheries Department
Ministry of Fisheries Development
P.O.B 90423 Liwatoni
Mombasa 80100
KENYA
Tel: +254 202 408080
Fax: +254 41 2315904
Email: ndegwafish@yahoo.com

Ms. Dorcus Sigana
Lecturer
School of Biological Sciences
University of Nairobi
PO Box. 30197-00100
Nairobi 00200
KENYA
Tel: + 254 0722 303184
E-mail: dsigana@uonbi.ac.ke

REPUBLIC OF KOREA/REPUBLIQUE DE COREE

Mr. Seon-Jae Hwang
Distant Water Fisheries Resources Division
National Fisheries Research & Development Institute
Fisheries Resources Division
408-1 Shirang-ri, Gijang-gun
Busan City 619-705
KOREA
Tel: +82 51 720 2325
Fax: +82 51 720 2337
Email: sjhwang@nfrdi.go.kr

MAURITIUS / MAURICE

Mr. Devanand NORUNGEE
Divisional Scientific Officer
Fisheries Division
Ministry of Agro Industry, Food Production and Security
Level 4, LICI Building
John Kennedy St
Port-Louis
MAURITIUS
Phone: +230 211 0604
Fax: +230 2081929
Email: dnorungee@mail.gov.mu

SEYCHELLES

Ms. Cindy Assan
Fisheries Scientist
C/O Seychelles Fishing Authority
P.O.Box 449
Victoria
SEYCHELLES
Tel : + 248 670600
Fax: +248 224508
E-mail: cassan@sfa.sc

Ms. Juliette Dorizo
Fisheries Statistician
Seychelles Fishing Authority
P.O. Box 449 Fishing Port
Victoria
SEYCHELLES
Tel: +248 670327
Fax: +248 224508
Email: jdorizo@sfa.sc

Mr. Vincent Lucas
Manager Fisheries Research and Development
Seychelles Fishing Authority
P.O. Box 449 Fishing Port
Victoria
SEYCHELLES
Tel: +248 670314
Fax: +248 224508
Email: vlucas@sfa.sc

Mr. Jan Robinson
Manager Research
Seychelles Fishing Authority
P.O. Box 449
Victoria
SEYCHELLES
Tel: 248 670338
Fax: 284 224508
Email: jrobinson@sfa.sc

Ms. Elisa Socrate
Fisheries Administrator
Seychelles Fishing Authority
P.O. Box 449 Fishing Port
Victoria
SEYCHELLES
Tel: +248 670335
Fax: +248 224508
Email: esocrate@sfa.sc

THAILAND – THAÏLANDE

Ms. Praulai Nootmorn
Director of Andaman Sea Fisheries Research and Development Center
Department of Fisheries
77 Sakdedej Road,
Phuket 83000
THAILAND
Tel: + 66 76 391138
Fax: + 66 76 391139
E-mail: nootmorn@yahoo.com

Ms. Chanthip Bunluedaj
Fishery Biologist
Deep Sea Fishery Technology Research and Development Institute
Department of Fisheries
Paholyothin road
Bangkok 10900
THAILAND
Tel : + 662 56205333
Fax : + 622 5620533
Email : chanthipb@gmail.com

Mrs. Patricia Lirdwitayaprasit
Fiheries Biologist
Deep Sea Fishery Technology Research and Development Institute
Department of Fisheries
Paholyothin road
Bangkok 10900
THAILAND
Tel : + 662 3950222
Fax : + 622 3890965
Email : pattira_deepsea@yahoo.com

UNITED KINGDOM/ROYAUME UNI

Dr. Chris Mees
Development Director
MRAG Ltd
18 Queen Street, London
W1J 5PN
UNITED KINGDOM
Tel: +44-20 7255 7783
Fax: +44-20 7499 5388
Email: c.mees@mrag.co.uk

COOPERATING NON-CONTRACTING PARTIES /PARTIE COOPERANTE NON-CONTRACTANTE

SOUTH AFRICA / AFRIQUE DU SUD

Mr. Dylan Clarke
Marine Scientist-Large Pelagics
Department of Environmental Affairs
Marine and Coastal Management
P.O.Box 2
Roggebaai, 8012
Cape Town
SOUTH AFRICA
Tel: + 27 214023120
Fax: + 27 214023034
Email: dclarke@deat.gov.za

Ms. Charlene Da Silva
Marine Scientist-Sharks
Department of Environmental Affairs
Marine and Coastal Management
P.O.Box 2
Roggebaai, 8012
Cape Town
SOUTH AFRICA
Tel: + 27 214023218
Fax: + 27 214023034
Email: cdasilva@deat.gov.za

Mr. Nqoro Mongezi
Policy Advisor
Department of Environmental Affairs
Marine and Coastal Management
P.O.Box 2
Roggebaai, 8012
Martin Hammerschlag Street
Cape Town
SOUTH AFRICA
Tel: + 27 214023654
Email: Mnqoro@deat.gov.za

OBSERVERS/OBSERVATEURS

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO) / ORGANISATION DES NATIONS UNIES POUR L'ALIMENTATION ET L'AGRICULTURE (OAA)

Dr. Jacek Majkowski
Fishery Resources Officer
Food and Agriculture Organization
Viale dell Terme di Caracalla
00100 Rome
ITALY
Tel: +39 06 570 56656
Fax: +39 06 570 53020
Email: jacek.majkowski@fao.org

BIRDLIFE INTERNATIONAL

Dr Ross Wanless
Regional Coordinator
Global Seabird Programme
Birdlife International
P.O.B 7119
Roggebaai, 8012
Cape Town
SOUTH AFRICA
Tel: +27 (0) 21 419 7347
Email: gsp@birdlife.org.za

REPUBLIC OF MALDIVES

Dr. Hussain Rasheed Hassan
Minister of State for Fisheries and Agriculture
Ministry of Fisheries and Agriculture
Ghazee Building
Ameeru Ahmed Magu,Male' 20-05
REPUBLIC OF MALDIVES
Tel: + 960 333 0096
Fax: + 960 777 1407
E-mail:hussain.hassan@fishagri.gov.mv

SOUTH WEST INDIAN OCEAN FISHERIES PROJECT (SWIOFP)

Mr. Rondolph Payet
Regional Executive Secretary
Regional Management Unit, c/o KMFRI
SWIOFP South West Indian Ocean Fisheries Project (World Bank)
P.O.Box 86151-80100
English Road
Mombasa
KENYA
Tel: + 254 208023924
Fax: + 254 412001133
E-mail: rpayet@gmail.com
rpayet@swiofp.net

SOUTH WEST INDIAN OCEAN FISHERIES COMMISSION (SWIOFC)

Mr.Aubrey Harris
Secretary
South West Indian Ocean Fisheries Commission (SWIOFC)
FAO of the United Nations
P.O.B 3730
Samora Machel Street
Harare
ZIMBABWE
Tel : + 263 4253655/7
Email :aubrey.harris@fao.org

MARINE CONSERVATION SOCIETY, SEYCHELLES (MCSS)

Dr. David Rowat,
Director, Marine Conservation Society, Seychelles
PO Box 384, Victoria
SEYCHELLES
Tel: + (248) 261511
Fax: + (248) 344223
Email: david@mcss.sc

OTHER PARTICIPANTS / AUTRES PARTICIPANTS

INVITED EXPERTS / EXPERTS INVITES

Mr. Ren-Fen Wu
Director
Overseas Fisheries Development Council
Information Division
19, Lane 113, Roosevelt Rd.sec.4
Taipei 106
TAIWAN,CHINA
Tel: +886-2-2738-1522-118
Fax: +886-2-2738-4329
Email: fan@ofdc.org.tw

Yu-Min Yeh
Assistant Proffessor
Graduate Institute of Environmental Management
Nanhua University
32, Chung Keng Li Dalin
Chiyahi 62248
TAIWAN,CHINA
Tel: + 886 5 2721001 ext.56341
E-mail: ymyeh@mail.nhu.edu.tw

WORKING PARTY CHAIRS / PRESIDENTS DES GROUPES DE TRAVAIL

Billfish / Poissons porte-épées
Mr. Jan Robinson
SEYCHELLES

Tropical Tunas / Methods
Thons Tropicaux / Méthodes
Mr. Iago Mosqueira Sánchez
EU

Fishing Capacity/La Capacité de Pêche
Dr. Hilario Murua
EU

Data Collection and Statistics/la Collecte des Données et les Statistiques
Mr. Miguel Herrera
SECRETARIAT

IOTC SECRETARIAT / SECRETARIAT CTOI

Indian Ocean Tuna Commission
P.O.Box 1011 Fishing Port
Victoria
SEYCHELLES
Tel: (+248) 225591
Fax: (+248) 224364

Mr. Alejandro Anganuzzi
Executive Secretary
Email: aa@iotc.org

Mr. Miguel Herrera
Data Coordinator
Email: mh@iotc.org

M. Julien Million
Tagging Officer
Email: julien.million@iotc.org

Ms. Lucia Pierre
Data Assistant
Email : data.assistant@iotc.org

Ms. Amélie Brito
Translator assisting the Secretariat
Email: amelie.brito@gmail.com

IOTC-OFCF PROJECT / PROJET OFCF-CTOI

Mr. Shunji Fujiwara
IOTC-OFCF Fishery Expert
Email: sf@iotc.org

RTTP-IO PROJECT / PROJET RTTP-IO

Mr. Jean-Pierre Hallier
RTTP-IO Chief Coordinator
IOTC
PO Box 1011
Victoria
SEYCHELLES
Tel: + 248 610 845
Fax: + 248 610 844
E-mail: jph@iotc.org

Thanks to the Interpreters

Ernest KONG'ANI
E-mail: kongani@pobox.com

Lewis MOUTOU
E-mail: lewismoutou@intnet.mu

Maria-Lily PAVLIDIS
E-mail: marlipav@iconnect.co.ke

Catherine JELE
E-mail: c.jele@aiic.net

Chantal MARIOTTE
E-mail: chantal.mariotte@gmail.com

Joe Keguro MUHINDI
E-mail: muhindi@africaonline.co.ke

Thanks to the support team from the IOTC Secretariat

Claudia Marie
Nishan Sugathadasa

APPENDIX II
AGENDA OF THE IOTC SCIENTIFIC COMMITTEE –12TH SESSION

(for more information refer to the annotated agenda, document IOTC-2009-SC-01)

1. OPENING OF THE SESSION

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

3. ADMISSION OF OBSERVERS

The Third Session of the Commission decided that its subsidiary bodies would be open to the participation of observers from Member parties of FAO, from international organisations and from non-governmental organisations which had attended previous meetings or were admitted to attend Commission Sessions.

4. UPDATE ON COMMISSION AND SECRETARIATS ACTIVITIES

The Secretariat will report on the outcomes of the 13th Session of the Commission and its own activities during the year 2009 and its proposal for activities in 2010 regarding, acquisition, processing and dissemination of information regarding tuna fisheries in the Indian Ocean.

5. PRESENTATION OF NATIONAL REPORTS

Delegates from Member Parties and Cooperating Non-contracting Parties will report on their tuna fisheries, statistical systems and research programmes, as well as on measures taken to implement Scientific Committee recommendations.

6. REPORTS ON 2009 WORKING PARTY MEETINGS

6.1 Billfish (IOTC-2009-WPB-R)

6.2 Ecosystems and Bycatch (IOTC-2009-WPEB-R).

6.3 Tropical Tunas (IOTC-2009-WPTT-R).

6.4 Fishing Capacity (IOTC-2009-WPFC-R)

6.4.1 Review of the draft of the report on the consultancy for estimating current fishing capacity.

6.5 Data Collection and Statistics (IOTC-2009-WPDCS-R).

7. EXAMINATION OF THE EFFECTS OF PIRACY ACTS ON TUNA FISHERIES IN THE WEST INDIAN OCEAN

Parties are invited to report on the effect of piracy on their tuna fleets, catches and CPUEs.

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

The Scientific Committee is invited to bring to the attention of the Commission any actions that might need to be taken, arising from the recommendations of these Working Parties considering these resources.

Management Advice and/or Executive Summaries should be adopted by the Scientific Committee prior to their transmission to the Commission. The latest Executive Summaries are available from IOTC-2008-SC-R.

8.1 Tunas (IOTC-2009-SC-03)

8.1.1 Development of advice on the status of the albacore tuna resource.

8.1.2 Development of advice on the status of the yellowfin tuna resource.

8.1.3 Development of advice on the status of the bigeye tuna resource.

8.1.4 Development of advice on the status of the skipjack tuna resource.

8.2 Billfish (IOTC-2009-SC-04)

8.2.1 Development of advice on the status of the swordfish resource

8.2.2 Development of advice on the status of the blue marlin, black marlin, striped marlin and indo-Pacific sailfish resources (new executive summaries were produced in 2009 and reviewed by the Working Party on Billfish).

8.3 Other species

8.3.1 Development of advice on the status of the neritic tuna resources (IOTC-2009-SC-05).

8.3.2 Development of advice on the status of sharks (IOTC-2009-SC-06).

8.3.3 Development of advice on the status of sea turtles (IOTC-2009-SC-06).

8.3.4 Development of advice on the status of seabirds (IOTC-2009-SC-07)

8.3.5 Report on biology, stock status and management of southern bluefin tuna (from CCSBT) (IOTC-2009-SC-INF11)

9. ACTIVITIES IN RELATION WITH THE INDIAN OCEAN TUNA TAGGING PROGRAMME

10. DISCUSSION ON THE IMPLEMENTATION OF THE OBSERVER REGIONAL SCHEME

11. SCHEDULE OF WORKING PARTY MEETINGS IN 2010

12. OTHER MATTERS

12.1 Activity report on the longline fleet of Taiwan,China

12.2 Activities on tuna by FAO

12.3 Discussion on improving/updating formats for the provision of advice

12.3.1 Data summaries, fact sheets

12.3.2 Access to documents (IOTC, IPTP) and IOTC website

12.4 EU project TXOTX (Technical eXperts Overseeing Third country eXpertise) - update

12.5 EU project MADE (Mitigating Adverse Ecologoical Impacts of Open ocean fisheries) – update

12.6 IUCN red list workshop on tuna and billfish (30 November – 4 December 2009)

12.7 South West Indian Ocean Fisheries Programme (SWIOFP) – update

12.8 Cooperation with Southwest Indian Ocean Fishery Commission on climate change

12.9 Discussion on Marine Protected Areas in the high seas related to the conservation of tuna

13. ADOPTION OF THE REPORT

APPENDIX III
LIST OF DOCUMENTS / LISTE DES DOCUMENTS

Reference / Référence	Title / Titre
IOTC-2009-SC-01	[E] Draft agenda for the Scientific Committee - 2009 [F] Ordre du jour prévisionnel de la Comité scientifique - 2009
IOTC-2009-SC-02	[E + F] List of documents / Liste des documents
IOTC-2009-SC-03	[E] Executive summaries of the status of the major Indian Ocean tunas. *IOTC Secretariat* [F] Résumés exécutifs sur l'état des principaux thons de l'ocean Indien. *Secrétariat de la CTOI*
IOTC-2009-SC-04	[E+F] Executive summaries of the status of Indian Ocean billfish / Résumés exécutifs sur l'état des poissons porte-epees de l'ocean Indien. *IOTC Secretariat / Secrétariat de la CTOI*
IOTC-2009-SC-05	[E+F] Executive summaries of the status of Indian Ocean neritic tunas / Résumés exécutifs sur l'état des thons nérétiques de l'ocean Indien. *IOTC Secretariat / Secrétariat de la CTOI*
IOTC-2009-SC-06	[E+F] Executive summaries of the status of the Indian Ocean sharks and sea turtles / Synthèses sur l'état des ressources de requins et des tortues de mer de l'océan Indien. *IOTC Secretariat / Secrétariat de la CTOI*
IOTC-2009-SC-07	[E+F] Executive summaries of the status of the Indian Ocean seabirds / Synthèses sur l'état des ressources d'oiseaux marins de l'océan Indien. *IOTC Secretariat / Secrétariat de la CTOI*
IOTC-2009-SC-08	[E] Observer materials IOTC Framework [F] Programme d'observateurs IOTC: développement des supports
IOTC-2009-SC-09	[E] Recommendations for addressing seabird bycatch data requirements in IOTC longline fisheries. *R. Bristol, S. Petersen, C. Small & M. Tasker* [F] Recommandations concernant les exigences sur les données relatives aux prises accessoires d'oiseaux marins dans les pêcheries palangrières de la CTOI. *R. Bristol, S. Petersen, C. Small & M. Tasker*
IOTC-2009-SC-10	[E] Impact of piracy threats on LL and PS fisheries. *F. Marsac , Y. Yeh , T. Nishida , J. Dorizo , J. Ariz and E Chassot* [F] Impact des menaces de piraterie sur les pêcheries de palangre et de senne. *F. Marsac , Y. Yeh , T. Nishida , J. Dorizo , J. Ariz and E Chassot*
IOTC-2009-WPB-R	[E] Report of the Seventh Session of the IOTC Working Party on Billfish [F] Rapport de la septième session du Groupe de travail de la CTOI sur les poissons porte-épées
IOTC-2009-WPEB-R	[E] Report of the Fifth Session of the IOTC Working Party on Ecosystems and Bycatch [F] apport de la cinquième session du groupe de travail de la CTOI sur les écosystèmes et les prises accessoires.
IOTC-2009-WPTT-R	[E] Report of the Eleventh Session of the IOTC Working Party on Tropical Tunas. [F] Rapport de la onzième session du Groupe de travail de la CTOI sur les thons tropicaux
IOTC-2009-WPFC-R	[E] Report of the First Session of the IOTC Working Party on Fishing Capacity. [F] Rapport de la première session du Groupe de travail de la CTOI sur la capacité de pêche
IOTC-2009-WPDCS-R	[E] Report of the Sixth Session of the IOTC Working Party on Data Collection and Statistics [F] Rapport de la sixième session du Groupe de travail de la CTOI sur la collecte des données et les statistiques
Information papers	
IOTC-2007-SC-INF01	Australia National Report
IOTC-2007-SC-INF02	European Community National Report
IOTC-2007-SC-INF03	Atlas of Tuna Fisheries and Resources in Maldives. (2009). R. Jauharee. A.R, Fujiwara S., M. Adam M. S., Itoh K., Nishida T., and Anderson R. C.(Hard copy only)
IOTC-2007-SC-INF04	Madagascar National Report
IOTC-2007-SC-INF05	India National Report
IOTC-2007-SC-INF06	Maldives National Report
IOTC-2007-SC-INF07	Japan National Report
IOTC-2007-SC-INF08	UK National Report
IOTC-2007-SC-INF09	Kenya National Report
IOTC-2007-SC-INF10	The joint IOTC-OFCF project. S.Fujiwara and M. Herrera
IOTC-2007-SC-INF11	Report on Biology, Stock Status and Management of Southern Bluefin Tuna: 2009. CCSBT
IOTC-2007-SC-INF12	South Africa National Report
IOTC-2007-SC-INF13	Estimating the fishing capacity on the tuna fleets in the Indian Ocean. R. Gillett and M. Herrera
IOTC-2007-SC-INF14	Seabird Bycatch Rates in IOTC Longline Fisheries. O. Anderson, R. Wanless, C. Small
IOTC-2007-SC-INF15	Scientific questions and recommendations following the 2009 yellowfin IOTC stock assessment. A. Fonteneau
IOTC-2007-SC-INF16	Korean National Report
IOTC-2007-SC-INF17	Mauritius National Report

Reference / Référence	Title / Titre
IOTC-2009-SC-INF18	The potential role of pelagic Marine Protected Areas for Tropical species in the Indian Ocean. C. Mees; A. Fonteneau; T. Nishida; L. Dagorn; J. Robinson; I. Mosquiera; H. Murua; M. Goujon
IOTC-2009-SC-INF19	China National Report
IOTC-2009-SC-INF20	Thailand National Report
IOTC-2009-SC-INF21	Seychelles National Report
IOTC-2009-SC-INF22	Seabird bycatch mitigation fact-sheets. Birdlife International (Hard Copy only)
IOTC-2009-SC-INF23	Etat des lieux de la piraterie en Océan Indien et impacts sur la flottille communautaire de senneurs. Orthongel
IOTC-2009-SC-INF24	FAO Fisheries Management and Conservation Service: Activities on Tuna. FAO
IOTC-2009-SC-INF25	Brief review on Taiwanese tuna longline fisheries operating in the Indian Ocean
IOTC-2009-SC-INF26	Mitigating ADverse Ecological impacts of open ocean fisheries (MADE)

APPENDIX IV
RECOMMENDATIONS FROM THE MOST RECENT MEETINGS OF THE IOTC WORKING PARTIES

Billfish – from IOTC-2009-WPB-R

Priorities

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

1. The WPB still considered determination of stock structure as a research priority as the information available tends to indicate localized depletion in certain areas. Ongoing initiatives, such as IOSSS and SWIOFP, should provide better information on the stock structure. The WPB encourages the countries in the region to cooperate with those initiatives. These programs should also be complemented by support to tagging programmes in both longline and sport fisheries.

2. To better understand the situation in the SW IO, the WPB recommended that a range of possible CPUE series and other indicators in the region be standardized and assessed in order to better explore the fine-scale patterns. The WPB recommended that the on going spatially disaggregated approach is continued for the future assessments.

Recommendations to improve the data available to IOTC

3. Improve the catch and effort data for artisanal fisheries, by:

- Sri Lanka to increase sampling coverage to 2005-06 levels in order to improve its collection and reporting of species and gear information.
- Iran, India and Pakistan to provide catch and effort and size data for their artisanal fisheries, notably gillnet and hand line, including catches of billfish disaggregated by species.
- Members to increase sampling coverage to obtain acceptable levels of precision (CV to be initially set at less than 20%) in their catch and effort statistics. The Secretariat to request countries to include levels of precision in their reports of catches and effort for billfish species.
- The WPB to address a request to the next meeting of the WPDCS to establish the levels of precision that are adequate for catch and size data for billfish species caught by artisanal fisheries.

4. Improve the recovery of existing catch and effort data from sport fisheries, by:

- The Secretariat to coordinate catch-and-effort and size data collection from major sports fishing bodies in the Indian Ocean and analysis of the information retrieved (CPUE and size data).

5. Improve the catch and effort and size data from industrial fisheries by:

- Members having industrial fisheries for swordfish, marlins and sailfish to use the standard IOTC logbooks to collect catch-and-effort data by species. This should include tools to assist fishers and data collectors to correctly identify billfish species. The Secretariat to urge countries that do not collect logbook data as per the IOTC standards to implement the IOTC standard logbooks as soon as possible.
- India to report catch-and-effort and size data for billfish species for its commercial longline fishery. The WPB to address this issue to the IOTC SC.
- The Republic of Korea to revise its catch-and-effort data series as soon as possible; the WPB to address this issue to the IOTC SC.
- The IOTC Secretariat to follow-up on the logbook programmes initiated by Indonesia and Taiwan,China for the collection of catch-and-effort data from their fresh tuna longliner fleets.
- Taiwan,China to collect and provide size data from its fresh tuna longliners.

- The EU-Spain longline to provide catches and size data of marlins and sailfish by time and area strata. The WPB to address this issue to the IOTC SC.
- The EU-Portugal, EU-UK, Kenya, Guinea, Senegal and Tanzania to collect and report size data for billfish species for its longline fleets.
- The Secretariat to request EU-Portugal to provide more information on the activities of longliners under its flag, especially concerning the limited fishing area covered by year.
- Japan to increase size sampling coverage (to cover a minimum of 10% of the catch (in number) by quarter by 10° latitude - 20° longitude area) from its longline fleet. The WPB to address this issue to the IOTC SC.
- Members ensuring that logbook coverage is appropriate to produce acceptable levels of precision (CV to be initially set at less than 20%) in their catch and effort statistics for billfish species. The Secretariat to request countries to include levels of precision in their reports of catches and effort for billfish species.
- Members with observer programmes to analyse the data collected to estimate discards of billfish species and the precision of these estimates. The Secretariat to request countries to provide estimates of discard levels of billfish species, including levels of precision for these estimates.
- The WPB to address a request to the next meeting of the WPDCS to establish the levels of precision that are adequate for
- Catches of billfish, by species, fishery and time-area strata.
- Size data of billfish, by species, fishery and time-area strata.

6. Reduce uncertainty in the following biological parameters important for the assessment of stock status of IOTC species by:

- Conversion relationships: The Secretariat to request CPCs having important fisheries for billfish to collect and provide the basic data that would be used to establish length-age keys and non-standard measurements to standard measurements keys (*eg*. length-weight keys, processed weight-live weight keys, non-standard length measurements-fork length measurements) for billfish species, by sex and area.
- The Secretariat to request CPCs having important fisheries for billfish to collect and provide sex ratio information by size and area.
- Japan and Taiwan,China to analyze the size samples collected from their longline fisheries for swordfish and marlins in order to verify if the length frequencies derived from such samples are representative of their fisheries.

Research recommendations

7. Swordfish stock structure and migratory range — using genetics techniques: The WPB encourages IOTC members to participate or contribute to the planned IOSSS project as much as possible, in particular in the collection of samples for analysis by the project. Samples from northern areas of the Indian Ocean are of particular importance.

8. Swordfish stock structure and movement rates — using tagging techniques: Including:

- The EU, Taiwan,China, Japan, Seychelles, Indonesia and the EU to initiate conventional tagging of swordfish specimens by longline fishermen and observers, in particular tagging of small swordfish specimens, and where possible inject fish with OTC.
- Use of the RTTP-IO tag recovery scheme to collect swordfish tags.
- Collaborate with SWIOFP in the implementation of its 2009/2010 programme to tag swordfish using PAT tags, in particular tag recovery and analysis of the results.

9. Swordfish growth: The IOTC Secretariat to promote the growth studies undertaken by Reunion (EU-France) and Taiwan,China scientists and comparison of the results obtained through those and other projects.

10. Size data analyses: The IOTC Secretariat to coordinate studies on the conversion of swordfish lengths into ages by using different assumptions on sex ratios at size/age for the Taiwan,China, Japan and EU fleets size data.

11. Stock status indicators: The IOTC Secretariat to further coordinate the exploration of indicators from available data and report these to next meetings of the WPB.

12. CPUE Standardization:

- China and Taiwan,China to report the results of their ongoing TDR studies (relationship between the number of hooks per basket and hook depth) to the next meeting of the WPB. The IOTC Secretariat to provide the results of a TDR study conducted by Australia at the next meeting of the WPB.
- Japan, Taiwan,China, EU, Seychelles and Indonesia to conduct research studies intended to improve the definition of variables that could be used as a proxy for targeting of swordfish, in particular changes in the number of hooks per basket set-times, area fished, moon-phase, use of light-sticks, bait-types and species composition. The WPB to review the results of these studies at its 2012 meeting. The WPB to review the standard IOTC requirements for logbook data on the basis of the results of these studies.
- Japan and Taiwan,China to examine the influence of zero catches in CPUE analyses through sensitivity analysis using delta log-normal models and report the results of these analysis to the next meeting of the WPB.
- Japan, Taiwan,China and the EU to conduct studies to ascertain that the areas used for the assessment are appropriate, in particular analysis of the influence of environmental heterogeneity at sub-regional scales and the combination of area-specific indices into a global index using different weighting schemes
- The EU and Seychelles to use set by set data in the standardization of the CPUEs for its longline fisheries and to report the results to the next meeting of the WPB. The IOTC Secretariat to assist Seychelles with this study, where required.

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

14. Stock assessment: The IOTC Secretariat to promote further development of stock assessment models for swordfish, in particular development of the models used by the WPB in 2008 and 2009.

15. Research on Istiophorids: The WPB showed concern about the paucity of the biological data available for marlins and Indo-Pacific sailfish noting the consequences that this is having on the assessments of the species. In order to overcome these problems the WPB recommended the implementation of a Large Scale Research Programme to collect the information required for these species, in particular biometric and morphometric data, marlins and sailfish movements, growth, and other information required for stock assessment (Appendix IV). The WPB agreed to address this request to the IOTC SC

Tropical tunas – from IOTC-2009-WPTT-R

DATA

1. That the actions in Table 1 (Page 8) be taken to improve the standing of the data on tropical tuna species currently available at the Secretariat (Paragraph 5).

2. The WPTT recommends that complete and good quality data, as per IOTC requirements, is reported to IOTC Secretariat in due time, as these data are essential to the provision of scientific advice on stock status (Paragraph 6).

3. The WPTT recommends that the IOTC-OFCF program to improve data collection and statistics should continue and be extended (Paragraph 8).

4. The WPTT recommends that size data collection for yellowfin in Maldives continue and, if possible, data is collected separate for both fleets operating in that fishery (Paragraph 25).

5. The WPTT recommends that data is collected and analysed to prepare abundance indicators for purse seiners based on numbers and catches around FADs (Paragraph 47).

6. The WPTT recommends that data is collected on technological change in the purse seine fleet in order to improve the use of its CPUE series as an index of abundance of the stocks (Paragraph 82).

DATA ANALYSIS

7. The WPTT recommends that the differences between data reported in a recent document (IOTC-2009-WPTT-09) and previous literature regarding catches and setting times on FADs should be investigated (Paragraph 50).

8. The WPTT recommends that electronic tagging data is analysed in order to better understand the dynamics of residency of tuna around FADs ((Paragraph 68).

9. The WPTT recommends that further work on the various factors linked to fishing efficiency, such as gear change, use of technology and skipper experience, is carried out for the longline CPUE-based indices of abundance (Paragraph 79).

10. The WPTT recommends that a more detailed analysis is carried out and presented on the relative influence of the various factors introduced in the standardization process of the longline CPUE series on the estimated trends (Paragraph 81).

11. The WPTT recommends the continuing development and improvement of the MFCL model implementation for yellowfin tuna and the future involvement of the external consultant responsible for its application to Indian Ocean yellowfin (Paragraph 99).

12. The WPTT recommends that an important effort is made to assemble the necessary scientific knowledge that will enable a more detailed and precise evaluation of the status of the skipajck tuna resource in the Indian Ocean. Particular effort should be made in developing a range of indices of abundance, in application of indicators and estimators of exploitation rates based on tagging data, and in assembling a range of data sources, indicators and models that would allow the WPTT to provide well-backed advice on skipjack in 2010 (Paragraph 152).

RESEARCH

13. The WPTT recommends that national scientists conduct further research into the apparent declining trend in skipjack tuna length in purse seine catches to understand the reasons behind it (Paragraph 36).

14. The WPTT recommends that further research in carried out on the growth of yellowfin and bigeye tuna by means of otolith analysis. Samples should be obtained from the longline fisheries and from different areas of the Indian Ocean. Furthermore, and as a means to validate otolith readings, the WPTT recommends to compare the number of days estimated from otolith readings with the number of days-at-liberty obtained for tagged specimens with known date-at-release and date-at-recovery. The WPTT also recommends that sex and other biological information should be obtained from recaptured tagged fish of large size (Paragraph 57).

15. The WPTT recommends that new small-scale tagging programmes should be initiated, in particular in Maldives, and that additional funds should be secured for these activities to be carried out (Paragraph 69).

16. The WPTT recommends that the relative importance and future effects of the current levels of catches on juvenile bigeye tuna around FADs be re-investigated (Paragraph 142).

PIRACY

17. The WPTT recommends more analysis to be developed regarding the effect of piracy on the spatial dynamics of the purse seine and longline fleets and their respective catch and present them to the next meeting of the Scientific Committee so that they can then be made available to the Commission (Paragraph 163).

Ecosystem and Bycatch – from IOTC-2009-WPEB-R

DATA

The WPEB recommended the following actions be taken to improve the standing of the data on non-tuna species currently available at the Secretariat**Error! Reference source not found.**. In general, these recommendations are made over and above the existing obligations and technical specifications relating to the reporting of data.

The WPEB noted that similar recommendations for data collection and submission were made every year. Participants also noted that it was impossible for the WPEB to fulfil its mandate without appropriate data. The WPEB **strongly recommended** that the SC and the secretariat investigate means to encourage better data collection and submission

More generally, the WPEB recommended that, in light of relatively low by-catch when compared to many other fisheries, a report on the purse seine bycatch should be produced and made available. Moreover, the WPEB recommended that similar work is carried out for other fleets to be presented at the next Session of the WPEB

SHARKS
The 5% fin to body weight ratio measure be replaced with a resolution requiring sharks to be landed with fins naturally attached to the body.
CPCs that are conducting research cruises and observer programs, develop digital photo archives of shark species and make them available to IOTC for wider use.
The status of Indian Ocean shark stocks be assessed, to the extent possible, using available information on various fishery indicators.
Particular attention and immediate research and assessment effort should be directed to the following species: blue shark (*Prionace glauca*), oceanic whitetip shark (*Carcharhinus longimanus*) and silky shark (*Carcharhinus falciformis*).
IOTC resolution 08/04 "Concerning the recording of the catch by longline fishing vessels in the IOTC area" be amended to: (a) add the following species to the minimum requirement list: great white shark crocodile shark, thresher sharks, tiger shark, requiem sharks, hammerhead sharks and pelagic stingray; (b) replace 'mako shark' with 'mako sharks'; and (c) delete porbeagle shark.
Priority be given to reviewing the status of pelagic sharks at the next meeting of the WPEB.
Information of potential value for stock assessment of whale sharks should be compliled
SEABIRDS
An ERA process be commenced for seabirds, with work carried out inter-sessionally and at the next meeting of the WPEB.
No changes be made to the seabird conservation measures in Resolution 08/03 at this time, but that the WPEB should consider new recommendations based on rigorous scientific evidence at the next meeting in 2010.
In light of new information on the distribution of juvenile albatrosses and petrels, consideration be given to extend the area in which longliners are required to use mitigation measures further north to latitude 25˚S.
Bycatch issues be given appropriate consideration in the development of observer data collection forms, standards and reporting procedures to the Commission.
Any data previously collected by CPCs on bycatch of seabirds should be made available for preliminary assessment by the WPEB on the extent of bycatch and species composition.
The Commission should encourage CPCs to fulfil their FAO obligations to assess the need for NPOAs Seabirds and develop plans if appropriate.
Seabird Executive Summaries should be produced in time for the 2009 Scientific Committee meeting, and updated regularly.
Priority be given to updating seabird recommendations at the next meeting of the WPEB.
SEA TURTLES
Complete conversion to the use ecological FADs be completed as soon as possible
Purse seine FADs be constructed from biodegradable materials
The use of circle hooks be extended to shallow-set tuna longlines in particular
Experiments of every fishing combination with longlines be conducted to assess the relative effects of hook type, bait and target depth in order to propose practical mitigation measures
IOTC guidelines on releasing sea turtles be developed, and that these be made freely available to fishers
All longline vessels to be equipped with the necessary tools to remove hooks from turtles to ensure safe release and minimize post-release mortality.
DEPREDATION
An amendment be made to Resolution 08/04: Appendix II, Section 2-2 CATCH/CAPTURES, with the addition of

the following text: " 2) For each species, number of individuals damaged by sharks or cetaceans should be given in brackets after the number of individual caught. Numbers of damaged fish should not to be included with the number of individuals caught, which are considered as non-damaged individuals."
A second amendment be made to Resolution 08/04: Appendix II, Section 2-4 REMARKS/REMARQUES, with the addition of the following text: " 3) Each depredation event (damage of the catch by sharks or cetaceans) should be carefully documented in the remarks. The cause of damage may be identified by sighting of predators in the vicinity of the vessel/gear or by post-mortem traces on damaged fish; this should be indicated in the remarks. Sightings information should include the number of individual predators seen in the vicinity of the gear/vessel."
There is a need to continue research on monitoring and mitigation of depredation within the Indian Ocean.
ECOSYSTEM APPROACH
Further work on Ecological Risk Assessments and that ERA analysis is expanded to other fisheries and taxa.
Population explosions of mantis shrimps and swimming crabs within the western Indian Ocean should be properly documented.

Fishing Capacity – from IOTC-2009-WPFC-R

GENERAL
The WPFC agreed that ICCAT had undertaken several sensible initiatives to address the issue of capacity estimation, and that this could be the model followed in the IOTC with modifications to address issues specific to the IOTC region (paragraph 10).
The WPFC agreed that input-based measures of fishing capacity are far more useful for management purposes (paragraph 15).
DATA
The WPFC noted that improvements in certain areas are required in order to obtain more precise estimates of input fishing capacity, in particular (paragraph 30): • Pakistan, Sri Lanka and Maldives providing lists of active vessels, including information about medium-scale vessels (<24m) that operate outside its EEZ; • India providing a complete list of active vessels under its flag; • Indonesia identifying which of its medium scale vessels (<24m) operate outside its EEZ: • Indonesia to verify vessel-tonnage measurements and to provide length measurements for all of its vessels; • All countries having large- and medium-scale vessels to provide separate catches by vessel size class, in particular Indonesia, Iran, India and Malaysia.
The WPFC agreed that to understand the total fishing pressure directed at tuna resources, estimates of fishing capacity should include consideration of the fishing boats under 24 m which operated exclusively inside the EEZ of participating countries fleets (paragraph 31).
The WPFC agreed that the use of only two vessel-length categories to assess input capacity, less than 24m and 24m or greater, may be insufficient recommending that the use of narrower vessel length categories be assessed for future estimates of input capacity (paragraph 32).
The WPFC agreed that, in order for the estimates of fishing capacity in the IOTC Area to be useful in a management context, the following information is required: Detailed information on the fleets for which fishing capacity is to be estimated, in particular vessel unique identification, vessel length and gross tonnage, levels of activity and gear used for each

individual vessel for the fleets under consideration, and target species (Paragraph 34).
The WPFC noted that to better understand future evolution of fishing capacity special attention should be given to investigate changes in fishing efficiency of the different fleets, along the lines of existing initiatives (*e.g*. working group on fishing technology of the WCPFC or in CLIOTOP) (paragraph 36).
METHODS
The WPFC recommended that methods to investigate input-based capacity measures should be developed in conjunction with the work carried out in other tuna RFMOs and that close collaboration should be pursued with these organisations in this area. Especially, in developing methods to relate fishing mortality levels and the effective effort measures which will be of great help in the process of producing management advice in terms of fishing capacity limits (paragraph 37).

Data Collection and Statistics – from IOTC-2009-WPDCS-R

Main data issues:

The WPDCS recommended that the following issues be addressed as a matter of priority:

1. Complete lack of statistics from the industrial longline fishery of **India**.

2. Complete lack of statistics from the artisanal fisheries in **Yemen**.

3. Complete lack of statistics from industrial longliners operating under flags of **non-reporting countries**.

4. Lack of catch-and-effort and size frequency data for the fresh-tuna longline fisheries of **Taiwan,China**.

5. Lack of statistics from industrial longliners of **Indonesia** and **Malaysia** not based in their territories.

6. Lack of catch-and-effort data and detailed size frequency data for the oceanic gillnet fisheries of **Pakistan** and **Iran** and the gillnet/longline fishery of **Sri Lanka**.

7. Lack of catch-and-effort and size frequency data for the artisanal fisheries of **India**.

8. Complete lack of statistics from the artisanal fisheries of Madagascar and Comoros.

9. Insufficient time-area coverage for size sampling data for important longline fleets, in particular **Japan**.

10. Catches not fully by species and/or gear for large-scale and medium-scale purse seine fisheries of **Indonesia**, **Malaysia** and **Thailand** and for the gillnet/longline fishery of **Sri Lanka**.

11. Size frequency statistics not reported by IOTC standards for the fisheries of **Japan, Taiwan,China, Indonesia** and **Malaysia**.

Gillnet fisheries: The WPDCS recommended that Iran, Pakistan and Sri Lanka make every possible effort to improve species identification, including strengthening of port sampling and implementation of logbook systems on their oceanic gillnet fleets and reporting of catch-and-effort data to the IOTC, routinely.

Purse seine fisheries: The WPDCS recommended the EU to:

- Conduct an in-depth statistical analysis of the existing sampling and catch estimation procedures with a view to improving sampling design and/or estimation procedures, when required.
- Strengthen the sampling for biological parameters for skipjack tuna, yellowfin tuna, bigeye tuna and albacore, in order to improve the precision of catch-at-size data estimated for purse seine fleets.
- Revise the estimation procedure used for purse seiners and provide new estimates of catches by species as soon as possible.

The WPDCS recommended Thailand to revise its sampling scheme in order to verify the species composition and size frequency for its purse seine fleet; the WPDCS recommended that Thailand work with the EU and Seychelles, where appropriate.

The WPDCS recommended that a 2nd international Working Group be convened, including participation of experts from the Tuna-RFMOs concerned, to assess the results of the statistical analysis conducted by the EU on its purse seine fleet and implementation of other recommendations issued by the Working Group. The WPDCS recommended that the next meeting of the Working Group be organized as a component of the T-RFMO Science Meeting.

Longline fisheries: The WPDCS noted that, to date, no catch-and-effort data are available from fresh-tuna longliners of Indonesia and Taiwan,China stressing the need for these countries to implement logbook systems on their fleets and report catch-and-effort data to the IOTC.

Capacity building activities:

The WPDCS strongly recommended that the IOTC Secretariat maintains its support to countries in the IOTC region, with a view to improving the quality of tuna fisheries statistics. The WPDCS recommended that countries that benefitted from activities under the IOTC-OFCF Project make every possible effort to maintain these activities once the IOTC-OFCF support comes to an end.

The WPDCS recommended that the Secretariat collaborates with the Bay of Bengal Large Marine Ecosystem project in capacity building activities in countries of the Eastern IOTC Region with a view to improving data collection and statistical systems for tuna fisheries on those countries.

The WPDCS recommended that a coordinating mechanism be implemented among all existing capacity building initiatives, to avoid duplication of efforts.

Documentation of IOTC fisheries and statistical systems:

The WPDCS recommended that the IOTC Secretariat continues collection of Questionnaires on data collection and processing systems and report progress to the next meeting of the WPDCS.

The WPDCS requested the Secretariat to prepare a report on the quality of IOTC statistics to be presented to the next meeting of the WPDCS, according the guidelines provided at the WPDCS meeting.

Data acquisition:

The WPDCS recommended that the IOTC Secretariat finalizes the Guidelines for the reporting of statistics to the IOTC and data submission forms and make this available through the IOTC web site as soon as possible.

Dissemination of IOTC statistics:

The WPDCS recommended that the IOTC Secretariat assess the costs involved in the preparation of a new IOTC Data Summary, including printing costs of a reasonable number of documents, and incorporates this in its next budget proposal for the consideration of the Commission.

Implementation of recommendations on data and statistics:

The WPDCS noted that some of the recommendations existing have been in place for a number of years and are still to be addressed, recommending the Chair of the WPDCS, in consultation with the IOTC Secretariat, to monitor the implementation of the recommendations on data and statistics and report progress to the next meeting of the WPDCS.

APPENDIX V
NATIONAL REPORT ABSTRACTS

AUSTRALIA

Pelagic longline and purse seine are the two main fishing methods used by Australian vessels to target tuna and billfish in the Indian Ocean Tuna Commission (IOTC) Convention Area. In 2008, five Australian longliners (one from the Western Tuna and Billfish Fishery and four from the Eastern Tuna and Billfish Fishery) operated in the IOTC Convention Area. Together they caught 10.3 t of albacore tuna (*Thunnus alalunga*), 26.6 t of bigeye tuna (*Thunnus obesus*), 1.2 t of yellowfin tuna (*Thunnus albacares*), 142.2 t of broadbill swordfish (*Xiphius gladius*) and 0.5 t of striped marlin (*Tetrapturus audax*). These catches represent less than six percent of the peak catches taken in 2001, for these five species combined. The number of active longliners and levels of fishing effort have declined substantially in recent years due to reduced profitability, primarily as a result of lower fish prices and higher operating costs. The estimated catch of southern bluefin tuna (*Thunnus maccoyii*) in the purse seine fishery was 4531 t in 2008. The 2008 purse seine catch of skipjack tuna (*Katsuwonus pelamis*) was xxx t1, a decrease of xx percent from that caught in 2001 (1039 t).

Note: The Privacy Act 1998 prevents the disclosure of non-aggregated landing data to the public. The Australian Fisheries Management Authority currently has a policy that stipulates the minimum number of vessels required to publish aggregated landing data is five. The number of active vessels in the Western Tuna and Billfish Fishery (WTBF) and Skipjack Fishery (SJF) was less than five in the years 2006 and 2007. As such, total landing data for WTBF longliners and skipjack purse seiners for the years 2006 and 2007 cannot be provided in this report and have been blacked-out "……." accordingly. Where possible, reference has been made to 2005 catches, or combined with those from the Eastern Tuna and Billfish Fishery (ETBF), where four vessels operated in the IOTC convention area (bringing the total to five vessels).

BELIZE

No report supplied.

CHINA

Document IOTC-2007-SC-INF19. Longlining is the only fishing method used by Chinese vessels to catch tuna and tuna-like species in the IOTC waters. The number of longliners operating in the Indian Ocean remains 46 in 2008, with the fishing area of 40 ºE ~ 90ºE and 20ºN ~ 40ºS. Chinese fishing fleet caught 7,097.4 MT of tunas in 2008 , 34.8 % lower than the previous year, among which 4,963 MT of bigeye tuna, 900 MT of yellowfin tuna, 420 MT of swordfish , 341 MT of blue shark, 65 MT of shortfin mako, 158 MT of albacore, 151 MT of billfish and102.6. MT of other fishes. Most majorities (about 95%) of the tuna catch are from the west part of the Indian Ocean. Shanghai Ocean University (SOU)(the former name Shanghai Fisheries University) has been responsible for the programmes of the training and data collection and compilation of the Indian Ocean tuna fishery statistics with the cooperation of the Branch of Distant Water Fisheries of China Fisheries Association. Under the authorization by the Bureau of Fisheries, Ministry of Agriculture, the scientific observer program has been carried out smoothly under the fully cooperation of the Branch of Distant Water Fisheries of China Fisheries Association and supported by Shanghai Fisheries University. Three observers were dispatched on board the tuna longliners in the Indian Ocean in 2008, covering the area of 15°00´S~ 32°00´S and 60°00´E ~ 80°00´E. China provided length frequency distributions for tropical tunas caught by longliners operating in IOTC waters and also the length frequency data collected through the scientific observers. Under the support of the Branch of Distant Water Fisheries of China Fisheries Association and cooperated by the tuna fishing companies, the Logbook system has been carried out smoothly as normal data collection work. All Chinese longlineres have equipped with de-hooking devices in 2009, and all the deep freezing longliners have been equipped with VMS system. Chinese Fisheries Authority will continue to strengthen the management of her tuna fisheries through implementing fishing license system, national tuna observer program,VMS,and the measures recommended by the IOTC Commission and through supporting research on mitigation measures of reducing the incidental catch of sea turtles and sea birds.

COMOROS

No report supplied.

ERITREA

No report supplied.

EUROPEAN UNION

OVERVIEW

EU tuna fisheries exploit high sea pelagic resources in the Indian Ocean under 5 flags, listed as follows by decreasing catch number: Spain, France, Portugal, United-Kingdom and Italy. Total catch for these fleets reached almost 230,000 tonnes in 2008, after a record catch of about 300,000 tonnes in 2005-2006. The activities of the fleets are generally well-monitored, 100% of logbooks, VMS positions for all vessels, and species and size composition validated by scientists being available. The discards are also estimated for most of these fleets through observer programmes which results are submitted to the IOTC. Several biological, ecological and population dynamics research, are also conducted by EU research laboratories (IEO, AZTI, IRD, IFREMER) on most of the main tuna species exploited in the Indian Ocean. Fisheries and research activities in the different EU countries are summarized below.

FRANCE

Fisheries: Three fleets are operating tuna fishing activities in the Indian Ocean: 16 purse seiners operating from the Seychelles, 46 longliners based in Reunion, and the artisanal fishery in Reunion (Although not EU flagged, the results of the two French purse seiners based in Mayotte are included in this report). The catch amount of this fleet notably decreased in 2009, after some purse seiners shifted to the Atlantic Ocean. Total tuna catch for French purse seiners in the Indian Ocean amounted to 85,000 tonnes in 2008 (yellowfin= 42,100 t.; skipjack 34,300 t.; bigeye 7,600 t. and albacore 880 t.), which is a slightly higher level than in 2007 (82,450 t), but a much lower one than previous years (100-110,000 t). Total CPUE in 2008 have slightly increased compared to 2007, but they remain as low for yellowfin and skipjack as they were at the beginning of the fishery. Average weights have decreased for all three species, in particular for skipjack (2.1 kg) which has reached a historically low level, never observed since the beginning of the purse seine fishery. Spatial distribution of catches has been once again heavily affected by the piracy which has developed from the Somali towards Seychelles and southwards: the fishery extended further East to 75°E, and was more present in the Mozambique Channel. The observer programme implemented since 2005 allowed to provide preliminary assessments of discards and bycatch for 2003-2008, which were presented to the WPEB in 2009. The longline fleet based in Reunion consisted in 2008 of 46 vessels (15 units over 16 meters of length and 31 units under 16 meters of length). Swordfish remains the target species of this fleet, but tuna catches (yellowfin, bigeye and albacore) have become a majority. In 2008, the catch amounted to almost 2,800 t, which corresponds to a decrease compared to 2007 (3,300 t). An observer programme started in 2007, with a 2% coverage rate. The catch of the Reunion artisanal fleet is low and estimated to have amounted to about 380 tonnes in 2008.

Research: The French research conducted by the IRD in its laboratories located in Sète and Reunion are of different kinds, and deal with population biology and dynamics, and ecology and exploitation of this resource. The IRD also organized in June 2009 an international working party (gathering experts from all tuna commissions) on statistical problems related to species and size composition of purse seine landings. In February 2009, the Ifremer in Reunion initiated research aiming at a better knowledge of the structure of sub-populations of Indian Ocean swordfish. Finally, the laboratory of the Reunion University is conducting active research on seabird ecology and how to use it as a bio-indicator of the status of high sea ecosystems. France has also actively taken part in all the working parties organized by the IOTC, and presented almost 40 scientific contributions.

SPAIN

Fisheries: Two Spanish fleets are operating in the Indian Ocean: the purse seine fleet, targeting tropical tuna (yellowfin, skipjack and bigeye) and the longline fleet targeting swordfish. In 2008 a total of 17 purse seiners and 25 longliners operated in the area. Purse seiners' carrying capacity for most of the boats is higher than 1,200 t. Longline vessels range from 27 to 42 meters in length. Spanish total catches in 2008 were as follows: 46,051 t of yellowfin, 65,096 t of skipjack, 12,490 t of bigeye, 299 t of albacore and 3,925 t of swordfish, resulting in a grand total of 127,870 t. Purse seine catch in 2008 increasing a more than 9% with respect to 2007. Tropical multispecies tuna sampling in 2008 has been carried out to a good level of coverage: 922 samples and 171,791 fish were measured. In 2003 a biological sampling program (including sex ratio and maturity) in the Seychelles cannery was started. For the longline fleet, in 2008, 18,526 swordfish have been measured and sex at size has been estimated for most spatio-temporal strata through biological sampling.

Research: Two Spanish research Institutes (IEO and AZTI) are involved in the tropical tuna scientific groups, while IEO is also involved in swordfish research. Since the beginning of the 90's a Spanish expert on fisheries has been permanently based in Mahé. Scientists involved in these fisheries have actively participated in the meetings and activities of the most IOTC meetings. This year 4 documents have been presented. Research programs are or will be conducted in order to implement the scientific recommendations, in particular: for collecting information on supply vessels and fishing on FADs. For this purpose a joint IEO-AZTI working plan has been established. To estimate the by-catch associated with the purse seine fishery, a total of 9 trips have been covered by observers in the Indian Ocean in 2004, 12 trips in 2005, 13 in 2006, 19 in 2007 and 12 in 2008 and only 1 trip in 2009 due to piracy. Traditional opportunistic tagging is still being carried out on longliners, on swordfish and other associated species by the voluntary tagging done by the commercial fleet (and by scientific observers). During the year 2008 a total of 57 pelagic fish were tagged and released, 19 swordfish and 38 bycatch fishes, with already seven recaptures (5 *Thunnus obesus* and 2 *Carcharhinus longimanus*)

UNITED KINGDOM

UK longliners have been fishing in the India Ocean since 2004, and five UK flagged vessels have been fishing during 2008. The five UK vessels active in 2008 caught 2028 tonnes (40% swordfish and sharks 40%). The corresponding total yearly catches of this fleet have been reported to the IOTC, but there is no detailed scientific follow up of this fleet by EU scientists.

PORTUGAL

Longliners flagged in Portugal has been fishing in the Indian Ocean since 1998. A total of 26 longliners have been active in 2008, and this fleet has been mainly targeting swordfish (90% of its retained catches). The corresponding total yearly catches of this fleet have been reported to the IOTC but there is no detailed scientific follow up of this fleet by EU scientists.

ITALY

There was only one Italian purse seiner active in the Indian Ocean (since 1997), and all the detailed fishing activities of this vessel have been fully and permanently followed by French scientists. The corresponding catches and catch at size have reported fully reported by time and area strata and fishing mode to the IOTC.

FRANCE

Included in the report of EU.

GUINEA

No report supplied.

INDIA

Tuna fisheries in India have undergone significant changes in recent years. Though the coastal multi-species fishery is the mainstay for harvesting tunas and tuna-like fishes, targeted fishery for exploiting the tropical tunas is emerging. The production has gone up to an all time high of 158,458 t during the year 2008, out of which 24.2% was formed of oceanic tunas, 35% neritic tunas, 4% billfishes and 36.8% seerfishes. In the coastal fishery, landings from the FAO Areas 51 and 57 were 64% and 36% respectively. Among the oceanic species, skipjack and yellowfin were dominant contributing 22,060 t and 13,507 t respectively whereas among the neritic tunas, kawakawa was predominant (58.4%) followed by longtail tuna (13.5%) and frigate tuna (11.1%). Gear-wise, 43.8% of catch was obtained in gillnet followed 14.4% in hook and line, 8.5% in purse-seine, 5.9% in pole and line and the remaining in other gears. From the oceanic fishery, the catch of tunas and allied species reported was 2,839 t, out of which yellowfin tuna contributed 59.2% and bigeye tuna 0.21%. Billfishes accounted for about 30% of the catch. The catch of oceanic tunas from the coastal and oceanic fishery together was 38,323 t, formed of skipjack (57.6%), yellowfin (36.6%), albacore (2.7%) and bigeye tuna (0.1%). In the fleet targeting on tunas, about 465 pole and line boats are operating in the Lakshadweep waters. In the mainland, fishing capacity from the shelf fishery is being diverted, with appropriate modifications, for harvesting the tropical tuna resources. 235 fishing boats in the size range of 13-24 m OAL have been converted for tuna longline fishing during the last few years. Under the Letter of Permission (LOP) scheme, 60 tuna longline vessels in the range of 21.6 - 58.7 m OAL, which are of foreign origin, but registered as Indian vessels, have been permitted for fishing in the Indian waters, but the active vessels during the year 2008 were only 30. The vast majority of the longliners operating is smaller boats, the larger ones above 24m OAL being only about 11%. The export of tunas and tuna products has shown remarkable growth from 1230 t in the year 2001–02 to an all time high level of 37,302 t in the year 2007-08. The product profile covers several diversified and value added items. Research activities are given due importance and necessary R&D support is given by the government institutions for development of the tuna fishery. Several recommendations of the Scientific Committee / IOTC are being implemented. The country is poised for a quantum jump in harvesting of tropical tunas, with its indigenous fleet.

IRAN

No report supplied.

JAPAN

The number of longline vessels operating in the Indian Ocean which was 249 vessels in 2007, decreased to 172 vessels in 2008 (preliminary). Longline catch of each species in 2008 was 1,814MT for southern bluefin, 5,332MT for albacore, 14,202MT for bigeye and 11,099MT for yellowfin. The catch of yellowfin in 2008 decreased to about half of that in 2005 and 2006 in spite of that the catch of bigeye, albacore has been roughly same level during this period. Japanese purse seine vessels operating in the Indian Ocean are 350-700 GRT class (700-1000 carrying capacity). In 2008, three Japanese purse seine vessels operated in this ocean. Total fishing effort was 294 days in 2008. Catch in weight of skipjack, yellowfin and bigeye in 2008 was 3,133MT, 1,175MT and 1,009MT, respectively. Progress on the implementation of recommendations of the Scientific Committee was reported including size data collection, tagging activities (IOTC and Nippon maru, JAMARC) and the OFCF project.

KENYA

Tuna fishery in Kenya is exploited by artisanal, recreational and long lining. The artisanal fleet targets tuna by use of gillnets, handlines, longlines, seine nets and troll lines and in 2008, the landing was 320 t. Recreational fishery in Kenya also landed considerable amounts of mainly the yellowfin tuna (16, 640 kg), but the catches of all tuna for the year 2008 were 19,953 kgs. The catches of bigeye and yellowfin from the Kenyan longliner in 2008 were 23 and 22 tons respectively from 239 fishing days. The tuna landings at the cannery were mainly composed of yellowfin larger than 10 kgs. Development of artisanal fisheries database is going on and data collection by sampling will be experimented. Training in the observer mission and port state control measures will be carried out early next year. Funds for the preparation of the national plan of action for the sharks, turtles, sea birds and marine mammals will be set aside during the next financial year in order to execute requirement by IOTC. The main research activity on Tunas is currently under SWIOFP, based at Kenya Marine and Fisheries Research Institute. The research aspect of the project has not taken off in our area but gap analysis has included Bigeye tuna (*Thunnus obesus*), skipjack tuna (*Katsowonus pelamis*) and the small tuna *Euthynnus affinis*. Piracy has drastically affected both research and fishing activities in Kenya.

REPUBLIC OF KOREA

The Korean tuna longline fishery has shown a decreasing trend from the late 1970s to recent years in both number of fishing vessels and annual catches in the Indian Ocean. In 2008, 24 vessels were operating in the Indian Ocean, which is a decrease by 7 vessels as compared to 2007 and total catch amounted to 2,762 mt, which is highly decreased in catches as compared to 2007. Catch consists of 1,010 mt of yellowfin tuna, 757 mt of southern bluefin tuna, 505 mt of bigeye tuna, 119 mt of albacore, 49 mt of other tunas and 322 mt of billfishes. Catch of southern bluefin tuna increased but yellowfin tuna and bigeye tuna highly decreased in 2008. These three major tunas accounted for 82% of the total catches by Korean tuna longliner. Korean longliners were operated in the fishing grounds with a range of 20°N~45°S and 15°~115° E. The fishing ground was a little extended to the eastern Indian Ocean as compared to 2007. The National Fisheries Research and Development Institute (NFRDI) began to operate fisheries observer program in 2002 to monitor Korean distant-water fisheries for tunas and to meet the requirements of regional fisheries bodies. In 2008, NFRDI could not dispatch any Korean observer to monitor the Korean tuna longline vessels in the Indian Ocean. However, in 2009, 3 observers were dispatched to monitor the Korean tuna longline vessel.

MADAGASCAR

No abstract supplied

MALAYSIA

No report supplied.

MAURITIUS

The tuna fishery forms the basis of important local fish processing industries. Tuna transhipment is a valuable related activity since several decades. The sport fishery also lands an important quantity of pelagic fishes. An artisanal tuna fishery has also been developed around fish aggregating devices placed around Mauritius. In 2008, licensed local and foreign longliners transhipped 7 966 tonnes. The catch included 1 364 tonnes caught by licensed European longliners and 476 tonnes caught by two Mauritian flagged vessels. This also included a total of 3685 tonnes caught in Mauritian waters. Length frequency data of the albacore tuna were obtained during regular samplings and a total of 3 685 fish was measured. During 2008 five fishing vessels (less than 24 meters) effected 23 trips and landed 41.37 tonnes of chilled fish. Each year about 600 to 700 calls of longliners are noted at Port Louis. During 2008, a total of 20 250 tonnes of tuna and tuna-like species was transhipped at Port Louis by licensed and non-licensed longliners Twenty- four FADs are maintained around Mauritius. About 300 fishermen are involved in this fishery and the catch has been estimated to be around 300 tonnes of pelagic fish annually. The sports fishery supplies the local market with an additional estimated amount of about 350 tonnes of fish which include marlins, tuna, dolphin fishes and sharks. Presently there are two main tuna processing plants in Mauritius employing about 5000 workers..The factories satisfy all the requirements for export of processed tuna to the European markets. A Vessel Monitoring System has been set up since 2005. During 2008, a total of 248 fishing vessels reported to the Mauritian FMC During 2008, 102 licences were issued to foreign fishing vessels which included 81 longliners and 16 purse seiners. A National Plan of Action (NPOA) to prevent, deter and eliminate IUU Fishing has been prepared and approved by the government. Daily catch statistics (logbook data), landing statistics and length frequency data are collected from licensed local and foreign vessels. All the data are processed using the software “FINSS”. Measures taken to implement recommendations of the Scientific Committee include transmission of mandatory statistics to IOTC, Port sampling to collect length frequency data on longline catch, Support for tagging programme, setting of VMS and port inspections.

OMAN

No report supplied.

PAKISTAN

No report supplied.

PHILIPPINES

No report supplied.

SIERRA LEONE

No report supplied.

SEYCHELLES

The Seychelles national report summarizes activities of the purse seine, longline and semi Industrial fishery. The total catch for the purse seine fleet fishing in the WIO in 2008 is estimated at 278,956 MT, representing an increase of 13% over the catches reported for 2007. The mean catch rate stands at 20.36 MT/ fishing day. For the Seychelles fleet the total catch for 2008 is estimated at 56,382 MT, representing an increase of 14% and the mean catch rate stands at 18.81 MT/ fishing day. Significant increases were reported in catches of yellowfin, bigeye and albacore by the whole fleet and the Seychelles fleet particularly on free schools. For the longline fishery, a decrease of 57% was recorded in licences issued and remarkable improvement in logbook return to SFA. The total catch for the Seychelles fleet in 2008 is estimated at 6,723 MT obtained from a fishing effort of 15 million hooks. A significant decrease of 68% was reported in yellowfin catches whilst albacore catches increased by 145%. The number of local semi industrial vessels targeting tuna and swordfish increased from 4 in 2007 to 7 in 2008. The total catch for that fishery stands at 233.328 MT representing a decrease of 6% in catches despite an 80% increase in fishing effort. The CPUE (0.68 MT/1000 hooks) was the lowest recorded since the beginning of the fishery. As for the shark fishery, there was a decrease of 50% in total shark fins landed. Seychelles has revised its logbook format for the longliners to ensure IOTC requirements under Resolution 08/04 are met. All mandatory statistical data were submitted before the deadline and is working towards the implementation of a national observer program.

SRI LANKA

No report supplied.

SUDAN

No report supplied.

TANZANIA

No report supplied.

THAILAND

Neritic tuna and king mackerel species in the Andaman Sea Coast, Thailand comprise 6 species (*Thunnus tonggol*, *Euthynnus affinis*, *Auxis thazard*, *Katsuwonus pelamis* and *Sarda orientalis*, *Scomberomorus spp.*). These species were caught from purse seine, king mackerel gill net and trawl, while purse seine was the main fishing gear. The trend of neritic tuna catches have been decreasing from 45,083 metric tons in 1997 to 13,093 metric tons in 1999. The production was quite stable around 17,000 metric tons during 1999 to 2007. These neritic tuna species are more or less have its production trend similarity. The oversea tuna longline fishery of Thailand was conducted by two Thai tuna longliners in the West Indian Ocean. Four hundred and seventeen fishing operations were carried out in 2008. The total catches were 269.19 metric tons with average catch per unit effort 64.5 kg/100 hooks. Yellowfin tuna was the dominant species caught with 34% of the total, followed by bigeye tuna, billfish, albacore tuna and other species. Regarding to tuna purse seine fishery by four Thai tuna purse seiners, 388 sets were conducted in the Indian Ocean. The total catches were 9,614.20 metric tons with average catch per unit effort 24.78 metric tons/set. Skipjack tuna was the dominant species caught with 64% of the total, followed by bigeye tuna, yellowfin tuna and bonito.

UNITED KINGDOM

The UK (BIOT) National Report summarises fishing by vessels licensed to fish for tuna and tuna like species in the British Indian Ocean Territory (Chagos Archipelago) Fisheries Conservation and Management Zone (FCMZ) during the 2008 / 2009 fishing season. In 2008/09 26 licences were issued to 22 longline vessels. The estimated total catch was 371t comprising 23% yellowfin tuna, 57% bigeye tuna, and 20% other species. 45 licences were issued to 43 Purse seine vessels and their total catch for the 2008/09 season was 14,962t. The catch was dominated by yellowfin tuna 66% (9,927t) with skipjack tuna at 24% (3,596t) and minor catches of bigeye tuna (4% - 617t) and albacore (1% - 822t). It is estimated that a further 25.2t of tuna and tuna like species were landed by recreational fishers on Diego Garcia in 2008. There was no BIOT observer programme during 2008/09. Some data on other species is, however, available in BIOT longline logbooks, and billfish, including swordfish, striped marlin and sailfish together comprise 8% of the total catch, followed by elasmobranchs (7%) and miscellaneous teleost fish (5%). Assessment of changing spatial fleet dynamics due to piracy off Somalia was presented to WPTT in October. Minor changes to BIOTAs systems have been introduced as a result of IOTC SC and Commission recommendations and resolutions and 2008 recommendations made by SC on sharks have been implemented in BIOT since 2006. The Foreign and Commonwealth Office (FCO) has launched a public consultation on the possibility of declaring the whole BIOT FCMZ a marine protected area.

VANUATU

No report supplied.

MALDIVES

Fishing for tuna using live-bait and pole-and-line has been the main occupation and livelihood of Maldivians for at least a thousand years. With a fishing fleet of approximately 1,200-1300 pole-and-line vessels and approximately 250-350 handline large yellowfin vessels, close to 15,000 fishers and their families depend on fishing. This represents about 10-15 percent of the local workforce. The period 2004 -2008 saw a general declining of aggregate fishing effort largely as a result of fuel price hikes. Pole and line fishing, the dominant fishing activity, accounts for between 51 percent and 64 percent of the aggregate fishing effort and as much as 69-76% of total fishing effort directed for capturing skipjack tuna. In the last five years, the aggregate volume of skipjack tuna and yellowfin tuna accounted for between 66 and 75 percent and between 12 and 18 percent of total landings, respectively. The landings of other species of tuna remained relatively insignificant by volume, the total landings of frigate tuna, kawakawa and dogtooth tuna accounting for approximately 2-3 percent, 1-2 percent and less than 1 percent in the same period, respectively. The aggregate landing of other species of fish including sail fishes, sharks and groups of other reef and oceanic fishes accounted for between 9 and 11 percent of aggregate landings. New Fisheries Regulations have been introduced recently to implement an effective fisheries management regime and licensing has been made mandatory for all commercial fishing, fish processing and aquaculture activities. The new Regulations also empower the relevant authorities to implement effective gathering of statistics, monitoring control and surveillance (MCS), inspections of fishing vessels and inspections of relevant fish processing and fish handling facilities. Maldives has been collaborating with IOTC on tuna tagging and in collection of catch statistics in the past. To implement her international obligations, Maldives has recently banned shark fishing within her territorial waters, adopted a draft National Plan of Action (NPA) on sharks, and applied to become a Cooperating Non-Contracting Party of IOTC.

SENEGAL

No report supplied.

SOUTH AFRICA

South Africa has three commercial fishing sectors which either target or catch tuna and tuna-like species as by-catch in the Indian Ocean. These sectors are swordfish/tuna longline, pole and line and shark longline. In addition, there is a boat-based recreational/sport fishery. The number of active longline vessels decreased from 29 in 2007 to 25 in 2008. The total reported swordfish catch in the Indian Ocean for 2008 was 244 t (dressed weight) and increased by 6 t compared to that of 2007. The nominal CPUE for swordfish-directed vessels also increased from 321 kg.1000hooks-1 in 2007 to 336 kg.1000hooks-1 in 2008. Yellowfin and bigeye tuna reported catches for swordfish-directed vessels in 2008 were 520 t and 389 t (dressed weight) respectively. This was much less than the 865 t of yellowfin and 470 t of bigeye reported in 2007. The nominal CPUE of the swordfish-directed vessels (for yellowfin tuna) decreased from 191 kg.1000hooks-1 in 2007 to 169 kg.1000hooks-1 in 2008. Despite the decreased catches of bigeye tuna, the nominal CPUE increased from 112 kg.1000hooks-1 in 2007 to 251 kg.1000hooks-1 in 2008. The use of pole and line in the South African tuna fishery has essentially targeted sub-adult albacore in near-shore waters off the west coasts of South Africa and Namibia. It is important to note that within the tuna pole fishery there has been an emerging rod and reel component that targets large yellowfin tuna south of Cape Town. Although the fishing ground lies just outside the IOTC area the catch is presumed to be of Indian Ocean origin. Currently, these catches are reported to ICCAT and further research is being conducted to determine the origin of the catch and should be concluded by the end of 2009. Traditional linefish catches of tuna and tuna-like species have continued to remain low in the Indian Ocean in 2008 (less than 100 t). Pelagic shark catches started to increase in 2003 when the fishery shifted fishing to the east Agulhas Bank area. Fishing effort for the pelagic shark directed fishery in the Indian Ocean decreased from 334 thousand hooks in 2007 to 225 thousand hooks in 2008. The catches in 2008 declined to 288 t mako and 21 t blue shark compared to 310 t mako and 26 t blue shark in 2007. Nominal CPUE increased for mako sharks from 928 kg.1000.hooks-1 in 2007 to 1277 kg.1000.hooks-1 in 2008. Similarly, catch rates for blue sharks increased from 80 kg.1000.hooks-1 in 2007 to 94 kg.1000.hooks-1 in 2008. By-catches of yellowfin and swordfish accounted for less than 2 t in both years. Bird and turtle data has been submitted to the Secretariat for 2008 by number, fleet (flag), 1x1 degree grid blocks and per species. South Africa has included various bird mitigation measures in their tuna/swordfish longline permit conditions. In addition, scientific observers also collect data on bird mortality rates and provide dead specimens for identification. Awareness programmes have been held to educate permit holders/ skippers of the impact longliners have on seabird populations. To encourage responsible fishing permit holders have been given bird posters so as to be able to identify the common species occurring in Southern African waters. In addition, WWF and Birdlife SA have also provided vessels with tori lines and given instructions on how to use them. A total of 12 turtles were caught in 2008. The most commonly caught turtle in 2008 was the loggerhead (36%) followed by the leatherback (31%). Green and Olive Ridley turtles were also recorded but in small numbers. Although there was still little research capacity in 2009 to process data, South Africa was able to meet its IOTC data reporting obligations on time. South Africa, with the assistance of NGOs and universities, continued to assess the impact of longline fisheries on seabirds, turtles and sharks and to investigate various mitigation and management measures, and in addition, South Africa has also embarked upon a research programme to determine the stock delinecation of yellowfin in the boundary region between the Indian and Atlantic Oceans. South Africa has also started to conduct research on the age and growth of albacore and bigeye tuna, as well as the spatial distribution and movement of bigeye tuna, swordfish and blue sharks in the Atlantic and Indian Oceans using pop-up archival satellite tags. South Africa is a long standing Member of ICCAT. Consequently, South Africa has implemented ICCAT management and control measures for her fleets, including measures to combat IUU fishing, mandatory VMS, onboard scientific observer coverage for longline vessels (including size sampling onboard vessels and at ports), full port inspection scheme, minimum size limits and a daily logbook system for commercial fisheries. South Africa has also improved upon its port state control measures for foreign vessels making application to use South African port facilities. South Africa also provides fishery statistics according to IOTC specifications on an annual basis and implemented all relevant IOTC Scientific Committee recommendations.

URUGUAY

No report supplied.

APPENDIX VI
EXECUTIVE SUMMARIES ON THE STATUS OF IOTC SPECIES, SHARKS AND SEA TURTLES

EXECUTIVE SUMMARY OF THE STATUS OF THE ALBACORE TUNA RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

BIOLOGY

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

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

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

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

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

FISHERIES

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

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

The catches of albacore increased rapidly during the first years of the fishery, remaining relatively stable until the mid-1980s, except for some very high catches recorded in 1973, 1974 and 1982. The catches increased markedly during the 1990's due to the use of drifting gillnets, with total catches reaching around 30,000 t. Catches have steadily increased since 1993, after the drop recorded in 1992 and 1993 as a consequence of the end of the drifting gillnet fishery. Catches between 1998 and 2001 were relatively high (ranging from 37,800 t to 43,800 t). By contrast, the average annual catch for the period from 2004 to 2008 was 27,900 t.

Longliners from Japan and Taiwan,China have been operating in the Indian Ocean since the early 1950s and they have been the major fishers for albacore since then (Table 1). While the Japanese albacore catch ranged from 8,000 t to 18,000 t in the period 1959 to 1969, in 1972 catches rapidly decreased to around 1,000 t due to changing the target species mainly to southern bluefin and bigeye tuna, then ranged between 200 t to 2,500 t as albacore became a bycatch fishery. In recent years the Japanese albacore catch has been around 2,000 to 6,000 t. By contrast, catches by Taiwanese longliners increased steadily from the 1950's to average around 10,000 t by the mid-1970s. Between 1998 and 2002 catches ranged between 21,500 t to 26,900 t, equating to just over 60 % of the total Indian Ocean albacore catch. Since 2003 the albacore catches by Taiwanese longliners have been less that 16,900 t.

The catches of albacore by longliners from the Republic of Korea, recorded since 1965, have never been above 10,000 t. Important albacore catches of around 3,000 t to 5,900 t have been recorded in recent years for a fleet of fresh-tuna longliners operating in Indonesia (Figure 3).

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

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

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

Nominal Catch (NC) Data

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

Catch-and-Effort (CE) Data

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

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

Size Frequency Data

The size frequency data for the Taiwanese longline fishery for the period 1980-2006 is now available. In general, the amount of catch for which size data for the species are available before 1980 is still very low. The data for the Japanese longline fleets is available; however, the number of specimens measured per stratum has been decreasing in recent years. Few data are available for the other fleets.

STOCK ASSESSMENT

In 2008, an age structured production model was used to examine the effect of the interaction between age at selection by the fishery and age-at-maturity and how this might affect stock status. The total catch biomass (1950-2007) and Taiwanese long-line CPUE data (1980-2006) was used to estimate the parameters of the model. Two scenarios were examined: Case 1 where selection begins one age-class before maturation i.e selectivity is at age 4 and maturity is at age 5; and Case 2 where selection follows the maturity ogive i.e. selectivity is at age 5 and maturity is at age 5, but spawning occurs before fishing.

For both scenarios there was no outstanding indications that the stock was over-fished (B2007/BMSY >1), or that overfishing is occurring (hcurrent < hMSY); however, there were considerable differences in the estimates of other stock parameters (the current levels of exploitation rate and current relative to MSY levels). It appears that the interaction of age-at-maturity and age-at-selection has a major influence on the results. In scenario 1 fish are available to the fishery a little earlier than they mature (it does not fully select immature fish but assumes the fishery begins to take fish before they can effectively spawn). For scenario 2 the ages at selection and maturation are the same and, given that the population model assumes that fishing occurs post-spawning, all fish are allowed to spawn at least once before they are exploited. This makes a large difference to the estimated MSY levels. For the values of steepness here (in fact even for lower values) if the fish are permitted to spawn at least once before being exploited then the model estimates that population can permanently sustain very high levels of exploitation.

For scenario 1, MSY was estimated to be 28,260 t (95% CI = 25,353t -31,333 t) and for scenario 2, MSY was estimated to be 34,415 t (28,414t -38,037 t). Both scenarios indicated that annual catches at the historically high level experienced over the period 1998 to 2001 (range 35,000 to 43,000 t, average 38,300 t) would likely exceed MSY levels.

There appears to be a well defined spatial nature to the dynamics of albacore, with relatively few juvenile and immature fish being available to the fishery compared to mature fish. With more information on the spawning condition of fish by location, growth and maturity, as well as improvements to the current indices of abundance and how to interpret the catch data, a well defined spatial assessment model for albacore may be possible in the future.

MANAGEMENT ADVICE

Current status

Based on the preliminary analyses undertaken in 2008 there are no indications that that the albacore stock is over-fished (B2007/Bmsy >1) and overfishing is currently likely not occurring for the scenarios envisaged. Point estimates of MSY ranged from 28,260 t to 34,415 t. This indicated that continuous annual catches at a level approaching 38,000 t (equivalent to the historically high level of catch experienced over the period 1998 to 2001) may not be sustainable in the long term.

Albacore catches have been around 27,900 t annually over the past five years (2004-2008) and this level is only slightly higher than the historical average annual catch taken for the past 50 years (22,800 t). Other fisheries-based indicators show considerable stability over long periods. The mean weight of albacore in the catches has remained relatively stable over a period of more than 50 years. Furthermore, the average weight of albacore in the Indian Ocean is higher than that reported in the other oceans and is likely to result in a higher yield per recruit. The catch rates of albacore have also been stable over the past 20 years.

Because of the low value (Figure 7) and, as a likely result, low profitability of the albacore longline fishery compared to the fisheries for other tuna species, there is likely to be very little incentive for an increase in fishing effort on this species in the immediate future.

On balance of the information available, albacore is considered to be not overfished and overfishing is not occurring.

Recommendation.

The SC acknowledges the preliminary nature of the albacore tuna assessment in 2008, but on balance of the available stock status information considers that the status of the stock of albacore is not likely to change markedly over the next 2-3 years and if the price of albacore remains low compared to other tuna species, no immediate action should be required on the part of the Commission. T

The SC **recommended** that a new albacore tuna assessment be presented to the Scientific Committee at the latest in 2010.

ALBACORE TUNA SUMMARY

Management quantity	2008 (or most recent assessment)	2009 assessment
Most recent catch	33,200 t (2007)	32,900 t (2008)*
Mean catch over the last 5 years (2004-2008)		27,900 t
MSY	Range: 28,260 t – 34,415 t	
F_{2007}/F_{MSY}	Range: 0.48 – 0.91	
B_{2007}/B_{MSY}		
SB_{2007}/SB_{MSY}		
B_{2007}/B_0	>1	
SB_{2007}/SB_0		
$B_{2007}/B_{2007,F=0}$		
$SB_{2007}/SB_{2007,F=0}$		

*preliminary catch estimate.

Note: This Executive Summary has been updated to take account of recent catch data. The management advice, and stock assessment results are based on data up to 2006.

***Table 1.** Best scientific estimates of the catches of albacore tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).*
Data as of November 2009

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Purse seine	France																										0.3	0.5
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2
	Total																						*0.0*	*0.0*	*0.0*	*0.0*	*0.6*	*0.7*
Longline	China																											
	Taiwan,China	1.2	1.1	1.4	1.3	1.6	1.5	1.1	1.7	1.6	7.6	7.7	7.2	7.0	7.0	12.0	17.4	6.4	9.7	9.8	12.8	15.0	11.0	12.3	21.9	17.0	13.9	6.2
	Japan	10.4	11.1	15.2	17.6	12.6	17.8	11.4	13.1	14.1	10.1	8.6	4.9	3.3	1.4	2.0	2.8	1.3	1.2	0.4	0.4	0.4	0.6	1.2	1.3	1.7	1.8	2.3
	Indonesia																0.0	0.1	0.1	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.3
	NEI-Deep-freezing																											0.0
	Korea, Republic of							0.5	0.6	6.2	0.9	4.4	1.6	2.4	3.8	9.1	9.7	3.9	4.2	2.1	4.6	2.0	1.8	0.9	0.6	0.6	0.4	0.5
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.0	0.8	0.2	0.6	0.5	0.5	0.4	0.2	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.0
	Total	*11.6*	*12.1*	*16.6*	*19.0*	*14.1*	*19.4*	*13.2*	*15.6*	*22.0*	*19.3*	*20.8*	*14.4*	*13.3*	*12.7*	*23.4*	*30.2*	*11.6*	*15.3*	*12.5*	*18.1*	*17.7*	*13.7*	*14.7*	*24.2*	*19.6*	*16.7*	*9.3*
Gillnet	Taiwan,China																								0.1	0.1		0.7
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.0*	*0.7*
Other gears	*Total*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.4*	*0.1*	*0.1*	*0.0*
All	*Total*	*11.6*	*12.1*	*16.6*	*19.0*	*14.2*	*19.4*	*13.2*	*15.6*	*22.0*	*19.3*	*20.9*	*14.4*	*13.3*	*12.7*	*23.5*	*30.2*	*11.7*	*15.3*	*12.5*	*18.2*	*17.7*	*13.7*	*14.8*	*24.7*	*19.8*	*17.3*	*10.8*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Purse seine	France	0.5	0.2	0.2	0.2	0.2	0.0	0.0	0.9	1.4	0.3	0.3	0.4	0.4	0.5	0.5	0.2	0.4	0.7	0.3	0.6	0.1	0.1	0.9	0.3	1.0
	Other Fleets	0.4	0.3	0.0	0.0	0.1	0.0	0.3	1.4	1.9	1.0	2.3	0.9	1.2	1.5	1.1	0.4	0.8	0.6	0.5	0.9	0.2	0.1	0.7	0.4	0.5
	Total	*0.8*	*0.6*	*0.2*	*0.2*	*0.3*	*0.0*	*0.3*	*2.2*	*3.3*	*1.3*	*2.6*	*1.3*	*1.6*	*2.0*	*1.6*	*0.6*	*1.2*	*1.3*	*0.8*	*1.5*	*0.2*	*0.2*	*1.5*	*0.7*	*1.4*
Longline	China																									
	Taiwan,China	12.9	11.0	11.1	13.1	11.0	7.1	5.8	13.1	11.1	12.0	14.4	14.2	16.9	15.2	21.6	22.5	21.7	26.9	21.5	13.1	12.5	10.4	9.5	16.9	15.3
	Japan	4.9	4.6	2.5	2.3	1.3	0.9	1.0	1.0	1.8	1.3	1.8	2.0	2.4	3.2	3.2	2.3	2.6	3.0	3.2	2.3	3.6	4.1	6.2	5.3	5.3
	Indonesia	3.2	0.9	0.1	0.3	0.3	0.4	0.4	0.3	0.5	0.4	0.6	0.7	1.3	1.6	1.5	1.7	2.7	3.2	2.8	5.9	5.2	3.2	2.8	2.3	2.7
	India	1.2	0.1															0.0			0.0	0.8	0.6	0.7	2.1	2.1
	NEI-Deep-freezing	0.8	1.5	0.7	0.7	1.7	1.0	1.2	2.5	1.8	3.2	4.2	4.2	7.3	4.8	9.0	9.5	8.2	5.8	3.8	1.4	0.7	1.8	0.9	0.2	0.5
	NEI-Fresh Tuna	0.8	0.1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.5	1.4	1.7
	France-Reunion	0.6	0.1						0.0	0.0	0.1	0.1	0.1	0.3	0.2	0.3	0.3	0.5	0.6	0.3	0.3	0.4	0.7	0.5	0.8	0.5
	Belize	0.5	0.1																1.4	0.6	0.2	0.1	0.7	0.7	0.9	0.3
	Spain	0.5	0.1												0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.8	0.6	0.6	0.3
	Seychelles	0.3	0.1														0.0	0.4	0.8	1.1	1.2	0.1	0.1	0.1	0.4	0.8
	Korea, Republic of	0.2	1.3	0.4	0.4	0.4	0.2	0.2	0.3	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.4	0.2	0.3	0.1	0.0
	Other Fleets	0.7	0.3	0.1	0.1	0.2	0.5	0.5	0.6	0.7	0.6	0.8	0.4	0.2	0.2	0.7	0.5	0.2	0.3	0.3	0.3	0.4	0.5	0.8	1.0	0.8
	Total	*26.6*	*20.2*	*14.7*	*17.0*	*14.9*	*10.2*	*9.0*	*17.8*	*16.0*	*17.7*	*22.0*	*21.8*	*28.6*	*25.5*	*36.4*	*37.1*	*36.5*	*42.4*	*33.8*	*24.7*	*24.0*	*23.3*	*23.5*	*32.0*	*30.4*
Gillnet	Taiwan,China	0.0	1.9	18.2	14.0	14.4	10.6	25.7	9.0	2.6																
	Total	*0.2*	*1.9*	*18.2*	*14.0*	*14.4*	*10.6*	*25.7*	*9.0*	*2.6*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.4*	*0.4*
Other gears	*Total*	*0.3*	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.1*	*0.2*	*0.7*
All	*Total*	*27.9*	*22.8*	*33.2*	*31.3*	*29.7*	*20.9*	*35.1*	*29.2*	*22.0*	*19.1*	*24.7*	*23.1*	*30.2*	*27.6*	*38.1*	*37.8*	*37.9*	*43.8*	*34.8*	*26.4*	*24.4*	*23.7*	*25.1*	*33.2*	*32.9*

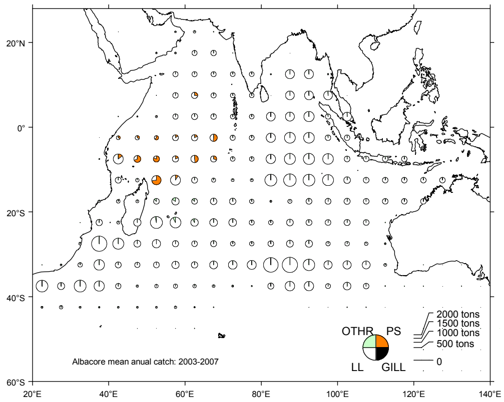


Figure 1. *Average albacore catches by gear during the period 2003-2007. Map shows the distribution of albacore extending from the Indian Ocean to the Atlantic Ocean. LL = longline, PS = purse seine, SU = pole and line.* *Data as of October 2008*

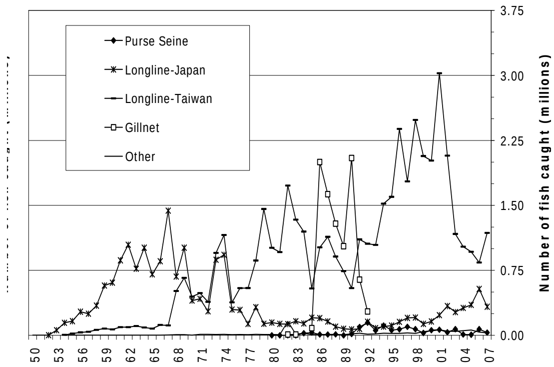


Figure 2. *Catches of albacore per fleet and year recorded in the IOTC Database (1958-2007). Data as of October 2008*

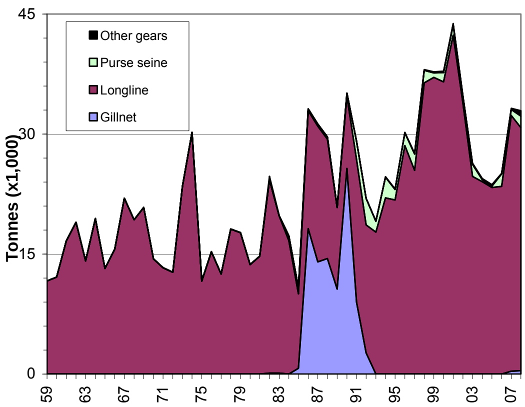


Figure 3. *Annual of catches albacore (thousand of metric tonnes) by gear from 1959 to 2008.* *Data as of November 2009*

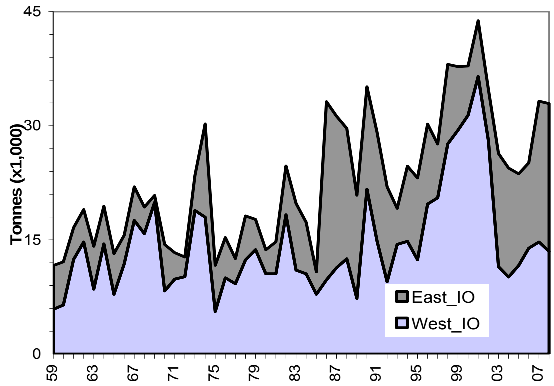


Figure 4. *Catches of albacore in relation to the eastern and western areas of the Indian Ocean (1959-2008).* *Data as of November 2009*

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

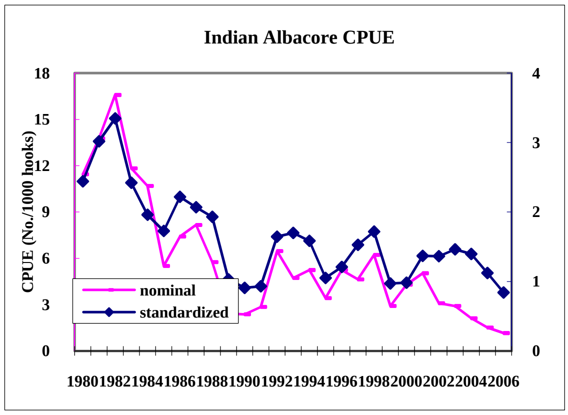


Figure 6. *Nominal and standardised CPUE indices for the Taiwanese longline fishery for albacore in the Indian Ocean..*

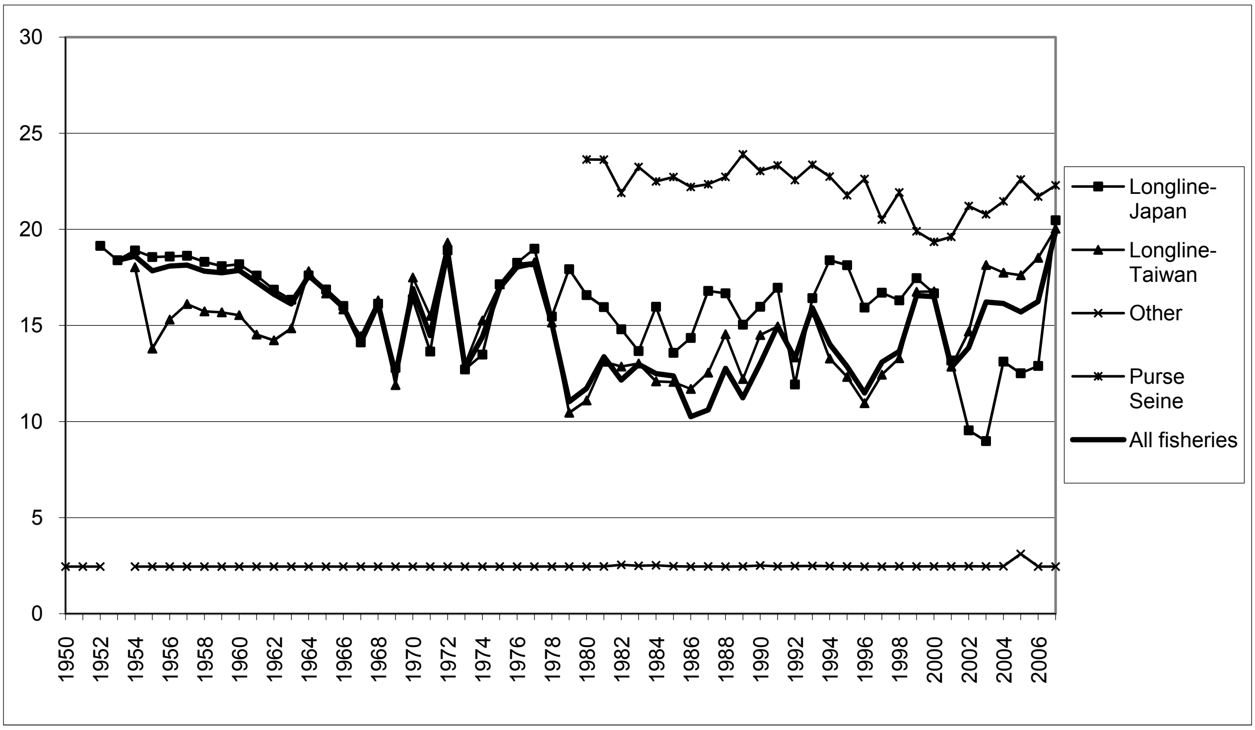


Figure 7. *Average weight of albacore per fleet from 1950 to 2007 in kg.'*

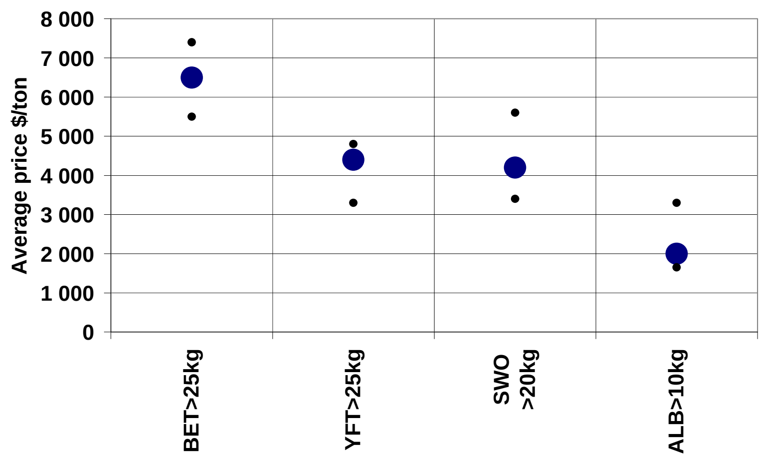


Figure 7. *Comparison of the prices of albacore with other species*

EXECUTIVE SUMMARY OF THE STATUS OF THE BIGEYE TUNA RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

BIOLOGY

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

The tag recoveries from the RTTP-IO provide evidence of rapid and large scale movements of juvenile bigeye in the Indian Ocean, thus supporting the current assumption of a single stock for the Indian Ocean. The new information on the apparent movements of tagged bigeye is presented in Figure 1. The average minimum distance between juvenile bigeye release and recapture positions is estimated at 657 nautical. Miles (IOTC-2009-WPTT-24). The range of the stock (as indicated by the distribution of catches) includes tropical areas, where reproduction occurs, and temperate waters which are believed to be feeding grounds. Of the three tropical tuna species, bigeye tuna lives the longest (probably more than 15 years) and that makes it the species most vulnerable, in relative terms, to over-exploitation. Bigeye have been reported to grow to 200 cm (fork length) long and over 200 kg and start reproducing when they are approximately three years old, at a length of about 100 cm.

The analyses of tag/recovery data from the RTTP-IO may support the hypothesis of a two-stanza growth pattern for bigeye tuna with slow growing juveniles, although more work is needed due to limited size range studied (IOTC-2009-WPTT-31). This pattern would be similar to the two-stanza growth pattern now estimated for yellowfin.

THE FISHERIES

Bigeye tuna is mainly caught by industrial fisheries and appears only occasionally in the catches of artisanal fisheries. Total annual catches have increased steadily since the start of the fishery, reaching the 100,000 t level in 1993 and peaking at 150,000 t in 1999. Total annual catches averaged 122,000 t over the period 2004 to 2008. Bigeye tunas have been caught by industrial longline fleets since the early 1950's, but before 1970 they only represented an incidental catch. After 1970, the introduction of fishing practices that improved the access to the bigeye resource and the emergence of a sashimi market made bigeye tuna a target species for the main industrial longline fleets. Total catch of bigeye by longliners in the Indian Ocean increased steadily from the 1950's to reaching 100,000 t in 1993 and around 140,000–150,000 t for a short period from 1997-1999 (Figure X). The average annual catch by longliners for the period from 2004 to 2008 was 95,000t. Taiwan,China is the major longline fleet fishing for bigeye and it currently takes just under 30% of the total longline catch (Figure X). However, the catches of Taiwanese longliners have decreased markedly in recent years, with current catches of bigeye tuna amounting to less than half the catches recorded in the mid 2000’s. Large bigeye tuna (averaging just above 40 kg) are primarily caught by longlines, and in particular deep longliners. Since the mid 1980’s, bigeye tuna has been caught by purse seine vessels fishing on tunas aggregated on floating objects. Total catch of bigeye by purse seiners in the Indian Ocean reached 40,700 t in 1999, but the average annual catch for the period from 2004 to 2008 was 25,000 t. Purse seiners mainly take small juvenile bigeye (averaging around 5 kg) whereas longliners catch much larger and heavier fish; and while purse seiners take much lower tonnages of bigeye compared to longliners, they take larger numbers of individual fish (Table 1).

By contrast with yellowfin and skipjack tunas, for which the major catches take place in the western Indian Ocean, bigeye tuna is also exploited in the eastern Indian Ocean (Figures 2). The relative increase in catches in the eastern Indian Ocean in the late 1990’s was mostly due to increased activity of small longliners fishing for fresh tuna. This fleet started operating around 1985. In the western Indian Ocean, the catches of bigeye are mostly the result of the activity of large longliners and purse seiners.

AVAILABILITY OF INFORMATION FOR ASSESSMENT PURPOSES

The reliability of the total catches has continued to improve over the past years, although still up to 15% of the catch has to be estimated. The fact that most of the catch of bigeye tuna comes from industrial fisheries has facilitated the estimation of total catches. Catch and effort data, potentially useful to construct indices of abundance, is also considered to be of good overall quality. Size-frequency information is considered to be relatively good for most of the purse-seine fisheries, but insufficient for the longline fisheries. This is due primarily to a lack of reporting from the Korean fleets in the 1970's, lack of reporting from Taiwanese fleets since 1989 and insufficient sample sizes in recent years in the Japanese fishery.

A range of information on biological parameters has been recently obtained from the RTTP-IO tagging programme and this has already greatly improved the knowledge on bigeye growth and movement patterns. Various studies using the tagging data demonstrated that growth is following a multi stanza pattern. However, the lack of recoveries of large fish did not allow the various models used to estimate a reliable Linf. This lack is mainly due to the lack of reporting by the longline fisheries of the Indian Ocean. These data was also analysis to provide estimation of natural mortality at age. A study was undertaken in 2008 but would need to be updated with the new data available. These improved data will be of major importance to improve the outputs of analytical models that are using this information.

In the case of the purse-seine fishery, it was not possible to derive indices of abundance from catch-and-effort information, because the quantification of nominal fishing effort is difficult because the rate of increase in fishing efficiency (use of FADs, technological improvements) is considered a complex exercise . In the case of the longline fisheries, indices of abundance were derived, although there still remain uncertainties whether they fully take into account targeting practices on different species (Figure 7).

The Japanese longline standardised CPUE (1960 to 2008) for the Indian Ocean tropical waters is currently used to derive the index of bigeye abundance both for the whole IO and main fishing areas (areas 1 to 5). Since 2006, sea surface temperature and gear characteristics have been included in the GLM standardisation procedure. In the whole Indian Ocean, this index generally declined from 1960 until 2002, with the exception of higher values in 1977 and 1978. Abundance values in 2003 and 2004 were higher than the lowest historical value in 2002 (Figure 7) and remain around lowest value of the time series during since. A similar analysis of the Taiwanese CPUE series was also presented in 2008 for the period 1979-2008. After standardisation, this index showed an stable period at the beginning of the series until 2000, then markedly increased up to 2005 to decrease thereafter to the lowest value of the time series in 2007. In 2008 a small increased was observed. (Figure 7). A significant differences could be observed between both indices; which, in turn, make the contradictory signals difficult to be used in conjunction in the assessment. Given that the standardisation procedure of the Taiwanese index is still work in progress, the WPTT decided to apply the Japanese index in the recent stock assessment runs, while recognizing and encouraging the significant improvements achieved in the generation of an index of abundance for the Taiwanese fleet.

Catch at size and catch at age data were updated up to 2009. Given that a catch-at-size matrix is an integral part of both length and age based assessment methods, the WPTT expressed their ongoing concerns about the low levels of size sampling being collected in the Indian Ocean. Notwithstanding these concerns the WPTT was encouraged by the potential of the information being obtained from the RTTP-IO in the belief that this programme is going to be important alternative source of size data in the very near future.

STOCK ASSESSMENT

In 2009, four stock assessment models were applied to the Indian Ocean bigeye tuna stock using an agreed list of input parameters.

Results

From the range of MSY estimates, the SC chose the value of 110,000 t. This was the MSY estimated by the ASPM and it was reported ahead of the estimates from the other methods because ASPM results have been reported in previous executive summaries; and the WPTT noted that several of the other assessment approaches used in 2009 needed further exploration and development. Given that the mean annual catch for the period 2003-2008 was

123,000 t, it appears that the stock is being exploited at around its maximum level. Results from the ASPIC analysis plotting the annual catches as a function of fishing mortality illustrate the MSY and its uncertainty (Figure 8).

Despite the broad agreement of the models in estimating MSY, they produced quite different estimates of absolute levels of virgin and current biomass, and thus in the ratios of current levels of F and SSB to MSY. This was probably due to how the variations in CPUE were interpreted by each model. While acknowledging the value of assessing the status of bigeye from a wide range of modelling perspectives, the WPTT recommended that the results of the ASPM would be used in the Bigeye Executive Summary in 2009.

The ASPM results indicate that the 2008 catch is close to the MSY. Furthermore, spawning stock biomass appears to be above the level that would produce MSY, and the fishing mortality in 2008 appears to below the MSY level.

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

Despite the progress made in the 2009 assessments, uncertainties in the results and projections still exist. These uncertainties relate to:

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

Notes about exploitation patterns

The exploitation patterns observed in 2003 and 2004 could be considered anomalous, and heavily influenced by the high abundances of yellowfin tuna, which concentrated the activity of the surface fleets. The decrease in the fishing pressure on bigeye currently observed is likely to be temporal, as the fleets appeared to come back to their previous pattern of activity by the second half of 2006.

Two other factors could also influence the short term evolution of the fishery. Rising fuel costs appear to be having an effect on the operating procedures of the surface fleets. Distances travelled at night, and consequently the number of FADs visited, are being reduced to save on fuel costs. The effect of this change could be however reduced by the increasing use of supply vessels, tasked with visiting FADs and informing purse seiners of the abundance of fish around them. The second factor is the limitation on the activity of all fishing fleets on the coast and EEZ of Somalia, due to the increase in the activity of pirates in the area. Some purse seine fleets have received indications from their governments not to venture into those waters. An important fishery on FADs has traditionally taken place in this area on the last quarter of the year, with significant catches of juvenile bigeye. Because of piracy acts off Somalia, the fishery has shifted into the South of the Arabian Sea, north of 10°N – an area where there are relatively few bigeye and where juvenile bigeye is not taken at FADs.

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

MANAGEMENT ADVICE

Current status

The results of the stock assessments conducted in 2009 were broadly similar to previous work. The preliminary estimate of catches in 2008 (107,000 t) is below the current estimate of MSY (110,000 t), catches in the past (1997-1999) have significantly exceeded MSY.

Estimated values of fishing mortality and SSB for 2008 are also close to MSY-related values, indicating a fully exploited stock.

Outlook

Recent changes in the areas fished by purse seiners do not appear to have had an effect on mortality for juvenile bigeye, despite the decrease in effort in the Somali basin where fishing on FADs usually caught the majority of juvenile bigeye.

Recommendations

The indices of abundance from two longline fleets available for this stock present divergent trends over the last few years, the differences observed in targeting are not fully explained.

The SC **recommended** that catches of bigeye tuna should not exceed the estimated MSY of 110,000t.

BIGEYE TUNA SUMMARY

Management quantity	2006 (Estimates for 2004)	2009 assessment
Most recent catch	121,600 t (2005)	107,000 t (2008)*
Mean catch over the last 5 years (2004-2008)		121,700 t
Maximum Sustainable Yield	111,200 t Range: 95,000 t – 128,000 t	110,000 t Range: 100,000 t – 115,000 t
$F_{Current}/F_{MSY}$	0.81 Range: 0.54 – 1.08	0.90
$B_{Current}/B_{MSY}$ (1)		1.17
$SB_{Current}/SB_{MSY}$ (2)	1.34 Range: 1.04 – 1.64	1.17
$B_{Current}/B_0$ (1)		0.42
$SB_{Current}/SB_0$ (2)		0.34
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

*preliminary catch estimate.

(1) Estimated through ASPIC
(2) Estimated through ASPM

***Table 1**. Best scientific estimates of the catches of bigeye tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).*

Data as of November 2009

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Purse seine	Spain																										0.8	1.3
	France																							0.0	0.0	0.2	2.3	4.3
	NEI-Other																									0.0	0.5	0.6
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.9
	Total																				*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.6*	*4.0*	*7.2*
Longline	China																											
	Taiwan,China	1.5	1.3	1.9	1.2	1.7	1.8	1.4	2.2	2.3	7.2	8.0	10.0	5.6	5.5	4.0	6.0	5.3	4.2	6.2	4.9	7.4	8.9	6.8	11.3	11.3	10.9	12.2
	Japan	8.4	14.8	13.0	17.3	11.6	16.0	17.6	21.4	21.8	23.6	14.4	12.7	11.2	8.3	5.2	6.9	5.5	2.1	3.1	10.9	4.2	5.9	7.8	11.4	18.3	14.0	17.2
	Indonesia															0.0	0.2	0.4	0.3	0.3	0.4	0.4	0.5	0.5	0.8	1.9	2.4	2.4
	Seychelles																									0.0	0.1	0.1
	India																									0.0	0.0	0.0
	NEI-Deep-freezing																											0.1
	Korea, Republic of							0.2	0.2	0.6	6.8	7.6	3.5	4.9	4.9	7.3	14.7	26.2	21.9	26.1	34.1	21.5	19.3	19.4	19.5	17.4	11.8	12.9
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.4	0.1	2.0	0.5	1.6	1.4	1.2	1.0	0.6	0.2	0.1	0.2	0.2	0.0	0.2	0.3	0.3	0.5	0.6	0.0
	Total	*9.9*	*16.1*	*15.0*	*18.5*	*13.3*	*18.0*	*19.6*	*24.1*	*24.8*	*39.6*	*30.5*	*27.8*	*23.0*	*20.0*	*17.5*	*28.4*	*37.7*	*28.6*	*35.9*	*50.6*	*33.5*	*34.9*	*34.9*	*43.4*	*49.5*	*39.7*	*44.9*
Other gears	*Total*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.2*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.5*	*0.4*	*0.4*	*0.7*	*0.6*
All	*Total*	*10.0*	*16.2*	*15.0*	*18.6*	*13.4*	*18.1*	*19.6*	*24.2*	*24.9*	*39.7*	*30.6*	*27.9*	*23.1*	*20.1*	*17.6*	*28.6*	*37.9*	*28.8*	*36.3*	*50.9*	*33.8*	*35.2*	*35.3*	*43.9*	*50.5*	*44.4*	*52.6*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Purse seine	Spain	10.2	4.1	1.8	5.0	6.8	5.9	4.9	6.0	3.6	5.4	5.9	12.2	11.4	15.9	11.2	16.0	11.3	7.8	10.9	8.5	8.6	10.3	10.0	9.8	12.5
	France	6.1	2.9	7.1	7.0	6.2	3.6	4.6	5.4	3.8	5.0	5.4	7.3	6.9	7.8	6.4	8.5	6.7	5.5	7.3	5.3	5.8	6.5	5.3	6.1	6.7
	Seychelles	4.4	0.8						0.0	0.0					0.9	2.0	3.0	1.8	2.8	3.7	3.4	4.4	4.8	3.5	3.9	5.4
	Thailand	1.9	0.2															0.2	0.1				1.6	4.0	1.7	2.3
	NEI-Other	0.7	1.1	1.0	0.8	0.8	0.5	1.0	1.5	0.9	1.9	2.5	3.4	3.4	6.2	5.2	7.5	6.0	3.1	4.1	2.4	0.9	0.6	0.6	0.5	0.7
	Other Fleets	2.0	1.4	0.7	0.7	1.3	2.0	2.2	2.6	2.9	3.7	5.1	5.5	2.8	3.2	3.5	5.7	4.0	4.4	3.1	3.2	2.7	2.3	1.3	1.9	1.9
	Total	*25.3*	*10.5*	*10.6*	*13.4*	*15.1*	*12.0*	*12.7*	*15.6*	*11.3*	*16.0*	*18.9*	*28.4*	*24.5*	*34.0*	*28.3*	*40.7*	*29.9*	*23.7*	*29.0*	*22.8*	*22.4*	*26.1*	*24.7*	*23.7*	*29.5*
Longline	China	7.6	1.2										0.2	0.6	1.7	2.3	2.4	2.8	3.1	2.8	4.6	8.3	8.9	8.7	7.2	5.0
	Taiwan,China	38.7	18.4	16.8	17.6	19.4	19.9	20.8	29.0	24.0	39.7	27.8	32.7	29.8	34.1	39.7	37.1	36.4	42.1	50.2	60.0	56.9	40.2	35.8	36.1	24.3
	Japan	13.9	12.5	15.8	15.5	12.3	7.7	8.2	7.8	5.6	8.3	17.5	17.2	16.5	18.8	17.1	14.0	13.6	13.0	13.9	10.0	10.6	12.5	13.9	18.2	14.2
	Indonesia	10.7	6.3	0.7	2.4	3.2	4.5	4.5	4.5	7.6	7.9	10.8	12.2	23.2	27.9	26.1	30.5	20.9	22.0	27.0	13.3	11.9	9.9	8.9	11.5	11.1
	Seychelles	5.4	0.7									0.0	0.0	0.1	0.0	0.1	0.1	0.5	1.0	2.2	3.7	7.0	6.1	4.1	5.6	4.4
	India	4.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	2.5	4.5	7.2	5.7
	NEI-Fresh Tuna	4.0	1.4				1.9	2.6	2.3	2.6	2.9	4.6	3.8	4.3	5.3	4.7	4.8	4.6	0.6	2.0	2.6	3.4	3.6	4.4	4.4	4.4
	NEI-Deep-freezing	3.6	3.2	1.1	0.9	2.9	2.8	4.4	5.5	3.8	10.7	8.1	9.7	13.0	10.8	16.7	16.7	14.0	8.3	8.3	5.6	6.5	4.5	3.7	2.3	1.2
	Korea, Republic of	2.0	8.4	11.9	14.4	17.1	12.2	10.7	2.3	4.8	5.3	8.9	6.6	11.9	11.1	3.6	1.5	3.6	1.6	0.2	1.2	2.5	2.7	3.1	1.3	0.5
	Philippines	1.6	0.3													1.4	1.0	1.3	0.9	0.8	1.4	0.9	1.5	1.8	2.1	1.9
	NEI-Indonesia Fresh	0.0	1.5	0.1		2.0	7.5	9.2	9.4	11.4	9.2	11.9	6.5	2.7	2.9	0.2	0.0									
	Other Fleets	2.1	0.7	0.3	0.3	0.2	0.0	0.0	0.0	0.3	0.5	0.2	0.1	0.2	0.2	0.4	0.9	0.9	2.7	2.5	2.2	1.8	1.9	1.9	2.3	2.5
	Total	*94.4*	*55.0*	*46.6*	*51.2*	*57.0*	*56.6*	*60.4*	*60.8*	*60.1*	*84.5*	*89.9*	*88.9*	*102.1*	*112.9*	*112.3*	*109.0*	*98.6*	*95.2*	*109.9*	*104.6*	*113.5*	*94.4*	*90.8*	*98.3*	*75.1*
Other gears	*Total*	*2.0*	*0.8*	*0.5*	*0.7*	*2.5*	*1.1*	*1.0*	*1.0*	*0.7*	*1.0*	*1.2*	*1.8*	*1.5*	*1.5*	*1.5*	*1.8*	*1.3*	*1.6*	*1.8*	*1.9*	*1.8*	*1.2*	*2.4*	*2.4*	*2.4*
All	*Total*	*121.7*	*66.3*	*57.8*	*65.3*	*74.6*	*69.6*	*74.1*	*77.4*	*72.1*	*101.5*	*109.9*	*119.1*	*128.0*	*148.3*	*142.1*	*151.4*	*129.8*	*120.5*	*140.7*	*129.3*	*137.7*	*121.6*	*117.9*	*124.5*	*107.0*

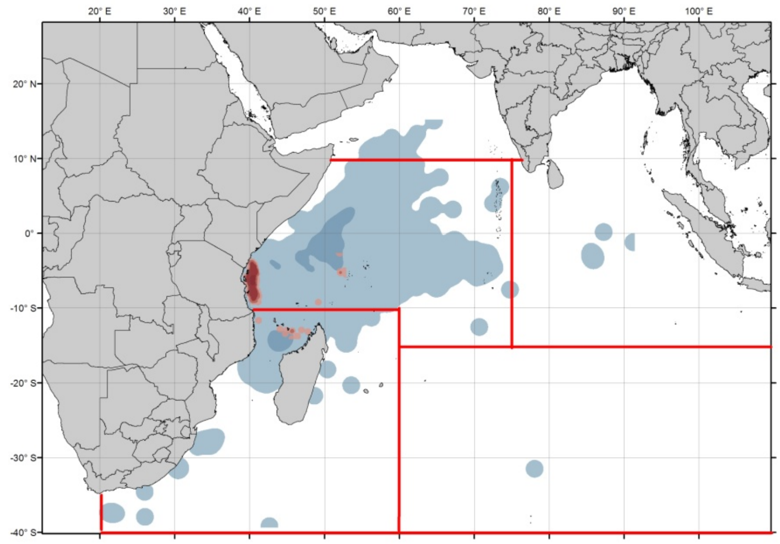


Figure 1. *Density map of Releases (red) and Recoveries (blue) of bigeye tuna during the RTTP-IO.* Data as of December 2009.

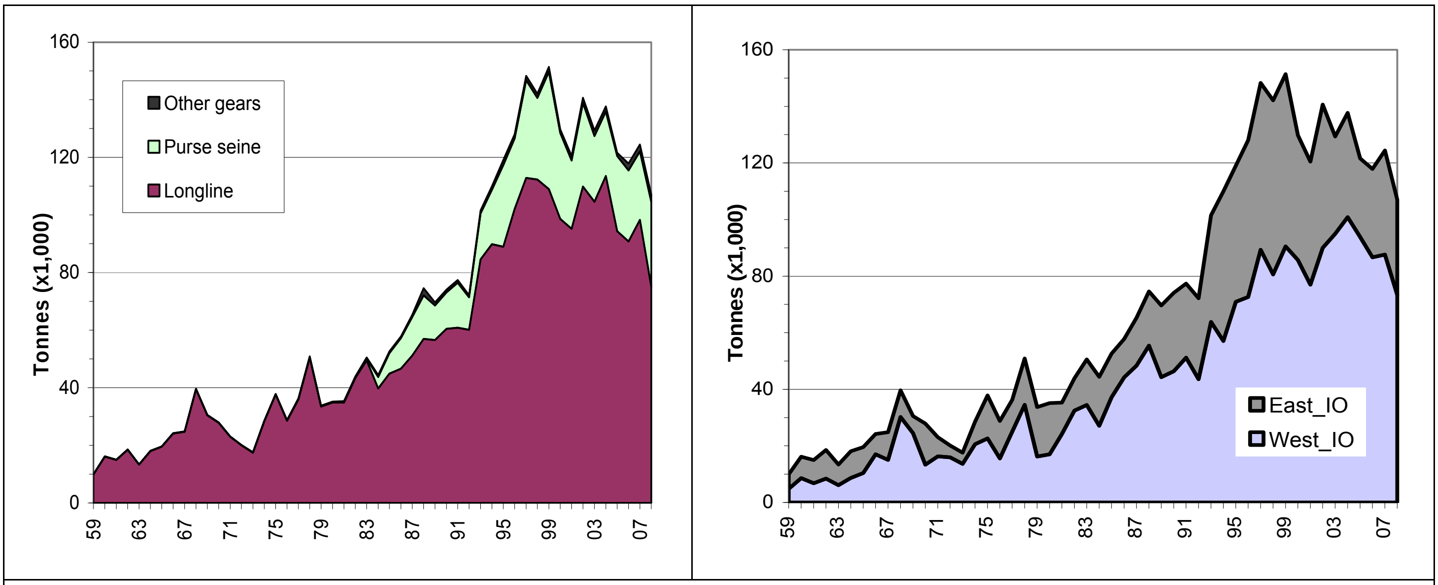


Figure 2. *Yearly catches (thousand of metric tonnes) of bigeye tuna by gear from 1959 to 2008 (left) and by area (Eastern and Western Indian Ocean, right.* Data as of November 2009

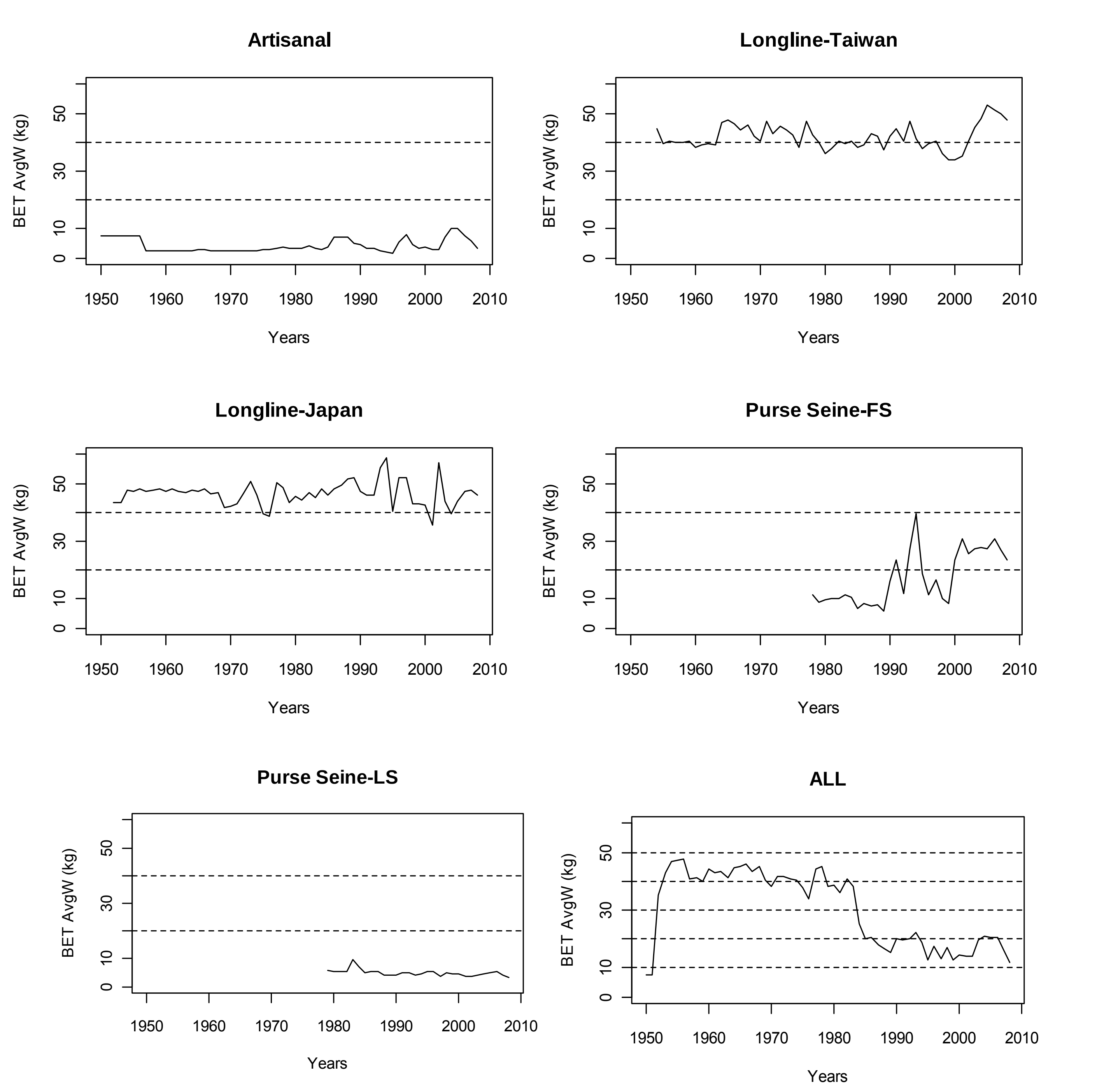


Figure 3*. Mean weight of bigeye measured from artisanal, longline and purse seine catches from 1950 to 2008. (FS = free school; LS = log school).*

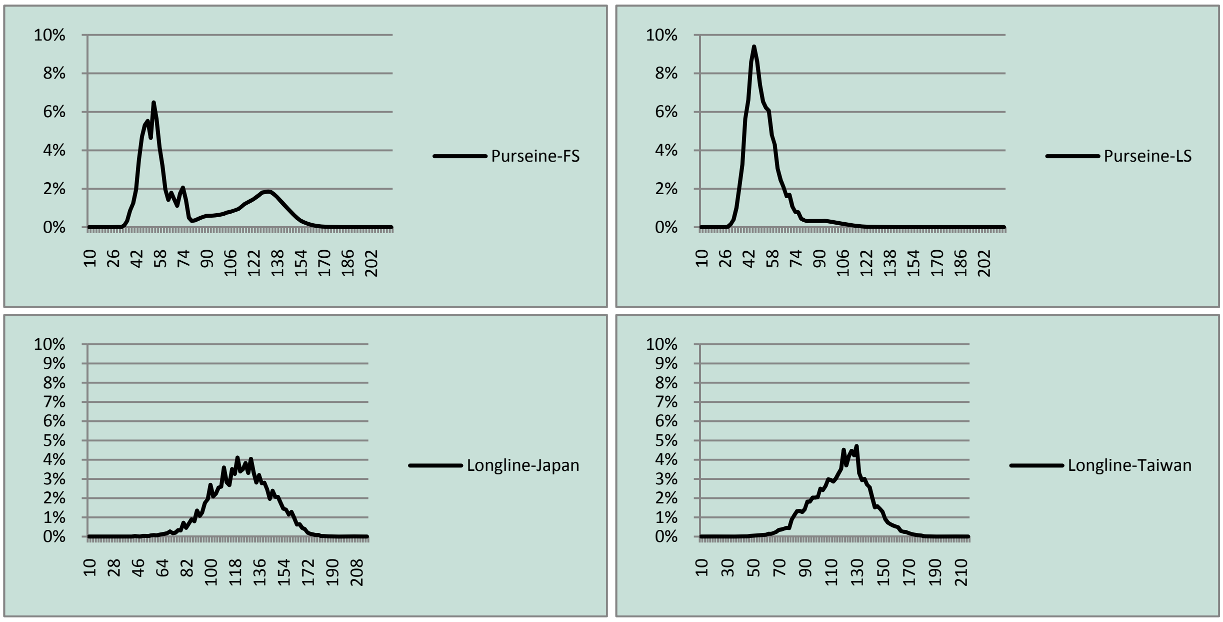


Figure 4. *Mean catch at size of bigeye measured from purse seine and longline catches from 1998-2008, in numbers LS = log school; FS = free school.*

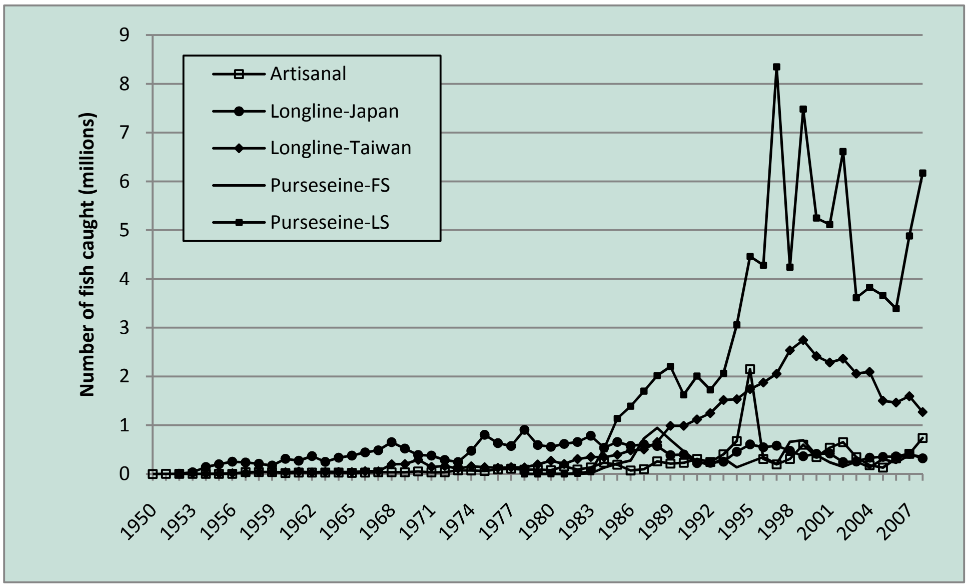


Figure 5. *Catch in numbers of bigeye tuna by gear (PS: purse seine (free school and log school); LL: longline and other gears). Data as of October 2009*

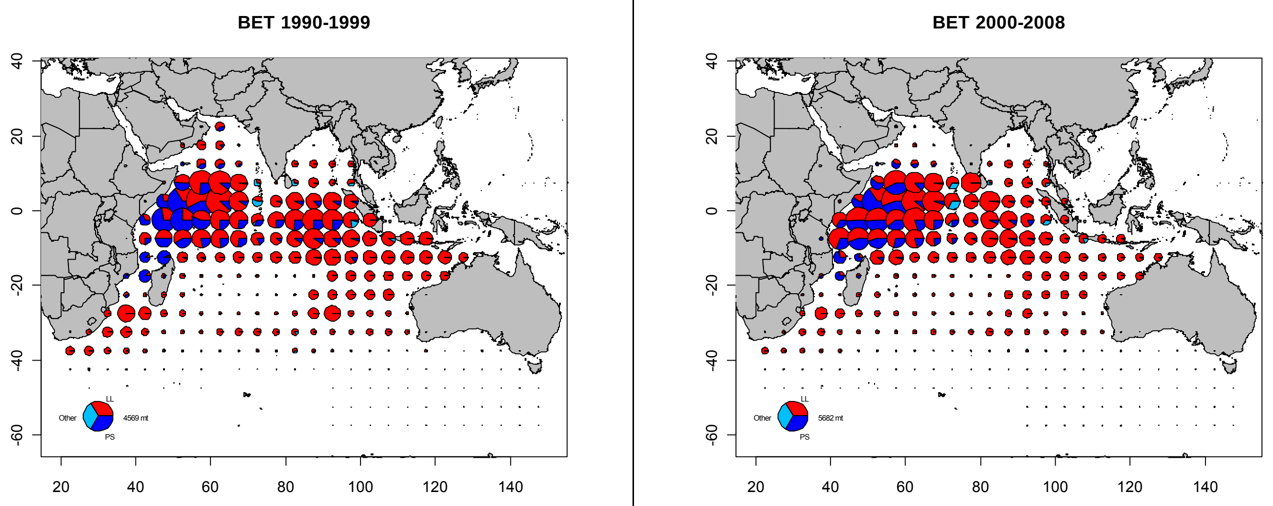


Figure 6. *Average annual bigeye catches by gear during the periods 1990-1999 and 2000-2008. LL = longline, PS = purse seine, SU = pole and line. Data as of October 2009*

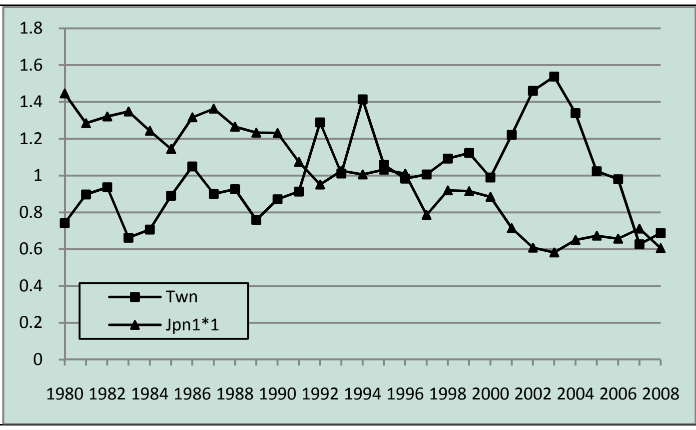


Figure 7. *Standardised CPUE indices for the Japanese and Taiwanese longline fleets in the Indian Ocean tropical waters*

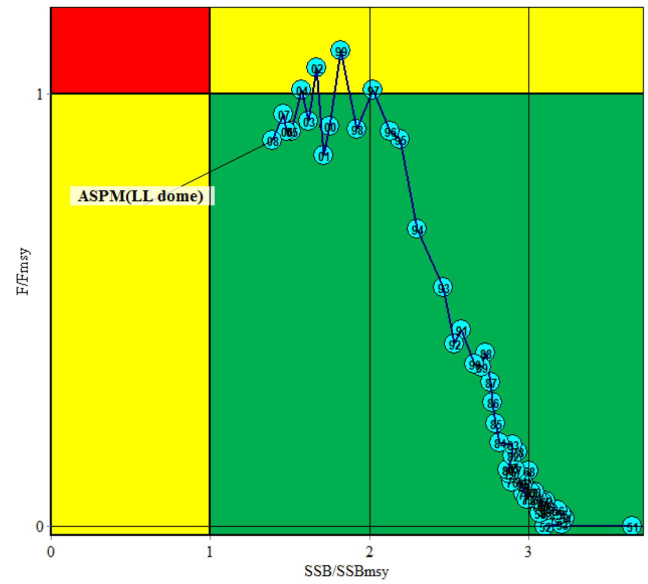


Figure 8. *ASPM Kobe plots*

EXECUTIVE SUMMARY OF THE STATUS OF THE SKIPJACK TUNA RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE, DECEMBER 2009)

BIOLOGY

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

Skipjack exhibits characteristics that result in a higher productivity when compared to other tuna species. Tagging recoveries of the RTTP-IO show that skipjack is exploited for at least 4 to 5 years in the Indian Ocean. This species has a high fecundity, and spawns opportunistically throughout the year in the whole inter-equatorial Indian Ocean (north of 20°S, with surface temperature greater than 24°C) when conditions are favourable. The size at first maturity is about 41-43 cm for both males and females (and as such most of the skipjack taken by the fisheries are fish that have already reproduced).

The growth of skipjack has now been estimated utilising the RTTP-IO tag/recovery data. These results are consistent with the results obtained in the mid 1990's using data from the IPTP tagging programme in Maldives. Skipjack recoveries indicate that the species is highly mobile, and covers large distances. The average distance between skipjack tagging and recovery positions is estimated at 640 naut. miles.

The tag recoveries from the RTTP-IO provide evidence of rapid, large scale movements of skipjack tuna in the Indian Ocean, thus supporting the current assumption of a single stock for the Indian Ocean. The new information on the spatial distribution of tagged fish is presented in Figure 1.

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

FISHERIES

Catches of skipjack increased slowly from the 1950s, reaching around 50,000 t at the end of the 1970s, mainly due to the activities of baitboats (or pole and line) and gillnets. The catches increased rapidly with the arrival of the purse seiners in the early 1980s, and skipjack became one of the most important tuna species in the Indian Ocean. Annual total catches exceeded 400,000 t in the late 1990's and the average annual catch for the period from 2003 to 2007 was 509,000 t (Figure 2, 3 and Table 1). Preliminary data indicate that catches in 2008 (405,000 tons) may have been the lowest reported since 1999 (426,100 t).

In recent years, the proportions of the catch taken by the industrial purse seine fishery and the various artisanal fisheries (baitboat, gillnets and others) have been fairly consistent, the majority of the catch originating from the western Indian Ocean (Figure 3), purse seine baitboat and gillnets representing 95% of the total skipjack catches. In general, there is low inter-annual variability in the catches taken in the Indian Ocean compared to those taken in other oceans.

The increase of skipjack catches by purse seiners is due to the development of a fishery in association with Fish Aggregating Devices (FADs). In 2008, 89 % (av 85% for UEPS on the last 10 years) of the skipjack tuna caught by purse-seine is taken in Log school.

The Maldivian fishery has effectively increased its fishing effort with the mechanisation of its pole and line fishery since 1974, and the use of anchored FADs since 1981. Skipjack represents some 80 % of its total baitboat catch, and catch rates have regularly increased since the beginning of the 1980s (Figure 4).

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

The average weight of skipjack caught in the Indian Ocean is around 3.0 kg for purse-seine, 2.8 kg for the Maldivian baitboats and 4-5 kg for the gillnet (Figure 6). For all fisheries combined, it fluctuates between 3.0-3.5 kg; this is larger than in the Atlantic, but smaller than in the Pacific. It was noted that the mean weight for purse seine exhibited a strong decrease in 2007 (2.5 kg) and 2008 (2.1 kg), for both free and log schools

Industrial purse seine fishery catch rates remained quite low in 2007-2008 compared to the recent period (1999-2006), but still in the range of the previous period. Maldives artisanal fishery. While the activities of pirates off the coast of Somalia have meant that vessels have been avoiding traditional skipjack fishing grounds where catch rates were high, it appears that the decline in catch rates in the Maldives fishery could be due to environmental causes such as higher than average sea surface temperatures. The marked increase of the fuel price appears also to have substantially reduced the fishing operations in the Maldivian fishery.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

In 2008, a review of skipjack was undertaken including the examination of a range of stock status indicators and exploitation rates derived from external analyses of the tagging data. New cpue indices were presented in 2009, using purse seine nominal cpue in the main fishing area north of equator.

Fishery indicators

As an alternative, the WPTT decided to analyse various fishery indicators to gain a general understanding of the state of the stock. Several of these indicators were updated in 2009.

1. **Trends in catches**: The trend in catches indicate a large and continuous increase in the catches of skipjack tuna since the mid-1980's (Figure 3). This is mainly due to the expansion of the FAD-associated fishery in the western Indian Ocean. After reaching a peak of 613,000 tons in 2006, total catches have strongly decreased, falling to 4,000 tons in 2008, the lowest observed since 1999. This is largely due to the purse seine fishery strongly affected by the piracy activities in the main skipjack fishing area.
2. **Nominal CPUE Trends:** In 2008, attempts to calculate standardised CPUEs from the purse seine fishery were carried out. The standardized CPUE showed a declining trend from 1984 to 1998, then an increase till 2003 and a marked decrease since 2006. This index was updated in 2009, CPUEs being computed from two types of efforts (catch by positive set and by searching time). A base case and two cases with a 2% and 3% increase in fishing efficiency were applied on searching time to explore the effect on the CPUE trend. When considering the base case, catch per searching time fluctuate without trend while it is observed an overall decline in CPUE of 38% (2% increase in fishing efficiency) and 58% (3% increase in fishing efficiency). (fig 5bis).This analysis is still provisional and could be much improved by incorporating detailed information reflecting changes in the fishing power and efficiency of purse seiners over time.
3. **Average weight in the catch by fisheries:** The average weights of skipjack taken by various gears and all gears combined have remained relatively stable since 1991 (Figure 6). The purse seine and the baitboat fisheries take the greatest catch of fish around 40-65 cm while 70-80 cm fish are mainly taken by the gillnet fisheries. However, a relatively strong decrease of the purse seine mean weight is observed since 2006 for both free and log schools, with the lower values observed since the begining of this fishery. There is no clear explanation to this observation (changes in fishing zones, environment, ...?). an equivalent decrease in mean weight was also mentioned for the maldivian baitboat fishery.
4. **Number of 1 CWP squares visited or fished:** This indicator (Figure 7) reflects the spatial extension of a fishery. Trends observed in the number of CWP with effort or catch since 1991 suggest that the area exploited by the purse-seine fishery has changed little since 1991, apart in 1998 when a particularly strong El Niño episode resulted in a much wider spatial distribution of the fishery.

Length-based analyses

No assessment was done on skipjack this year. Last year, a length-based cohort analysis has been carried out to analyze skipjack catches and length frequencies. In the 1980's, there was a marked increase of catches of smaller size fish (40-60 cm) due to the development of the purse seine fishery (Figure 8). The largest skipjack (60 cm+) tend to be taken by the artisanal fisheries (e.g. gillnets, troll line and handlines) and the Maldives's pole-and-line fishery (Figure 9). The marked increase in the catch of large skipjack (60-70 cm) by gillnets since 2000 is reflected by marked increase of the mean weight of skipjack caught by this gear (Figure 6).

Interaction between skipjack fisheries and other species

Purse seiners catch 40-60 cm skipjack whereas artisanal fisheries catch 60-70 cm fish (Figure 9), thus the fishing pressure applied by purse seiners on smaller size skipjack is likely to affect the catches of larger sized skipjack by the artisanal fisheries. Furthermore, large numbers of juvenile bigeye and yellowfin tuna are caught in the course of purse-seine sets on FADs that target skipjack tuna.

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

STOCK ASSESSMENT

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

External analyses on the tagging data were conducted in 2008. For both 2006 and 2007 the estimated numbers of skipjack recruits in the Western Indian Ocean were larger than those for both bigeye and yellowfin (even though they included older aged fish), confirming that substantially larger numbers of skipjack are present in the Indian Ocean compared to yellowfin and bigeye tuna. Exploitation rates of skipjack are relatively low - not exceeding 20% even for the most selected age-range of the stock. Abundance in 2006 was estimated to be higher than that in 2007, while the relative age-structure remained stable, with a similar decrease in relative abundance from ages 2 to 5. This indicates that the population has a reasonably stable year-class regime at least for the cohorts that encompass the data used in the analysis (2000-2005).

The Scientific Committee also notes that in most fisheries, declining catches combined with increasing effort are usually indicators that a stock is being exploited close or above its MSY. In the case of skipjack tuna, catches have continued to increase as effort has increased. However, the Scientific Committee noted that skipjack catches declined in 2007 and 2008, and the causes of this decline should be examined; the reduction of the Somali fishing area due to the piracy is probably one of the reason of the decline of the purse seine catches. Furthermore, the majority of the catch comes from fish that are sexually mature (greater than 40 cm) and therefore likely to have already reproduced.

MANAGEMENT ADVICE

Current status

The high productivity and life history characteristics of skipjack tuna suggest this species is resilient and not easily prone to overfishing. However, the analysis of some indicators of stock status for recent years suggests that the situation of the stock should be closely monitored in 2010.

Outlook

No new analysis has been carried out this year that allows the WPTT to predict the future evolution of this stock.

Recommendations

Given the limited nature of the work carried out on the skipjack in 2009, no new advice is provided for the stock.

SKIPJACK TUNA SUMMARY

Management quantity	2008 (or most recent assessment)	2009 assessment
Most recent catch	458,700 t (2007)	431,100 t (2008)*
Mean catch over the last 5 years (2004-2008)		499,900 t
Maximum Sustainable Yield		
$F_{Current}/F_{MSY}$		
$B_{Current}/B_{MSY}$		
$SB_{Current}/SB_{MSY}$		
$B_{Current}/B_0$		
$SB_{Current}/SB_0$		
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

*preliminary catch estimate.

Table 1. *Best scientific estimates of the catches of skipjack tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).Data as of November2009*

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Purse seine	Spain																										6.4	18.6
	France																							0.2	1.0	9.4	27.3	29.8
	Indonesia	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.6	0.6	0.7	1.1	1.4	1.1	1.0	1.5	1.7	1.7	2.5	3.0	2.6	2.8
	NEI-Other																									0.4	8.2	8.4
	Japan																			0.1	0.9	0.6	0.4	0.1	0.5	0.6	0.7	0.3
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.8	2.7	1.5	3.1	3.2
	Total	*0.2*	*0.2*	*0.3*	*0.3*	*0.4*	*0.6*	*0.4*	*0.4*	*0.4*	*0.5*	*0.5*	*0.4*	*0.4*	*0.6*	*0.6*	*0.7*	*1.1*	*1.4*	*1.2*	*1.9*	*2.1*	*3.1*	*3.7*	*6.7*	*14.8*	*48.3*	*63.2*
Baitboat	Maldives	10.0	9.0	8.0	8.0	8.0	8.0	14.1	16.9	18.9	17.5	19.6	27.6	28.0	17.5	19.5	22.5	14.9	18.6	13.7	13.2	17.3	22.2	19.6	15.3	19.3	32.3	42.2
	Indonesia	0.4	0.4	0.6	0.6	0.6	0.6	0.7	0.8	0.7	0.8	0.8	0.6	0.7	1.0	1.1	1.2	1.9	2.5	1.9	1.8	2.7	3.0	3.0	4.5	5.3	4.5	4.9
	India	0.2	0.4	0.6	0.2	0.4	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.6	0.6	2.6	0.8	1.0	1.9	1.3	1.7	2.3	2.7	1.7	2.2	2.5	3.2	3.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.3	5.0	10.8	2.1	0.1	0.6	0.8	0.4	0.0	0.2	0.7	0.6	0.4	0.4
	Total	*10.7*	*9.9*	*9.2*	*8.8*	*9.0*	*8.9*	*15.1*	*17.9*	*20.0*	*18.6*	*20.7*	*28.8*	*29.3*	*19.4*	*28.3*	*35.3*	*19.9*	*23.0*	*17.4*	*17.5*	*22.7*	*27.9*	*24.6*	*22.7*	*27.6*	*40.4*	*50.6*
Gillnet	Sri Lanka	1.9	2.4	3.0	4.5	6.1	5.8	5.6	6.4	7.1	8.0	8.9	7.0	5.0	8.9	10.6	9.3	7.3	12.7	12.6	14.9	12.4	16.3	18.4	18.0	16.4	13.3	14.9
	Indonesia	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.6	0.6	0.9	1.0	1.1	1.7	2.3	1.7	1.7	2.5	2.8	2.8	4.2	4.9	4.2	4.6
	Pakistan	0.9	1.2	1.0	1.6	2.4	3.4	3.6	4.9	4.7	4.7	4.3	3.9	3.2	3.8	3.0	4.1	4.5	4.2	3.8	2.2	3.8	1.8	2.7	3.4	1.1	1.2	2.0
	Other Fleets	0.3	0.5	0.8	0.2	0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.4	0.7	0.8	3.2	1.0	1.3	2.6	1.5	2.0	2.8	0.2	0.3	0.6	0.3	0.4	0.5
	Total	*3.6*	*4.5*	*5.3*	*6.9*	*9.5*	*10.1*	*10.2*	*12.2*	*12.9*	*13.9*	*14.3*	*11.8*	*9.6*	*14.4*	*17.8*	*15.6*	*14.8*	*21.9*	*19.7*	*20.8*	*21.5*	*21.1*	*24.3*	*26.1*	*22.7*	*19.2*	*22.0*
Line	Indonesia	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.6	0.6	0.9	1.0	1.1	1.7	2.2	1.7	1.6	2.4	2.7	2.7	4.0	4.7	4.0	4.4
	Other Fleets	0.5	0.6	0.7	1.0	1.4	1.3	1.2	1.4	1.6	1.8	2.0	3.1	2.8	3.1	3.7	3.5	3.5	4.7	4.2	4.2	3.8	4.7	5.1	3.3	3.4	3.4	3.2
	Total	*0.9*	*1.0*	*1.3*	*1.5*	*1.9*	*1.9*	*1.9*	*2.1*	*2.2*	*2.5*	*2.8*	*3.7*	*3.4*	*4.0*	*4.7*	*4.5*	*5.2*	*6.9*	*5.8*	*5.8*	*6.3*	*7.4*	*7.8*	*7.2*	*8.1*	*7.4*	*7.5*
Other gears	*Total*	*0.3*	*0.5*	*0.5*	*0.6*	*0.4*	*0.5*	*0.5*	*0.7*	*0.6*	*0.8*	*0.6*	*0.3*	*0.3*	*0.5*	*0.3*	*0.4*	*0.6*	*0.7*	*0.5*	*0.5*	*0.8*	*0.8*	*0.9*	*1.3*	*1.5*	*1.3*	*1.4*
All	*Total*	*15.7*	*16.2*	*16.6*	*18.1*	*21.2*	*22.0*	*28.1*	*33.4*	*36.2*	*36.3*	*38.8*	*45.0*	*43.0*	*38.8*	*51.8*	*56.5*	*41.5*	*54.1*	*44.7*	*46.5*	*53.4*	*60.4*	*61.2*	*64.0*	*74.6*	*116.5*	*144.7*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Purse seine	Spain	81.5	29.8	19.1	27.9	39.7	63.9	47.9	41.8	46.7	51.3	61.6	69.6	66.3	62.9	58.6	74.3	79.4	68.5	91.3	88.0	64.4	94.3	118.9	65.0	65.1
	France	37.9	19.8	36.1	35.6	36.1	43.1	29.0	39.4	45.0	48.2	58.4	48.7	40.1	31.3	30.3	42.7	39.9	36.3	54.4	38.9	38.0	43.2	48.1	30.4	29.7
	Seychelles	36.7	6.4						1.8	0.6					4.9	10.7	15.8	11.6	26.2	29.9	36.8	30.0	46.0	47.5	29.7	30.0
	Thailand	7.9	0.8															1.1	0.5				8.0	16.9	8.4	6.1
	Indonesia	7.5	3.2	2.7	3.3	3.4	4.1	3.5	3.8	4.0	4.8	5.0	4.8	6.5	7.7	7.1	7.3	7.3	8.7	5.7	5.9	8.1	3.0	11.7	7.4	7.4
	NEI-Ex-Soviet Union	6.4	4.0					0.7		10.1	8.7	8.2	18.4	14.7	11.2	10.2	17.3	19.8	19.2	6.8	24.7	17.8	11.3	2.8		
	NEI-Other	4.0	7.7	6.4	4.8	7.0	7.9	11.0	10.8	10.8	17.4	24.5	22.3	18.4	24.3	31.2	33.4	40.8	26.4	31.9	20.6	4.7	4.0	4.5	2.3	4.3
	Japan	2.8	3.7	0.6	0.9	2.3	3.4	10.9	15.9	31.6	31.3	20.1	16.1	7.0	6.7	5.7	4.6	2.3	1.8	1.9	2.4	1.5	3.1	2.0	4.4	3.2
	Other Fleets	3.6	3.3	4.5	10.1	7.9	8.4	8.8	13.1	6.4	7.1	6.3	3.9	2.7	4.9	3.2	9.4	4.9	9.7	22.4	0.0	0.1	1.2	6.3	5.1	5.2
	Total	*188.2*	*78.9*	*69.3*	*82.5*	*96.3*	*130.9*	*111.8*	*126.6*	*155.3*	*168.7*	*184.1*	*183.7*	*155.7*	*154.0*	*157.1*	*204.9*	*207.1*	*197.3*	*244.3*	*217.5*	*164.6*	*214.1*	*258.6*	*152.7*	*151.1*
Baitboat	Maldives	110.7	46.1	45.1	42.6	58.2	57.8	60.7	58.3	57.6	58.0	69.0	69.9	66.2	68.1	77.8	92.3	78.8	86.8	113.9	107.5	104.5	130.4	136.7	95.8	85.8
	Indonesia	13.3	5.6	4.7	5.8	6.1	7.1	6.2	6.6	7.0	8.4	8.7	8.4	11.5	13.6	12.5	12.9	12.8	15.4	10.0	10.4	14.3	22.1	3.8	13.1	13.1
	India	5.5	3.1	4.0	5.4	4.7	5.9	5.4	5.6	5.9	12.7	6.8	6.9	7.2	7.8	2.0	2.3	4.6	2.7	3.2	3.1	4.0	0.4	7.2	6.9	8.8
	Other Fleets	0.0	0.6	0.5	0.6	0.5	0.5	0.6	0.6	0.7	0.7	0.1	0.5	0.2	0.0	1.9	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*129.4*	*55.4*	*54.3*	*54.5*	*69.5*	*71.3*	*72.9*	*71.2*	*71.2*	*79.7*	*84.5*	*85.7*	*85.0*	*89.4*	*94.3*	*108.1*	*96.2*	*104.9*	*127.1*	*121.0*	*122.9*	*152.9*	*147.8*	*115.8*	*107.6*
Gillnet	Sri Lanka	71.8	28.1	14.6	15.3	15.9	17.4	20.5	23.1	27.0	31.6	38.9	40.7	47.3	56.1	57.0	72.6	79.4	74.7	72.9	83.0	83.2	48.0	60.2	80.5	86.8
	Iran, Islamic Republic	68.4	9.8				0.3	0.8	1.1	4.3	4.4	7.4	1.1	2.5	8.3	4.7	13.9	18.5	23.2	23.1	36.0	53.6	79.4	98.8	67.6	42.4
	Indonesia	12.3	5.3	4.4	5.4	5.6	6.6	5.8	6.2	6.5	7.8	8.1	7.8	10.7	12.6	11.6	12.0	11.9	14.3	9.3	9.7	13.3	5.8	18.3	12.1	12.1
	Pakistan	4.6	4.0	1.5	3.7	5.6	7.5	7.7	7.5	6.1	6.9	8.1	7.1	4.4	4.6	4.5	4.9	4.7	3.7	3.5	3.4	3.6	4.0	5.2	5.2	5.2
	Other Fleets	1.8	1.0	0.5	0.5	0.6	0.9	0.9	0.6	0.7	1.1	1.2	1.4	1.2	1.8	0.6	0.7	0.8	1.1	0.4	0.5	0.7	1.0	1.4	2.7	3.2
	Total	*158.9*	*48.1*	*21.0*	*25.0*	*27.7*	*32.7*	*35.6*	*38.6*	*44.7*	*51.7*	*63.7*	*58.1*	*66.0*	*83.4*	*78.4*	*104.0*	*115.3*	*117.0*	*109.2*	*132.7*	*154.4*	*138.3*	*183.8*	*168.2*	*149.7*
Line	Indonesia	11.8	5.0	4.2	5.2	5.4	6.3	5.5	5.9	6.2	7.4	7.8	7.5	10.2	12.0	11.1	11.4	11.4	13.7	8.9	9.2	12.7	10.2	12.8	11.6	11.6
	Other Fleets	7.2	4.0	3.3	3.3	3.4	6.2	6.3	6.3	10.7	7.7	4.5	4.7	4.4	4.8	4.5	3.5	3.9	4.0	4.8	4.0	9.5	6.2	8.2	5.9	6.4
	Total	*19.0*	*9.0*	*7.5*	*8.5*	*8.8*	*12.5*	*11.8*	*12.2*	*16.9*	*15.1*	*12.3*	*12.2*	*14.6*	*16.9*	*15.6*	*15.0*	*15.3*	*17.6*	*13.7*	*13.2*	*22.2*	*16.3*	*21.0*	*17.5*	*18.0*
Other gears	*Total*	*4.4*	*1.8*	*1.3*	*1.6*	*1.7*	*2.1*	*1.8*	*1.9*	*2.0*	*2.5*	*2.5*	*2.5*	*3.2*	*3.8*	*3.5*	*3.6*	*3.6*	*4.2*	*2.9*	*4.1*	*4.4*	*6.5*	*1.8*	*4.5*	*4.6*
All	*Total*	*499.9*	*193.2*	*153.4*	*172.2*	*204.1*	*249.5*	*234.0*	*250.4*	*290.1*	*317.8*	*347.1*	*342.2*	*324.7*	*347.6*	*349.0*	*435.6*	*437.5*	*441.1*	*497.2*	*488.4*	*468.5*	*528.1*	*612.9*	*458.7*	*431.1*

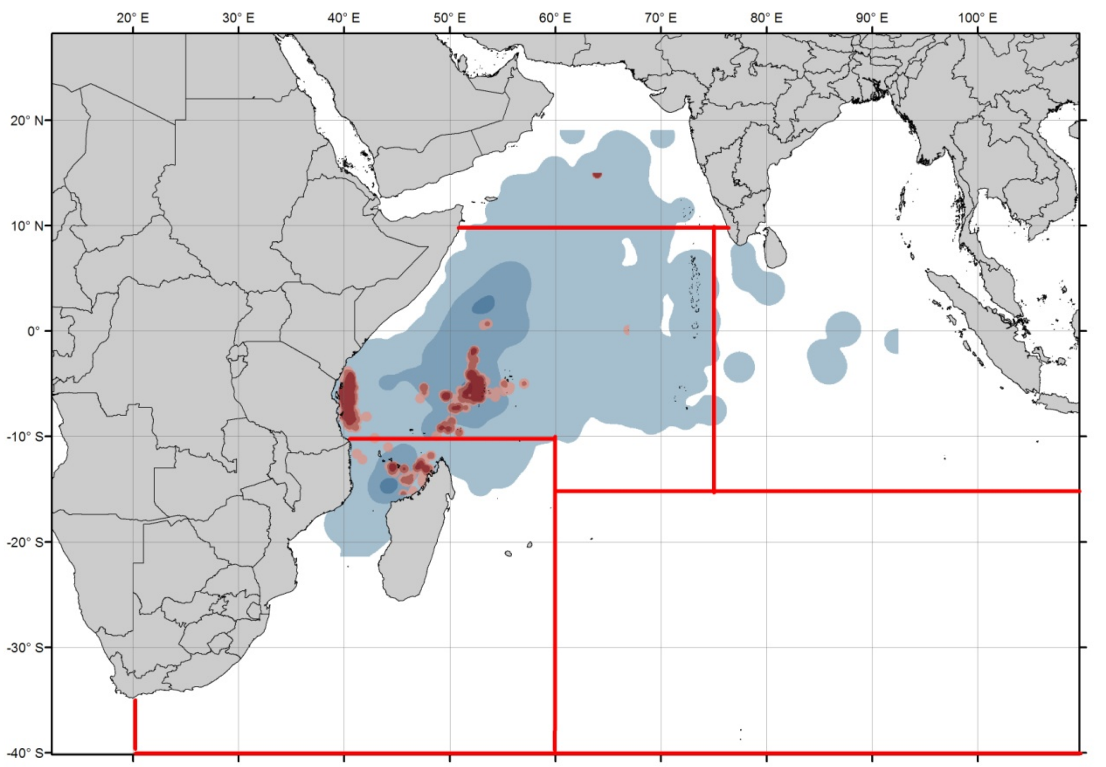


Figure 1. *Tag recapture densities for skipkjack tuna tagged in the south west Indian Ocean by the RTTP-IO. Data as of November 2009*

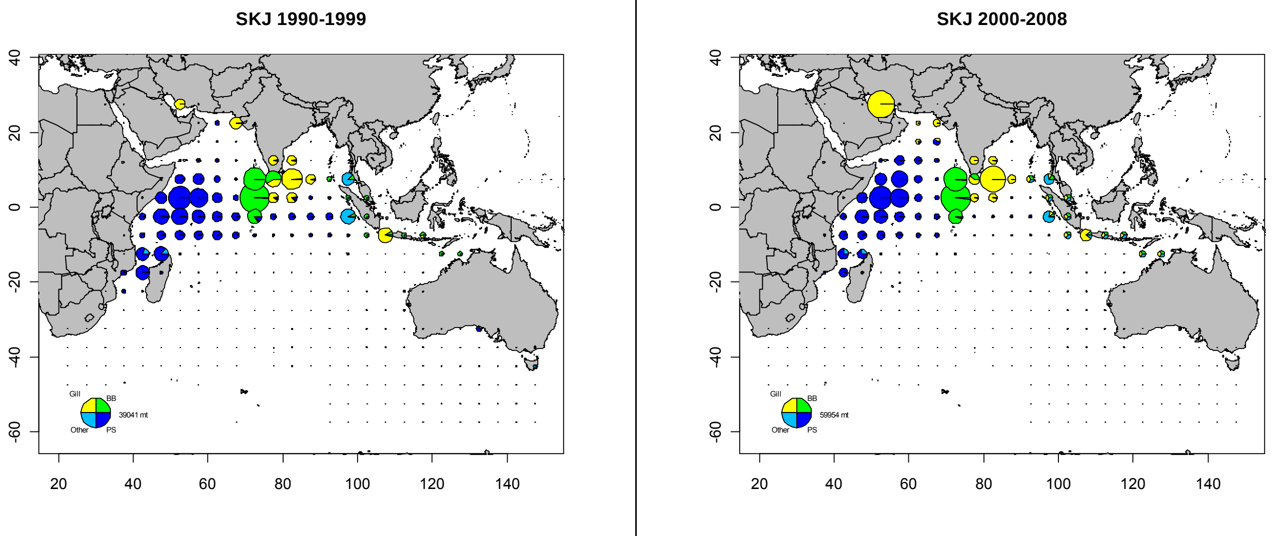


Figure 2. *Average annual skipjack catches by gear during the periods 1990-1999 and 2000-2008. LL = longline, PS = purse seine, GILL = gillnet, BB = bait boat/pole and line, OTHR = other gears. Note, due to a lack of spatial information, gillnet catches are aggregated into one 5 degree square, when in reality they have been taken over a wider area. Data as of October 2009 (to be updated from WP report)*

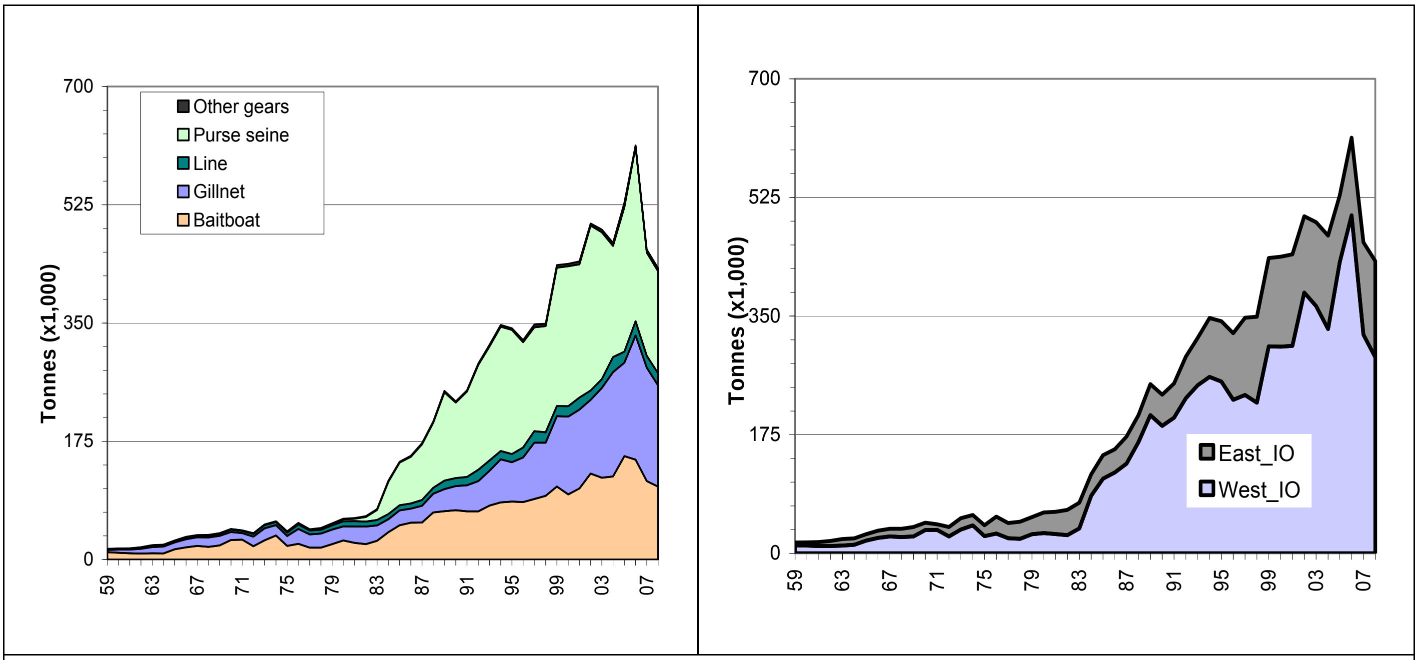


Figure 3. *Yearly catches (thousand of metric tonnes) of skipjack tuna by gear (left) and by area (Eastern and Western Indian Ocean (right) from 1958 to 2008. Data as of November 2009*

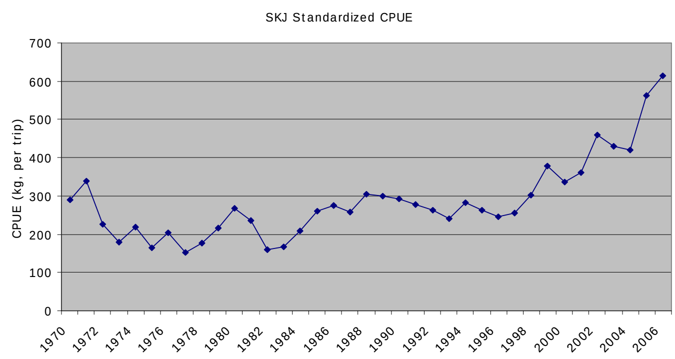


Figure 4. *Time series of standardized CPUE for the Maldivian baitboat fishery, 1970-2007 (from IOTC-2007-WPTT-R)*

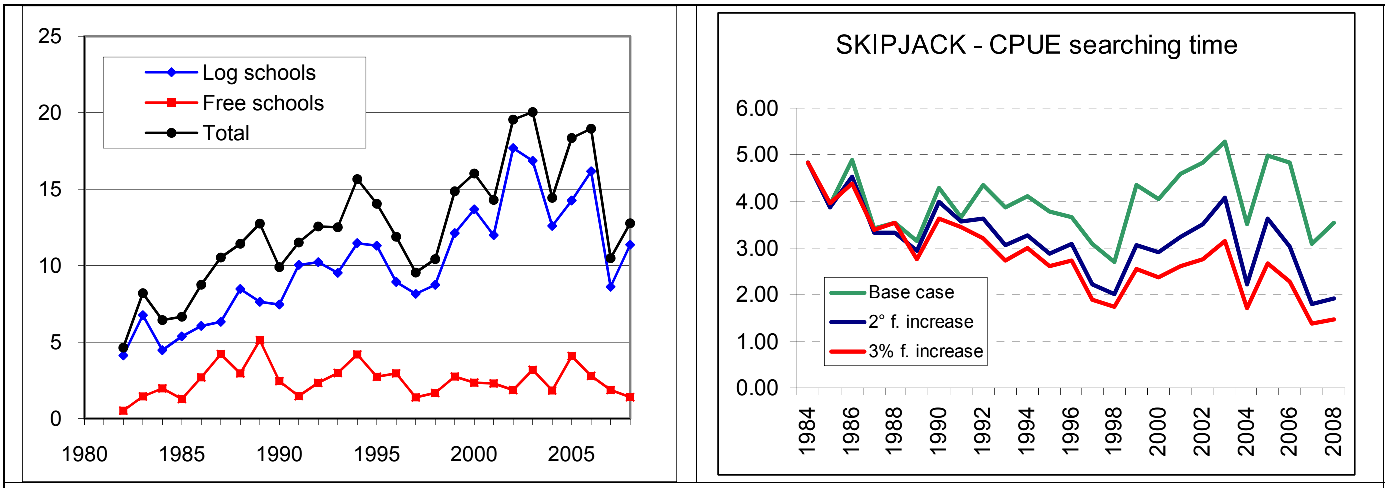


Figure 5. *Time series of CPUE of the purse seine fishery (raw, in tons per searching day), left and standardized including an*

increase in fishing efficiency (0%, 2% and 3%), right.

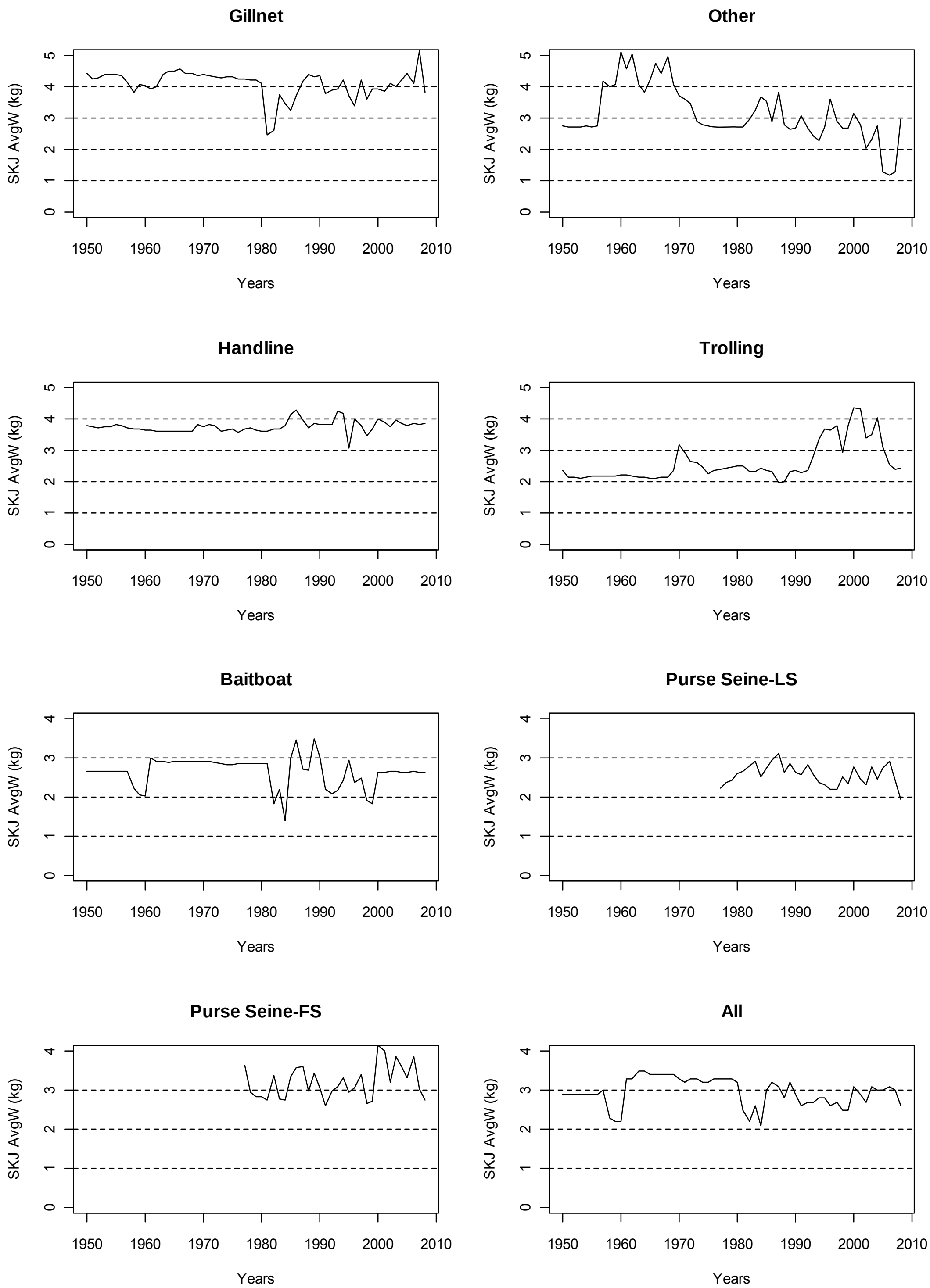


Figure 6. *Skipjack tuna average weight by main gear (from size-frequency data), 1950-2008. FS = free school; LS = log school*

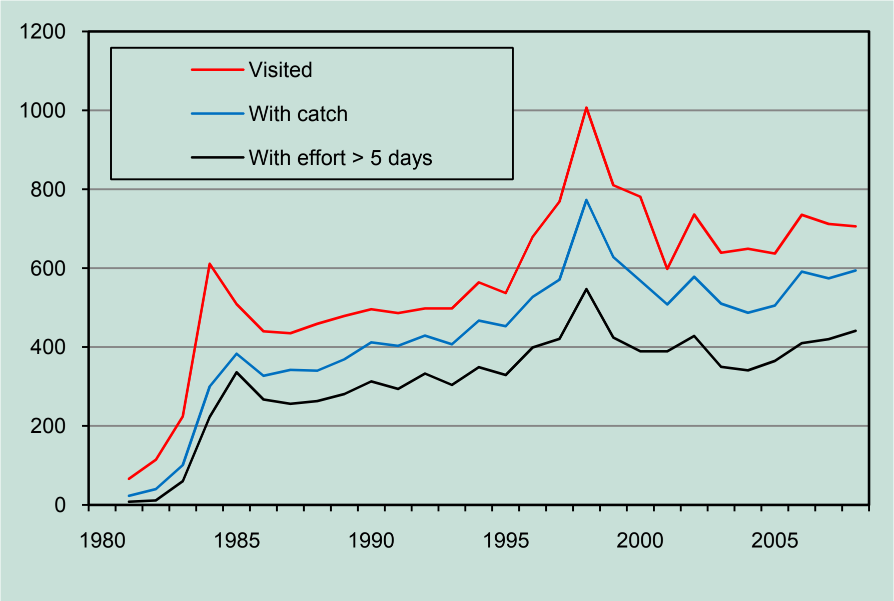


Figure 7. *Number of one degree CWP squares explored by the purse seine fishery.*

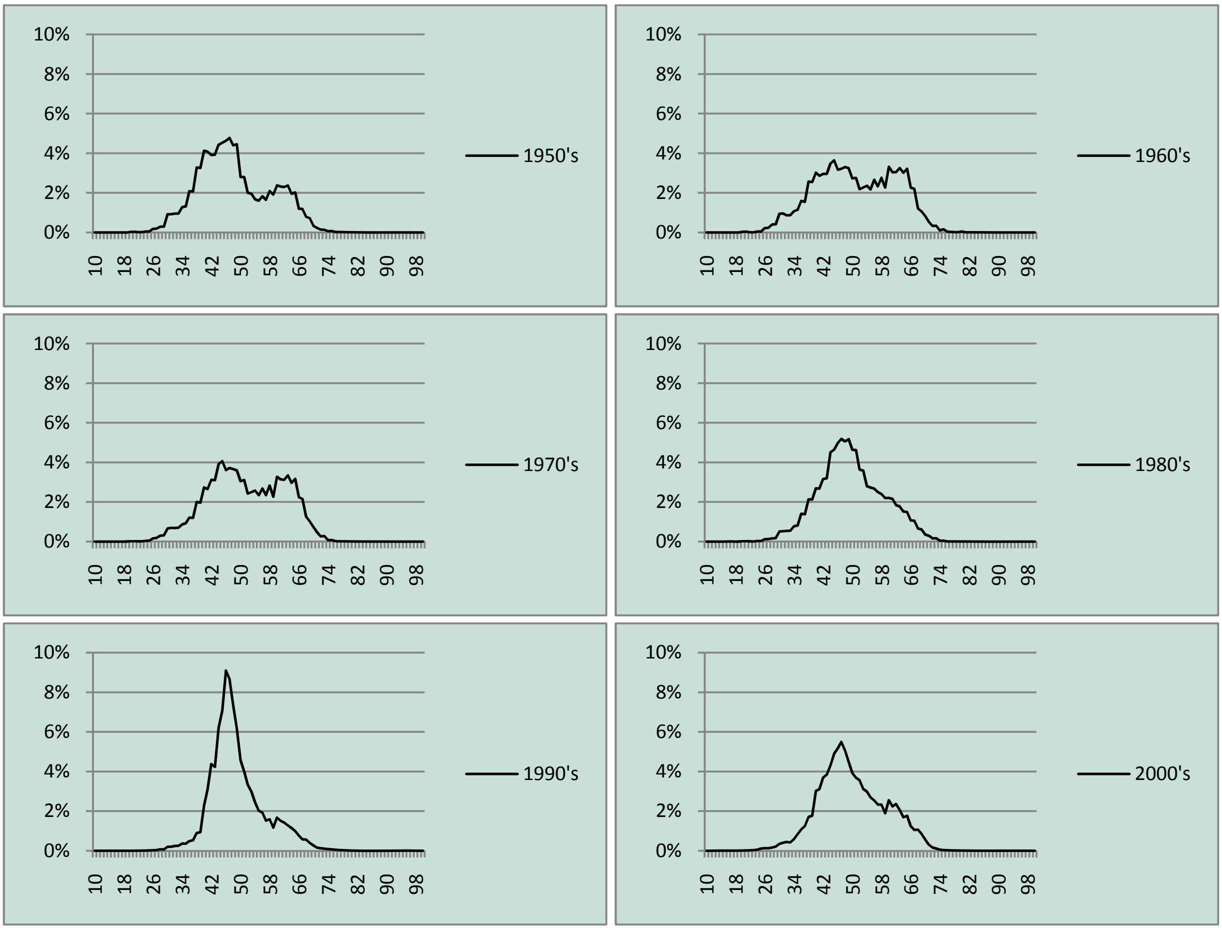


Figure 8*. Mean catch by size of skipjack tuna in numbers (left panels) from the 1950's to present.*

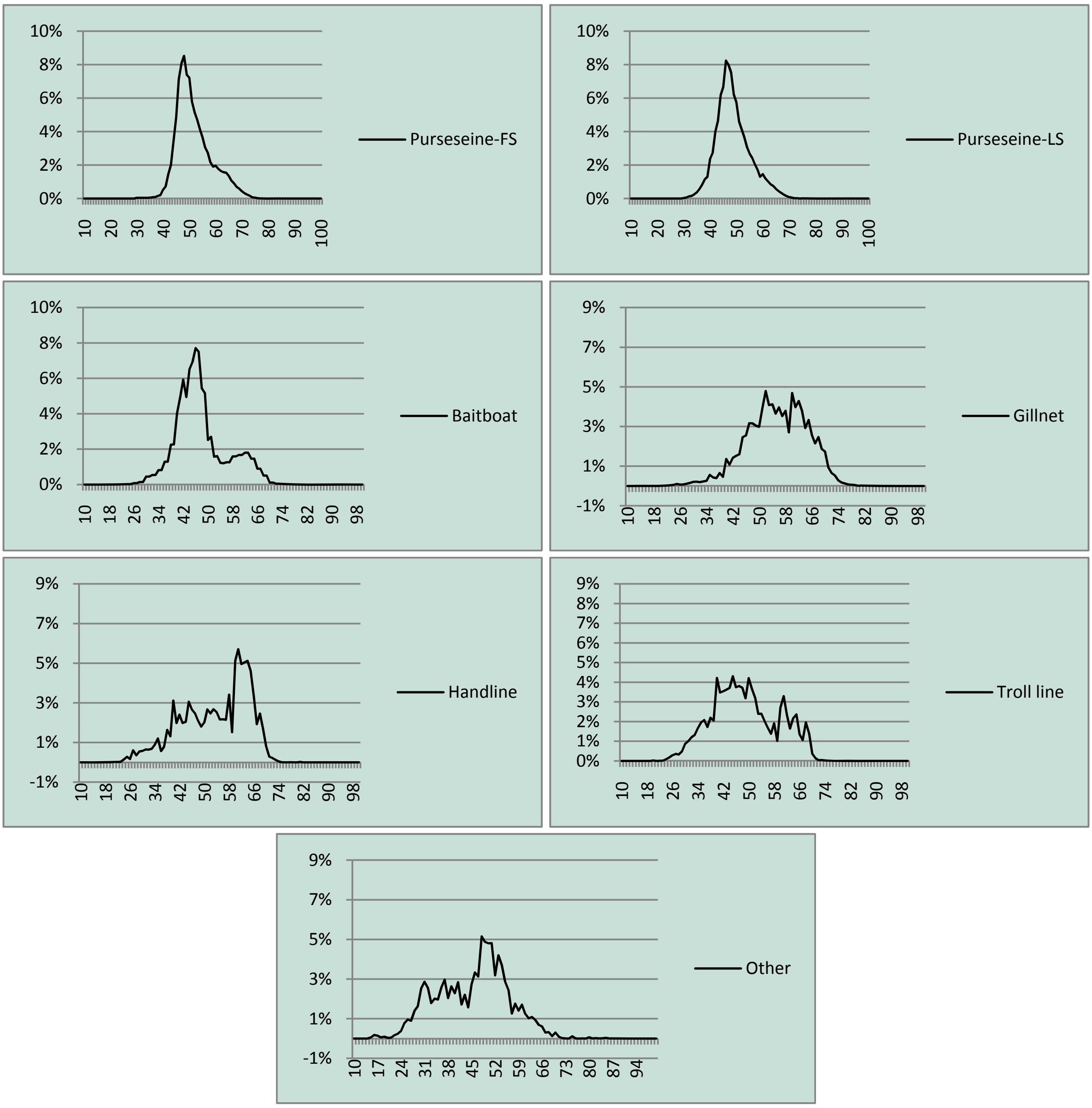


Figure 9. *Mean catch at size of skipjack tuna by gear for 1998-2008: in number (left panels). FS = free school. LS = log school.*

EXECUTIVE SUMMARY OF THE STATUS OF THE YELLOWFIN TUNA RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE, DECEMBER 2009)

BIOLOGY

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

The tag recoveries of the RTTP-IO provide evidence of large movements of yellowfin tuna, thus supporting the assumption of a single stock for the Indian Ocean. The average distance travelled by yellowfin between being tagged and recovered is 710 nautical miles , and showing increasing distances as a function of time at sea (figure 10). Both RTTP-IO and fisheries data indicate that medium sized yellowfin concentrate for feeding in the Arabian Sea. The new information on the spatial distribution of tagging and recovery positions is presented in Figure 1. Unfortunately the comparative analysis of total catches and total YFT recoveries of tagged adult YFT (table 1) allows the WG to conclude that the real movement pattern and movement scale of YFT were probably widely biased by the lack of reporting by most longliners: in the hypothesis that these large YFT are equally available to LL and PS in the W IO or entire IO area, it can be estimated that between 1448 and 2512 tagged YFT should have been reported by LL, when only 41 recoveries have been identified on these fleets.

Table 1. Comparison of the numbers of large YFT (>1m) caught by PS and by LL during recent years (2006-2008) in the Western Indian Ocean, and of the numbers of reported recoveries by each gear of the same categories (total ocean).

Gear and Area	PS West IO	LL West IO	LL total IO	Ratio of tag recovery (PS/LL)
Total number of large YFT > 1m caught	2,229,874	1,876,828	2,958,699	
Number of large YFT recovered at FL > 1m	2,984	46		
Number of tags reported / million YFT caught	1,338	25		55
Total number of tagged YFT caught / LL(?)		2,512	3,959	

Longline catch data indicates that yellowfin are distributed continuously throughout the entire tropical Indian Ocean,. A study of stock structure using DNA was unable to detect whether there were subpopulations of yellowfin tuna in the Indian Ocean.

Spawning occurs mainly from December to March in the equatorial area (0-10°S), with the main spawning grounds west of 75°E. Secondary spawning grounds exist off Sri Lanka and the Mozambique Channel and in the eastern Indian Ocean off Australia. Yellowfin size at first maturity has been estimated at around 100 cm, and recruitment occurs predominantly in July. Newly recruited fish are primarily caught by the purse seine fishery on floating objects. Males are predominant in the catches of larger fish at sizes than 140 cm (this is also the case in other oceans).

Tag-recovery data, recent age readings of otoliths and modal progressions provide support to a multi-stanza growth pattern for yellowfin, but more work is needed to accurately model this complex growth pattern so it can be better used in stock assessments

Direct estimates of natural mortality at age (M) have been estimated for juvenile (40 cm to 100 cm long) yellowfin in the Indian Ocean using the data from the RTTP-IO. The current estimates (0.8 for 0 to 1 year old fish and 0.4 for fish 2 years and over) is much lower that previously assumed levels (and to levels assumed in other oceans), but it is consistent with the natural mortality at age estimated by the Lorenzen method.

Feeding behaviour of yellowfin has been extensively studied and it is largely opportunistic, with a variety of prey species being consumed, including large concentrations of crustaceans that have occurred recently in the tropical areas and small mesopelagic fishes which are abundant in the Arabian Sea. It has also been observed that large yellowfin can feed on very small prey, thus increasing the availability of food for this species. Archival tagging of yellowfin has shown that yellowfin can dive very deep (over 1000m) probably to feed on meso-pelagic prey.

FISHERY

Catches by area, gear, country and year from 1959 to 2008 are shown in Table 2 and illustrated in Figure 2. Contrary to the situation in other oceans, the artisanal fishery component in the Indian Ocean (mainly using pole and line, driftnet and hand line) is substantial, taking an estimated 35 % of the total YFT catches during recent years (2000-2008).

The geographical distribution of yellowfin tuna catches in the Indian Ocean in recent years by the main gear types is shown in Figure 3. Most yellowfin tuna are caught in Indian Ocean north of 12°S and in the Mozambique Channel (north of 25°S).

Although some Japanese purse seiners have fished in the Indian Ocean since 1977, the purse seine fishery developed rapidly with the arrival of European vessels between 1982 and 1984. Since then, there has been an increasing number of yellowfin tuna caught although a larger proportion of the catches is made of adult fish, when compared to the case of the bigeye tuna purse-seine catch. Purse seiners typically take fish ranging from 40 to 160 cm fork length (Figure 4) and smaller fish are more common in the catches taken north of the equator. Catches of yellowfin by purse seiners increased rapidly to around 128,000 t in 1993. Subsequently, they fluctuated around that level, until 2003 and 2004, when they were substantially higher (224,200 t and 228,600 t, respectively). The amount of effort exerted by the EU purse seine vessels (fishing for yellowfin and other tunas) has been showing a decline of 15% in 2008.

The purse seine fishery is characterized by the use of two different fishing modes: the fishery on floating objects (FADs), which catches large numbers of small yellowfin (average weight of approximately 5kg) in association with skipjack and juvenile bigeye, and a fishery on free swimming schools, which catches larger yellowfin on mixed or pure sets. Between 1995 and 2003, the FAD component of the purse seine fishery represented 48-66 % of the sets undertaken (60-80 % of the positive sets) and took 36-63 % of the yellowfin catch by weight (59-76 % of the total catch), & later declining to the 2007 & 2008 levels (at 98.000t and 117.000t). Since 1997, the proportion of log sets has steadily decreased from 66 % to 48 %.

The longline fishery started in 1952 and expanded rapidly over the whole Indian Ocean. It catches mainly large fish, from 80 to 160 cm fork length (Figure 4), although smaller fish in the size range 60 cm – 100 cm have been taken by longliners from Taiwan,China since 1989 in the Arabian Sea. The longline fishery targets several tuna species in different parts of the Indian Ocean, with yellowfin and bigeye being the main target species in tropical waters. The longline fishery can be subdivided into an industrial component (deep-freezing longliners operating on the high seas from Japan, Korea and Taiwan,China) and an artisanal component (fresh tuna longliners). The total longline catch of yellowfin reached a maximum in 1993 (196,000 t). Since then, catches have typically fluctuated between 80,000 t and 123,000 t.

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

Yellowfin catches in the Indian Ocean during 2003, 2004, 2005 and 2006 were much higher than in previous years (an average cartch of 466.000t) but have returned to a lower level in 2007-2008 (318.000t.), while bigeye catches remained at their average levels. Purse seiners currently take nearly 1/3 (32%) of total yellowfin catches, mostly from the western Indian Oceana around Seychelles. In 2003-2006, purse seine total catches made in this area were at an average level of 202.000 t, and declining to 108.000t in 2007-2008. Similarly, artisanal yellowfin catches have been near their highest levels and longliners have reported higher than normal catches in the tropical western Indian Ocean during this period centered in 2005. In 2008, purse seine catches increased of 20% despite of a decrease in nominal fishing effort.

Yellowfin catches in weight y gear (purse seine, longline and other methods) have been updated and current estimates of annual mean weights of yellowfin caught by the whole fishery are shown in Figure 8. After an initial decline, mean weights in the whole fishery remained quite stable from the 1970s to the late eighties. Since 1990, mean weights in the catches in the yellowfin fisheries have been quite stable. Prior to 2003, although total catch in biomass has been stable for several years, catches in numbers have been high but quite stable since 1995(Figure 11a), when catches of large YFT have been showing a peak during the 2003-2006 period. (figure 11b)

AVAILABILITY OF INFORMATION FOR ASSESSMENT PURPOSES

The reliability of the estimates of the total catch has continued to improve over the past few years, and the Secretariat has conducted several reviews of the nominal catch databases in recent years. This has led to marked increases in estimated catches of yellowfin tuna since the early 1970s. In particular, the estimated catches for the Yemen artisanal fishery have been revised upwards sharply, based on new information, but they still remain highly uncertain.

Estimates of annual catches at size for yellowfin were calculated using the best available information prior to the 2008 WPTT meeting. A number of papers dealing with fisheries data, biology, CPUE trends and assessments were discussed by the WPTT in 2008, and additional data analyses were performed during that meeting. Estimated catches at age were calculated using the catch-at-size data and two alternative growth curves. The growth curves were used to develop natural mortality at age, maturity at age and average weight at age schedules. M was assumed to be higher on juvenile than adult fish. Natural mortality at age was also estimated by the 2008 WG from the recovery data, and these estimates were used in the 2009 Stock assessment.

In 2008, new stock assessment areas were defined (figure 1) in order to obtain more homogeneous area being in better agreement with the fished ecosystems. New standardised CPUE were calculated for yellowfin tuna for Japanese (1960 to 2008) and Taiwanese longliners (1989-2008) in each of these areas. These CPUE are showing a quite different trend: Japanese CPUEs showing a marked steady decline, when the Taiwanese CPUEs have been quite stable during the last 30 years in most areas. However the 2 CPUEs are showing similar major decline in area 5 (Equatorial Esatern IO) and also in most areas since 2006 (figure 9).

These GLM CPUEs by area tend to be very similar to the observed trend in nominal CPUEs of the 2 fleets (a global decline for Japan and a global stability for Taiwan,China). However, it was noticed than in 1992 there was a sudden unexplained discrepancy between Japanese GLM and Nominal CPUEs: stable nominal CPUEs and GLM CPUEs showing a sudden major decline. This unexplained divergency between the nominal & GLM CPUEs may be due to an improper standardization in the present GLM of the effects on changes in HBF configuration and implementation of monofilament lines.

There was no attempt in 2009 to calculate standardized CPUEs from the purse seine fishery, but ad hoc CPUE were calculated and showing similar trends as the 2008 GLM results

Since the early 1990’s the Taiwanese fleet has concentrated part of its operation in the Arabian Sea area whereas the Japanese fleet has operated more in the central and south western Indian Ocean (when Taiwanese LL have been seldom fishing in this area). It appears that the Japanese and Taiwanese longline fisheries are now to some extent spatially distinct, but still showing a wide range of common fishing zones (areas 2 & 5)

STOCK ASSESSMENT

The assessment of yellowfin tuna stock in the Indian Ocean is difficult because of the conflicting trends between total annual catches and abundance index (based on the longline CPUE) if data in 1950s and 1960s are included. These trends are not consistent with production-model dynamics, or any known theory of fishing because for any fished stock, dramatic and continuous increase in catches should be accompanied by a decline in abundance. For yellowfin, this is clearly not the case and suggests that there are some major unknown factors influencing the abundance index that need to be accounted for (for instance during the early nineties when the Japanese nomibal & GLM CPUEs have been showing an unexplained divergency).

The interpretation of the CPUE trend is also widely dependent of the potential changes in fishing power (permanently increasing at an unknown degree) and to decline in the YFT stock catchability (leading to the excessive decline of CPUEs during the 1953-1970 period).

All the 2009 YFT stock assessment have been conducted solely using the MFCL model. Multiple runs of the Multifan-CL assessment model were done, allowing to incorporate the tagging data obtained through the RTTP-IO programme. The 3 most important output of this RTTP have been on the YFT growth (now clearly multistanza), on Natural mortality (much lower than previously assumed) and movement patterns (very active, much more than previously assumed). The results from this model demonstrated the value of the tagging information for assessment purposes and improved the basis for the advice this group was able to provide compared with previous assessments of this stock. The value of this source of information is likely to increase over time as more tag are returned, over a wider area and for older fish, and as analyses on this dataset progress and improve.

All assessments are greatly dependent on the use of the Japanese longline CPUE series as indices of abundance of the stock and on the quality of size data entered in the model (recent decline of sampling size potentially reducing the range size of YFT caught). Although current standardization procedures applied various technological and environmental variables into the model it is uncertain if it could fully explain the change in fishing efficiency.

WPTT examined and discussed a wide range of these MF-CL results, allowing to widely improve the parameters and hypothesis used in the various model runs. This work allowed the WG to obtain results that have been accepted as being its best stock assessment results.

Results obtained by the 2009 MF-CL model appear to indicate that recent levels of fishing mortality are at historical high levels and that the stock has experienced a period of overfishing during 2003-2006 (i.e. F > FMSY), regardless of the assumptions on steepness of the stock-recruitment relationship. Current catches appear to be higher than the estimated MSY, estimated at around 300,000 t.

The current diagnosis of stock status is considered more realistic than previous assessments, noting that uncertainties remain. For instance, detailed results (*i.e.* recruitment, spatial distribution, movement patterns and fishing mortalities) obtained for some of the individually modeled areas within the Indian Ocean, do not realistically account for the known spatial dynamics of this stock. The apparent disagreement between the estimated value of MSY (around 300,000 t) and the long-term average yearly catches obtained from this stock during the period 1992-2002 (345,000 t) might also indicate that further refinements are still needed in the application of this model to this stock. However, it is also possible, as the model appears to indicate, that current estimates of MSY are lower than expected values due to recent high catches having impacted the recruitment capacity of the stock. Further improved modeling by MF-CL, combined with the use of a wider range of other stock assessment models, has been recommended to reduce these current structural uncertainties in future assessments.

Given the preliminary nature of the catch, effort and size data for 2008, and the know difficulties of the type of model applied to this stock at estimating population levels in the final year of the series, the SC considered that management advice should be based in the status of the stock as understood to be in 2007. The estimated situation of the stock in 2008 is presented on the biomass vs. fishing mortality ratios plot (“Kobe” plot) with the caveat of its very preliminary nature.

MANAGEMENT ADVICE

Current status

Estimates of total and spawning stock (adult) biomass continue to decline (figure 12), probably accelerated by the high catches of 2003-2006. It appears that overfishing occurred in recent years, and the effect on the standing stock is still noticeable as biomass appears to be decreasing despite catches returning to pre-2003 levels.

The MSY has been estimated to be 300,000 t, if steepness of the stock recruitment relationship is assumed to be 0.8. The preliminary estimate of 2008 catch (322,000 t) is above the current estimate of MSY while annual catches over the period 2003-2006 (averaging 464,000 t) were substantially higher than all estimated values of MSY.

The most recent estimate of biomass (2007), noting that the 2008 estimate was considerd too uncertain to base this years’ management advice, is above the MSY-related reference value, while fishing mortality levels are estimated to be above those linked to MSY catches. Preliminary estimates for 2008 show the stock could be below the SSB at MSY value and the fishing pressure might be even higher than in 2007.

Various indicators of catch rates for different fleets and areas appear to confirm this downward trend in abundance. Catches in 2008 for longliners operating in the Arabian Sea, for example, are at a historic low.

Two hypotheses have been put forward in the past to explain the very high catches in the 2003-2006 period: (i) an increase in catchability by surface and longline fleets due to a high level of concentration across a reduced area and depth range, and (ii) increased recruitment over the 1999-2001 period. Recent analyses of environmental and oceanographic conditions appear to be consistent with the first hypothesis, which would mean that the catches probably resulted in stock depletion. Environmental anomalies also appear to be a factor linked to the lower catches in 2007.

Outlook

The preliminary catch estimates for 2008 (318,400 t) is slightly lower than the average catch taken in the 1998-2002 period (336,000 t) *i.e.* preceding the 2003 to 2006 period when extraordinarily high catches of yellowfin were taken. While there is uncertainty about future catches, recent events in 2008 and 2009 where some vessels have left the fishery, together with fleets avoiding the historically important fishing grounds in the waters adjacent to Somalia for security reasons, may reduce catches in the short-term to below the pre-2003 levels. The SC noted that a return to a normal fishing scenario may result in increased effort levels, leading to catches above MSY.

Fishing mortality has recently exceeded the MSY-related level (figure 13) therefore some reduction in catch or fishing effort would be required to return exploitation rates to those related to MSY. The SC considers that the stock of yellowfin has recently been overexploited and is probably still being overfished. Management measures should be considered that allow an appropriate control of fishing pressure to be implemented.

Recommendations

The current estimate of MSY is 300,000 t, lower than the average catches sustained over the 1992-2002 period of around 343,000 t. The high catches of the 2003-2006 period appear to have accelerated the decline of biomass in the stock, which might be currently unable to sustain the 1992-2002 level of catches.

The SC **recommended** that catches of yellowfin tuna should not exceed the estimated MSY of 300,000 t.

The SC recommends that monitoring and data collection is strengthened over the coming year to be able to more closely follow the stock situation.

YELLOWFIN TUNA SUMMARY

Management quantity	2008 Assessment	2009 Assessment
Most recent catch	317,500 t (2007)	318,400 t (2008)*
Mean catch over the last 5 years (2004-2008)		410,800 t
Maximum Sustainable Yield		300,000 t
F_{2007}/F_{MSY}		1.16
B_{2007}/B_{MSY}		0.90
SB_{2007}/SB_{MSY}		1.12
B_{2007}/B_0		0.356
SB_{2007}/SB_0		0.342
$B_{2007}/B_{2007,F=0}$		0.400
$SB_{2007}/SB_{2007,F=0}$		0.340

*preliminary catch estimate.

Table 2. *Best scientific estimates of the catches of yellowfin tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959 to 2008.*

Data as of November 2009

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Purse seine	Spain																										11.5	18.4
	France																							0.2	1.0	10.5	36.7	39.1
	NEI-Other																									0.7	8.4	9.4
	Other Fleets	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.2	0.5	0.4	0.3	0.1	0.3	1.6	1.8	2.1
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*	*0.0*	*0.1*	*0.2*	*0.5*	*0.4*	*0.3*	*0.3*	*1.3*	*12.7*	*58.3*	*69.0*
Baitboat	Maldives	1.9	1.0	1.4	1.4	1.4	1.4	1.0	1.4	1.6	1.6	1.7	2.3	1.4	2.5	6.9	5.0	4.6	5.2	4.9	3.8	4.4	4.4	5.6	4.5	7.7	8.2	6.9
	Other Fleets	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.8	1.3	0.3	0.2	0.3	0.4	0.5	0.5	0.6	0.5	0.2	0.3	0.6
	Total	*2.0*	*1.0*	*1.5*	*1.5*	*1.5*	*1.5*	*1.0*	*1.5*	*1.7*	*1.7*	*1.8*	*2.4*	*1.5*	*2.7*	*7.7*	*6.3*	*4.9*	*5.4*	*5.1*	*4.2*	*4.9*	*4.9*	*6.1*	*5.0*	*7.9*	*8.5*	*7.6*
Longline	China	7.6	1.2										0.2	0.6	1.7	2.3	2.4	2.8	3.1	2.8	4.6	8.3	8.9	8.7	7.2	5.0		
	Taiwan,China	2.4	2.2	2.9	3.5	3.4	2.9	2.2	4.4	3.4	22.7	21.1	14.9	11.9	11.8	5.7	4.4	4.6	3.4	8.1	4.2	3.7	3.8	4.1	4.7	5.6	5.8	7.3
	Japan	22.2	36.1	32.7	44.2	22.0	22.2	24.9	40.8	30.2	48.3	23.1	10.3	13.4	7.9	3.9	4.9	6.4	2.8	2.1	4.6	3.3	3.2	4.9	7.3	7.8	7.9	9.5
	Indonesia															0.1	0.3	0.7	1.0	1.3	1.3	1.4	2.1	2.6	2.7	0.8	0.8	0.8
	NEI-Deep-freezing																											0.1
	Korea, Republic of							0.1	0.1	0.4	5.3	9.1	5.2	7.4	10.3	10.8	13.2	13.4	13.7	33.1	26.6	18.0	13.2	12.4	19.4	16.2	10.2	12.5
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.5	0.1	2.4	0.6	1.9	1.6	1.5	1.2	0.7	0.2	1.1	0.9	0.2	0.4	0.5	0.4	0.4	0.7	0.8	0.3
	Total	*24.6*	*38.3*	*35.6*	*47.7*	*25.4*	*25.3*	*27.7*	*45.7*	*34.0*	*78.6*	*53.9*	*32.4*	*34.4*	*31.5*	*21.7*	*23.5*	*25.4*	*21.9*	*45.4*	*37.0*	*26.9*	*22.8*	*24.4*	*34.5*	*31.2*	*25.5*	*30.5*
Gillnet	Sri Lanka	1.2	1.5	1.8	2.7	3.6	3.5	3.3	3.7	4.1	4.6	5.1	4.0	2.9	4.4	5.4	4.8	3.9	7.0	6.4	6.9	7.6	8.3	9.6	9.5	9.1	6.4	6.9
	Oman	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.5	1.5	1.8	2.0	2.2	2.4	2.2	2.7	2.5	1.9	0.8	2.5	1.2
	Pakistan	0.7	0.9	0.8	1.2	1.8	2.5	2.7	3.6	3.5	3.5	3.2	2.9	2.4	2.8	2.2	3.0	3.3	3.1	2.8	1.6	2.8	1.3	2.0	2.5	0.8	0.9	1.5
	Other Fleets	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.6	0.2	0.3	0.8	0.3	0.4	0.6	0.7	0.5	1.0	0.4	0.5	1.1
	Total	*2.3*	*2.8*	*3.1*	*4.3*	*5.8*	*6.4*	*6.4*	*7.7*	*8.1*	*8.6*	*8.8*	*7.3*	*5.7*	*7.9*	*8.7*	*9.6*	*9.3*	*12.9*	*11.6*	*11.3*	*13.1*	*13.0*	*14.7*	*14.8*	*11.2*	*10.3*	*10.7*
Line	Yemen	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.8	1.0	1.1	1.1	1.2	1.2	1.3	1.0	0.9	1.6	2.5	3.3
	Oman	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.8	1.0	1.1	1.2	1.3	1.2	1.5	1.4	1.0	0.5	1.3	0.7
	Maldives												0.3	0.2	0.2	0.3	0.3	0.3	0.5	0.4	0.5	0.7	0.7	0.7	0.3	0.3	0.3	0.2
	Comoros												0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Other Fleets	0.8	1.0	1.2	1.2	1.5	1.7	1.5	1.6	1.7	1.9	2.1	1.6	1.6	2.3	3.1	2.3	1.8	2.7	6.1	5.9	5.8	5.3	3.9	5.0	3.9	3.3	5.1
	Total	*1.3*	*1.4*	*1.6*	*1.6*	*1.9*	*2.1*	*1.9*	*2.0*	*2.3*	*2.4*	*2.6*	*2.4*	*2.4*	*3.1*	*4.1*	*4.4*	*4.2*	*5.6*	*9.0*	*9.0*	*9.0*	*8.9*	*7.1*	*7.4*	*6.5*	*7.7*	*9.4*
Other gears	*Total*	*0.2*	*0.1*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.3*	*0.3*	*0.6*	*0.6*	*0.8*	*1.0*	*1.2*	*1.2*	*1.2*	*0.9*	*0.8*	*0.4*	*0.9*	*0.8*
All	*Total*	*30.4*	*43.7*	*42.0*	*55.3*	*34.9*	*35.6*	*37.4*	*57.3*	*46.4*	*91.6*	*67.4*	*44.7*	*44.2*	*45.6*	*42.6*	*44.4*	*44.4*	*46.6*	*72.3*	*63.3*	*55.5*	*51.2*	*53.5*	*63.9*	*69.9*	*111.2*	*128.0*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Purse seine	Spain	62.6	23.9	20.0	26.3	44.9	41.1	43.7	44.0	37.8	47.8	43.1	65.1	59.4	61.0	38.6	51.9	49.4	47.7	53.4	79.0	80.8	77.5	70.9	37.8	46.1
	France	47.1	20.9	43.3	46.8	59.9	38.4	45.3	38.1	45.3	39.5	35.8	39.6	35.6	31.2	22.4	30.8	37.7	34.1	36.4	63.3	63.5	57.2	44.3	32.7	37.5
	Seychelles	30.0	4.9						0.4	0.2					2.8	7.4	9.8	11.6	12.9	16.6	33.3	48.8	36.5	28.1	16.1	20.7
	Iran, Islamic Republic	6.2	1.3							1.5	2.4	1.9	3.0	1.6	1.9	3.3	2.5	2.2	2.2	5.0	8.3	11.0	7.3	8.4	2.3	2.1
	NEI-Other	4.8	6.5	6.3	5.2	7.9	4.5	11.9	11.9	8.1	15.5	19.7	19.3	16.7	21.9	20.3	25.8	27.1	18.9	19.1	24.5	10.1	4.4	3.7	2.5	3.2
	NEI-Ex-Soviet Union	4.4	2.7					0.8		5.2	8.7	5.8	14.6	11.7	9.8	5.3	11.8	10.9	8.9	2.2	15.1	13.8	7.8	0.4		
	Other Fleets	4.4	2.8	4.2	5.7	6.1	5.9	7.0	11.1	14.3	13.7	7.4	6.6	4.8	3.7	3.3	2.3	1.5	5.5	6.6	0.8	0.5	3.9	4.1	6.4	7.4
	Total	*159.5*	*63.1*	*73.8*	*84.0*	*118.8*	*89.8*	*108.7*	*105.5*	*112.4*	*127.5*	*113.7*	*148.3*	*129.9*	*132.3*	*100.6*	*135.0*	*140.5*	*130.1*	*139.2*	*224.3*	*228.6*	*194.5*	*159.8*	*97.8*	*117.0*
Baitboat	Maldives	14.8	7.0	6.2	7.4	5.9	5.5	4.9	7.0	8.0	9.3	12.4	11.8	11.5	12.2	13.0	12.6	10.0	11.1	16.3	16.1	14.4	14.9	15.8	13.2	15.7
	Other Fleets	1.7	0.5	0.6	0.5	0.4	0.3	0.4	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.6	0.7	0.8	0.7	0.8	0.8	0.6	2.7	1.5	2.2	1.5
	Total	*16.5*	*7.5*	*6.8*	*7.9*	*6.3*	*5.8*	*5.3*	*7.6*	*8.6*	*9.9*	*13.0*	*12.4*	*12.1*	*12.9*	*13.6*	*13.3*	*10.9*	*11.8*	*17.1*	*16.9*	*15.1*	*17.6*	*17.3*	*15.5*	*17.2*
Longline	China	7.6	1.2										0.2	0.6	1.7	2.3	2.4	2.8	3.1	2.8	4.6	8.3	8.9	8.7	7.2	5.0
	Taiwan,China	38.9	18.2	16.2	22.3	22.7	22.4	31.6	30.7	56.0	88.2	34.1	23.1	27.9	18.4	23.4	17.7	17.4	26.9	33.2	29.7	49.8	67.6	34.7	25.7	16.6
	Japan	17.9	14.6	10.7	8.3	9.3	4.6	6.3	4.4	5.7	5.7	9.7	8.0	12.8	15.6	16.8	14.7	15.5	13.9	13.9	17.2	16.0	21.5	22.3	18.6	11.1
	Indonesia	12.6	8.0	0.7	1.3	2.3	3.8	4.6	5.5	9.3	10.8	14.8	16.7	31.8	38.2	35.7	41.7	29.6	28.7	25.1	21.1	17.1	14.6	10.3	10.2	10.8
	NEI-Fresh Tuna	7.5	4.9				11.9	16.6	14.4	16.7	16.5	23.7	17.1	17.7	21.2	16.6	14.8	13.3	0.9	3.3	4.6	5.7	6.9	8.4	8.4	8.1
	Oman	4.5	0.6															1.4	1.7	1.8	1.5	3.1	6.7	3.3	4.0	5.3
	NEI-Deep-freezing	3.7	2.9	1.1	1.2	3.4	3.2	6.7	5.9	8.9	23.8	9.9	6.9	12.1	5.9	9.8	7.7	6.6	4.2	5.3	3.3	6.8	6.8	2.9	1.2	0.7
	Korea, Republic of	3.1	7.2	15.5	13.2	14.1	8.7	7.5	3.2	4.4	4.3	3.9	2.6	3.8	4.0	2.6	1.0	2.0	1.6	0.3	2.2	4.2	3.5	3.4	3.6	1.0
	NEI-Indonesia Fresh Tuna	0.0	2.0	0.1		2.7	10.3	12.6	12.9	15.6	12.6	16.3	8.9	3.7	4.0	0.3	0.0									
	Other Fleets	14.8	4.0	1.0	0.6	0.4	0.4	0.1	1.9	20.1	34.4	8.0	5.2	3.8	2.0	4.0	6.0	5.6	5.3	4.6	7.6	14.9	23.2	14.9	13.3	7.4
	Total	*102.9*	*62.5*	*45.2*	*46.9*	*54.9*	*65.2*	*86.0*	*78.8*	*136.7*	*196.4*	*120.4*	*88.6*	*113.6*	*109.1*	*109.3*	*103.7*	*91.3*	*83.3*	*87.6*	*87.1*	*117.6*	*150.8*	*100.3*	*85.0*	*61.0*
Gillnet	Sri Lanka	35.7	13.9	7.1	7.4	7.7	8.3	9.6	11.6	13.9	16.6	21.5	18.9	23.7	29.6	29.2	37.0	33.9	30.7	32.5	38.5	39.3	26.5	38.9	36.6	37.0
	Iran, Islamic Republic	27.6	7.7				1.0	2.3	3.2	12.1	13.3	19.5	22.5	28.5	20.0	18.0	24.3	13.5	18.0	19.0	29.5	39.7	35.8	32.1	13.6	17.1
	Oman	8.8	3.3	1.4	3.1	8.3	8.7	7.7	2.8	7.0	5.9	5.0	9.5	4.6	3.4	6.3	3.8	3.7	3.3	3.0	6.1	12.1	7.6	7.1	7.9	9.5
	Pakistan	3.5	3.0	2.6	2.4	3.8	8.6	3.3	4.9	3.9	2.6	2.4	2.1	3.2	3.9	3.9	9.3	5.3	4.0	3.5	3.6	3.4	2.2	1.7	5.2	5.2
	Other Fleets	3.1	0.8	0.6	0.8	0.5	0.7	1.0	0.8	0.9	0.9	0.9	0.8	0.9	1.0	0.8	0.9	1.0	0.9	0.9	1.0	0.8	2.2	2.8	5.2	4.7
	Total	*78.8*	*28.7*	*11.6*	*13.8*	*20.4*	*27.3*	*23.8*	*23.4*	*37.8*	*39.3*	*49.3*	*53.8*	*60.8*	*57.8*	*58.2*	*75.4*	*57.2*	*56.7*	*58.8*	*78.7*	*95.3*	*74.2*	*82.5*	*68.5*	*73.5*
Line	Yemen	22.1	7.6	4.1	4.8	5.5	6.3	7.1	7.9	8.6	7.7	8.5	13.4	15.2	17.2	19.3	21.4	23.4	25.5	27.5	25.7	31.6	26.7	19.6	16.2	16.2
	Oman	7.7	2.8	0.7	1.7	4.5	4.8	4.2	6.0	6.0	5.3	13.5	9.1	5.2	6.2	4.4	3.5	3.3	2.9	2.2	1.9	8.4	7.0	6.6	7.4	8.9
	Maldives	6.3	1.1	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.6	0.7	1.6	2.5	4.2	2.5	6.8	5.5	5.8	7.4	5.9
	Comoros	6.2	2.3	0.2	0.2	0.2	3.7	3.7	3.7	5.0	5.0	5.9	5.9	5.8	5.6	5.6	5.5	5.9	5.5	5.9	6.1	6.2	6.2	6.2	6.3	6.3
	Other Fleets	8.5	3.9	5.8	4.8	4.4	3.1	3.6	4.0	3.9	4.3	4.4	4.4	4.4	4.4	3.8	4.1	4.7	4.4	4.3	4.3	4.4	11.0	7.2	11.6	8.5
	Total	*50.8*	*17.6*	*11.0*	*11.7*	*15.0*	*18.1*	*18.9*	*21.8*	*23.8*	*22.7*	*32.5*	*33.0*	*30.9*	*33.8*	*33.6*	*35.1*	*38.9*	*40.8*	*44.2*	*40.5*	*57.4*	*56.4*	*45.4*	*48.9*	*45.8*
Other gears	*Total*	*2.2*	*1.0*	*1.0*	*1.4*	*3.1*	*3.0*	*2.7*	*0.4*	*0.7*	*0.6*	*1.2*	*3.2*	*2.1*	*0.5*	*1.0*	*0.5*	*0.5*	*0.4*	*0.4*	*1.2*	*1.6*	*2.3*	*1.1*	*1.8*	*3.9*
All	*Total*	*410.8*	*180.4*	*149.4*	*165.8*	*218.4*	*209.2*	*245.4*	*237.4*	*320.0*	*396.5*	*330.0*	*339.3*	*349.4*	*346.4*	*316.2*	*362.9*	*339.3*	*323.2*	*347.2*	*448.6*	*515.6*	*495.9*	*406.5*	*317.5*	*318.4*

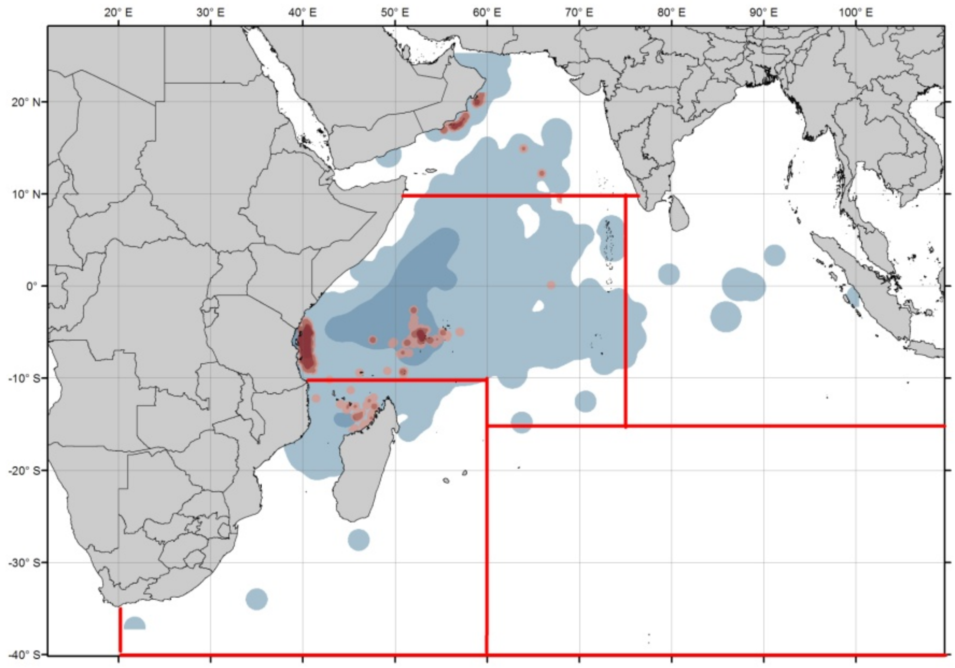


Figure 1. *Tag recapture densities for yellowfin tuna tagged in the south west Indian Ocean by the RTTP-IO and limits between areas presently used in the MF-CL model (November 2009).*

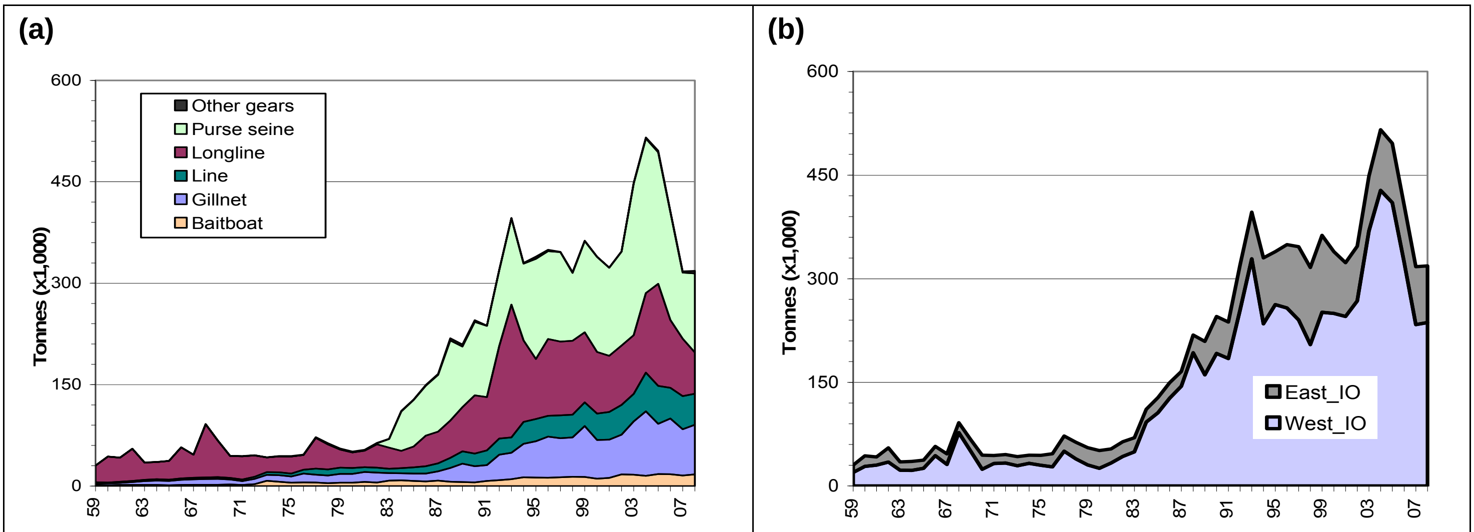


Figure 2. *Yearly catches (tonnes x 1000) of yellowfin by (a) gear and (b) area (to be updated) from 1959 to 2008.Data as of November 2009*

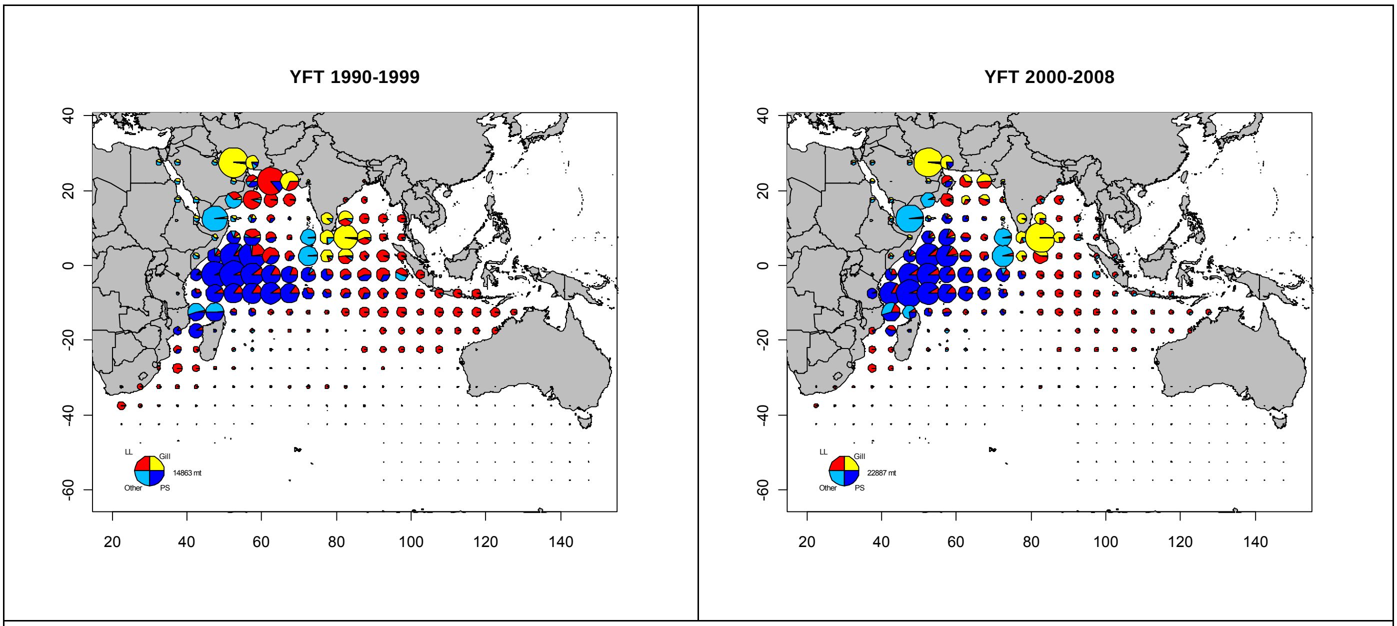
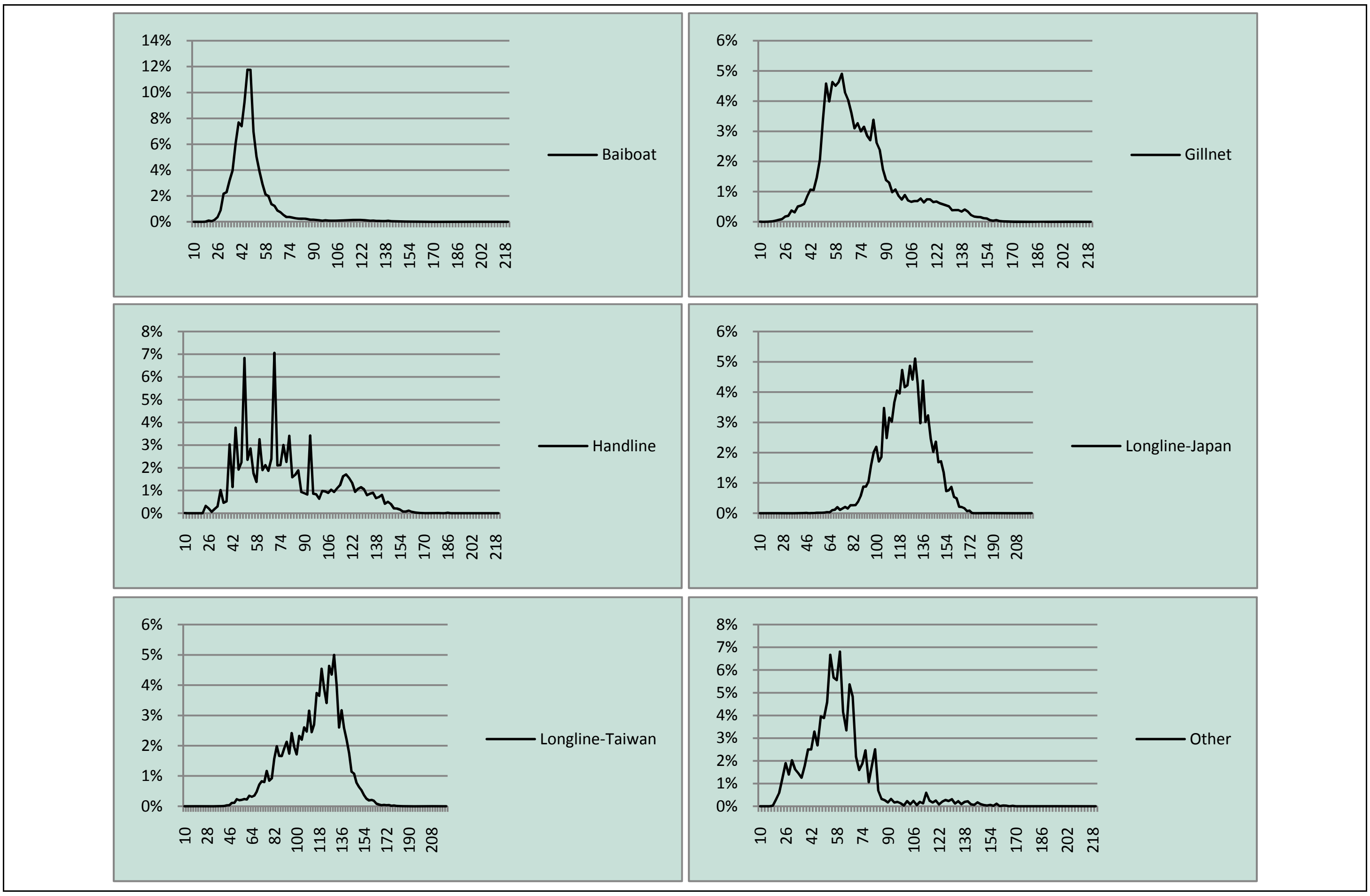


Figure 3. *Location and size of yellowfin tuna catches in the Indian Ocean by gear type. GILL = gillnet, LL = longline, PS = purse seine.* *Data as of November 2009*



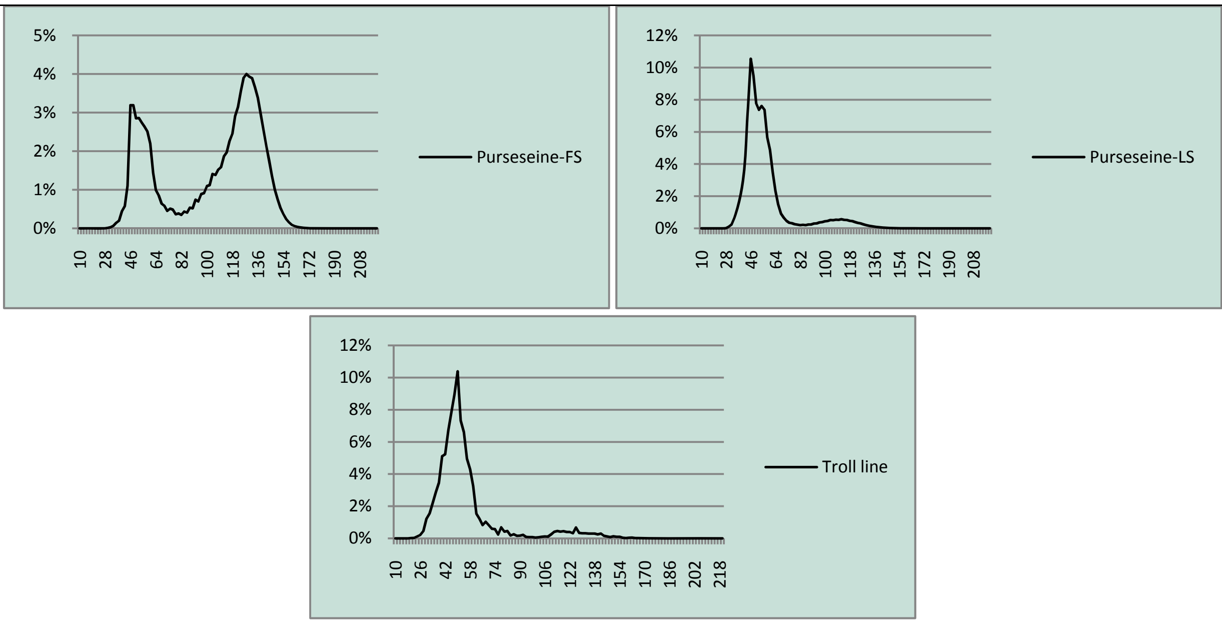


Figure 4. *Mean catch at size of yellowfin tuna measured from purse seine, longline, baitboat, line (hand line and troll line), gillnet and other gears catches from 1998-2008 in numbers. FS= free school, LS= log school*

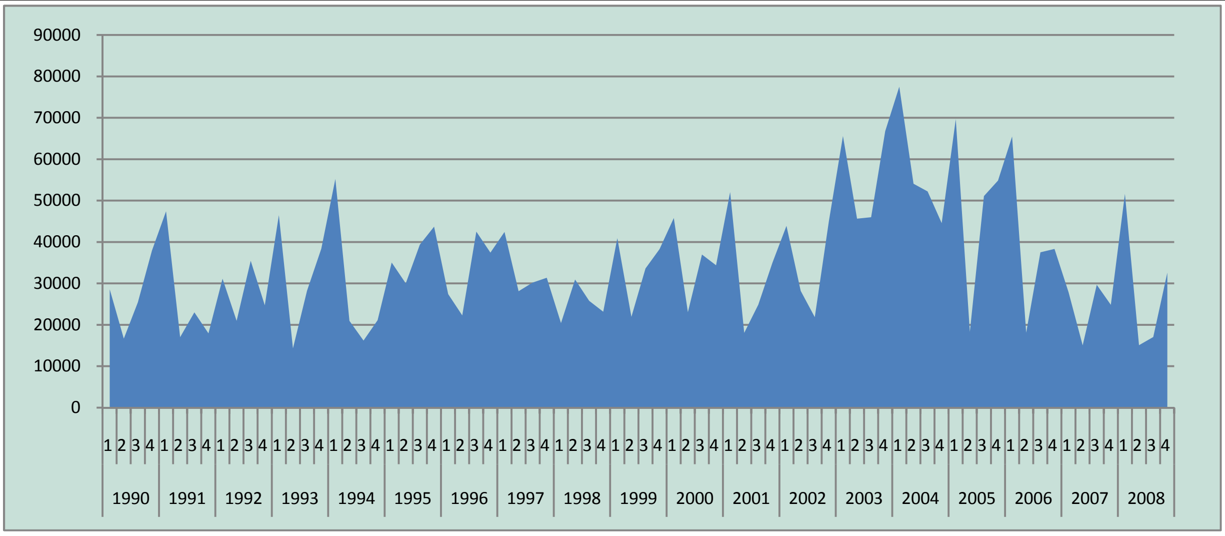


Figure 5. *Yellowfin tuna: quarterly catches by purse seiners in the Indian Oceans over the period 1999 to 2008*

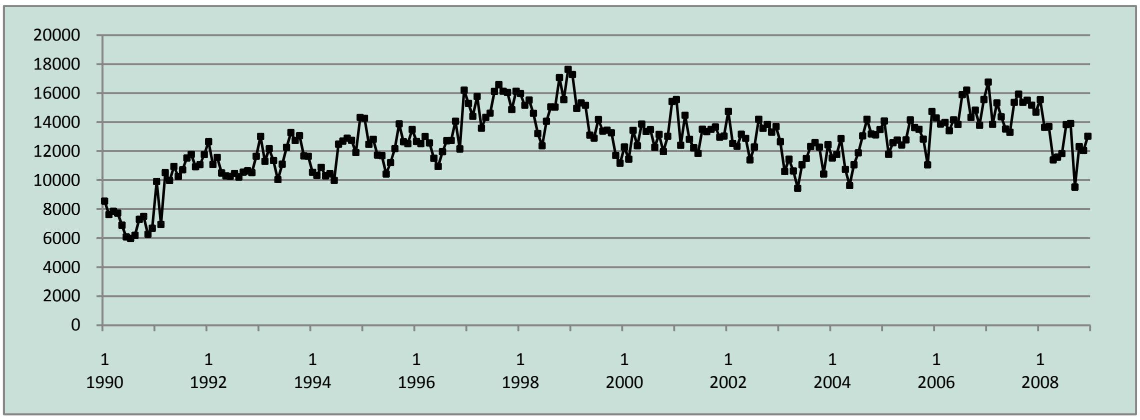


Figure 6. *Amount of effort (boat days per month) exerted by the EU purse seine fleet in the Indian Ocean.*

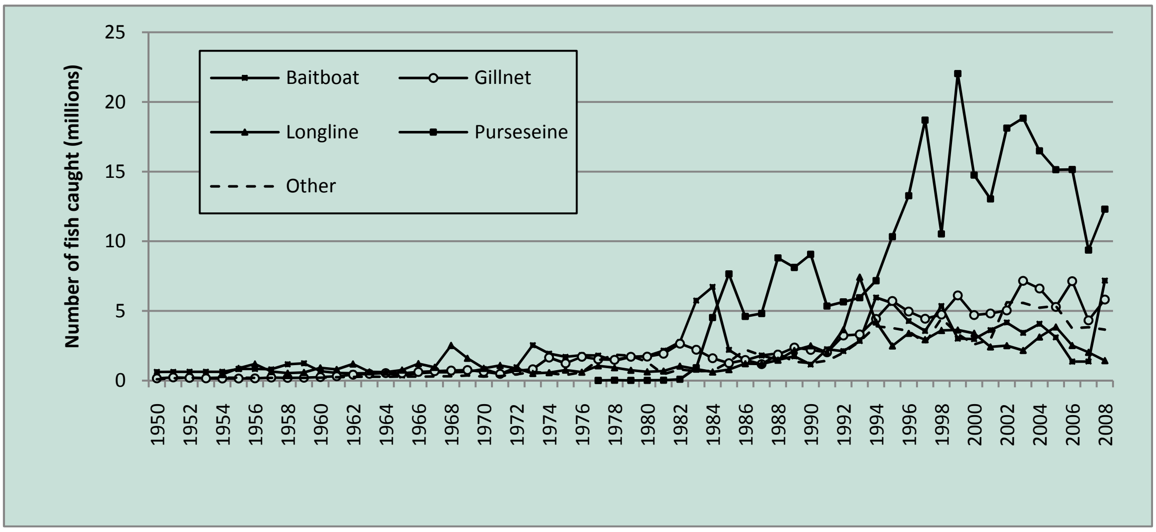
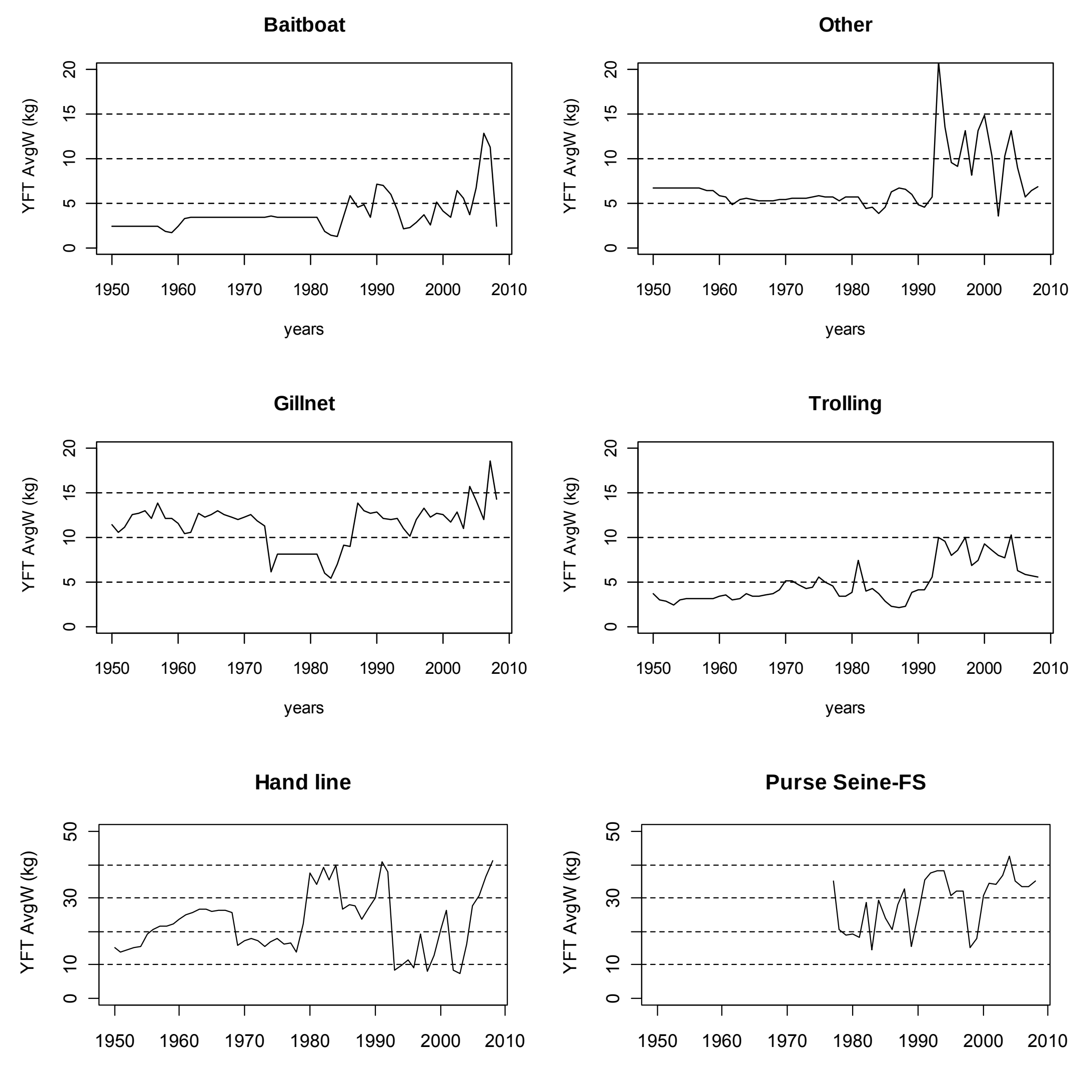


Figure 7. *Numbers of yellowfin caught by gear-type.Data as of December 2009*



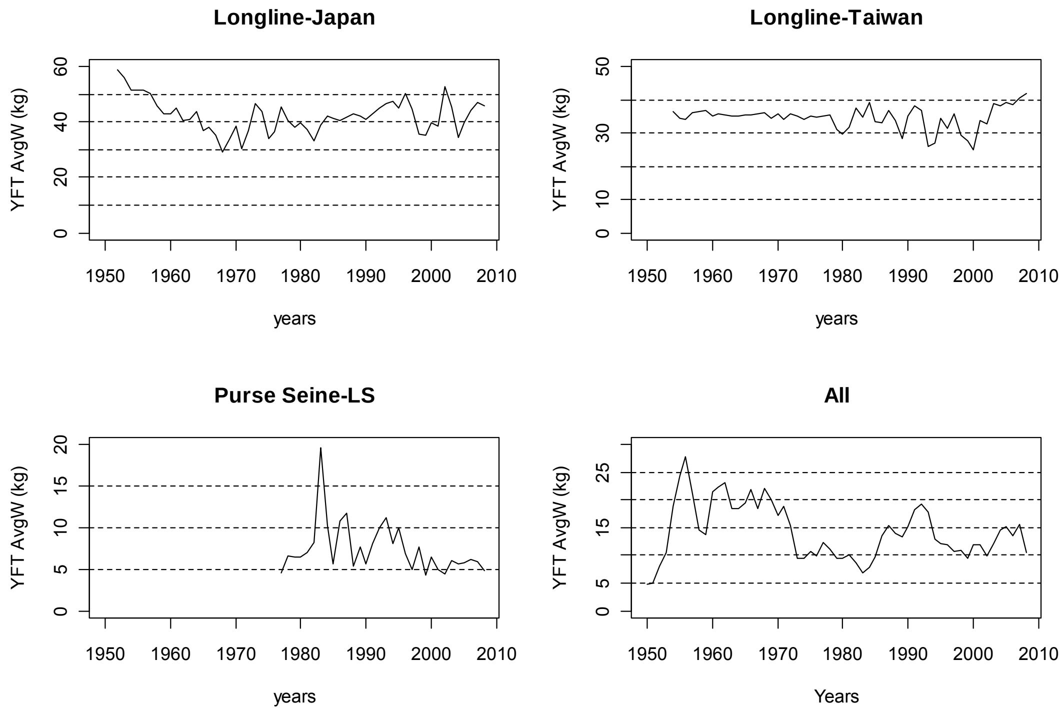


Figure 8. Mean weight (kg) of yellowfin individuals in the catch by gear. *Data as of December 2009*

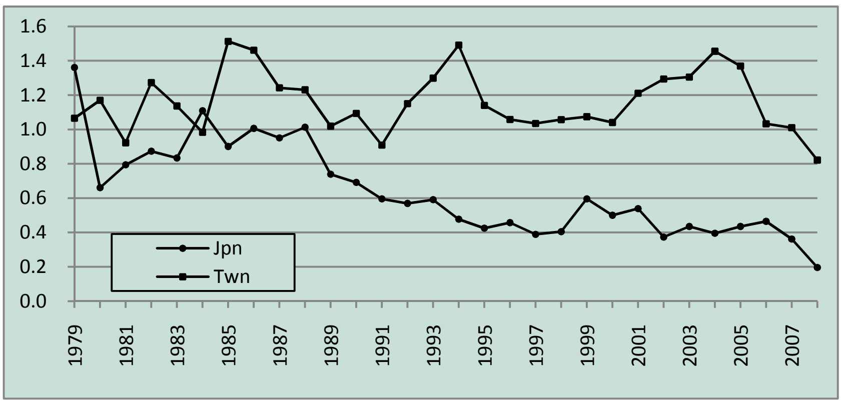


Figure 9. *Comparison of the relative standardized yellowfin CPUEs for Japan and Taiwan,China for the period 1979-2008.*

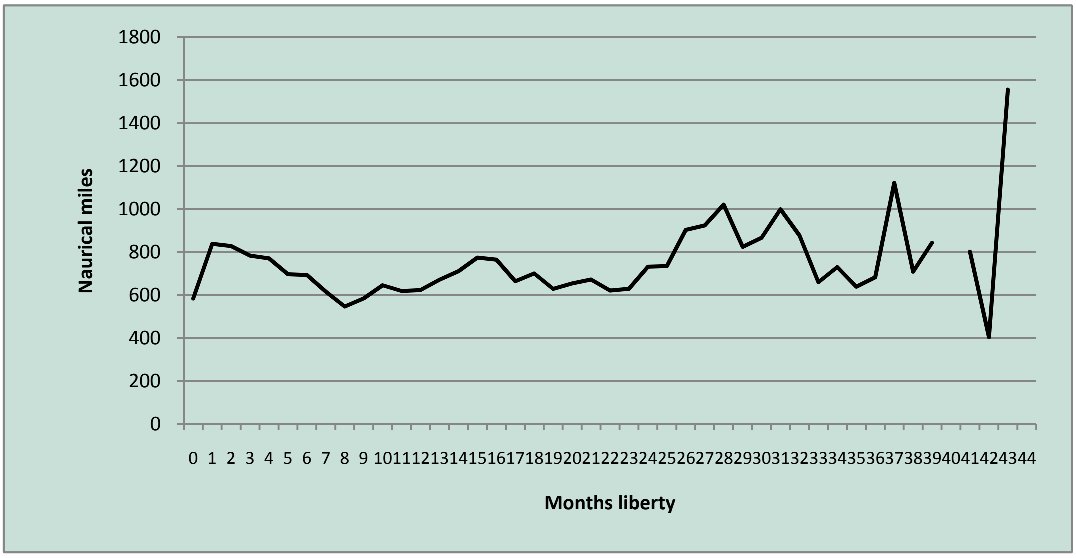


Figure 10: *Average distance between tagging and recovery position of YFT as a function of duration at liberty*

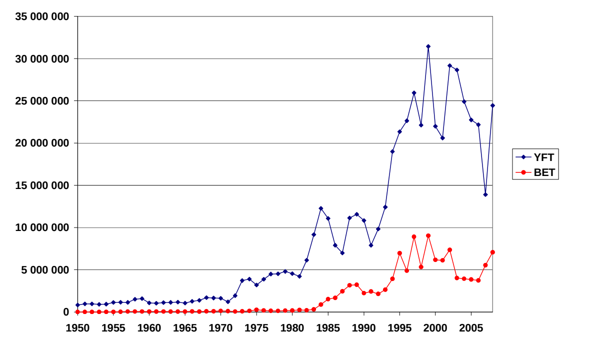


Figure 11: *Total yearly catches of small YFT < 90 cm taken by the whole fisheries*

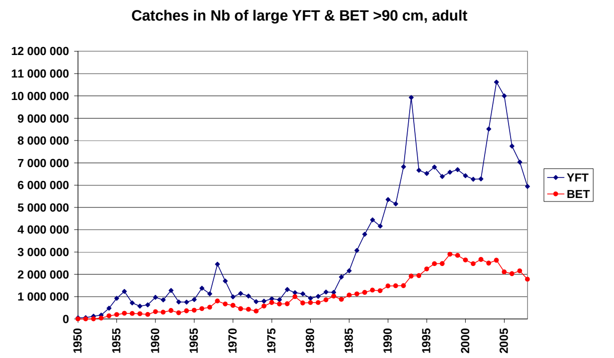


Figure 11: *Total yearly catches of large YFT > 90 cm taken by the whole fisheries*

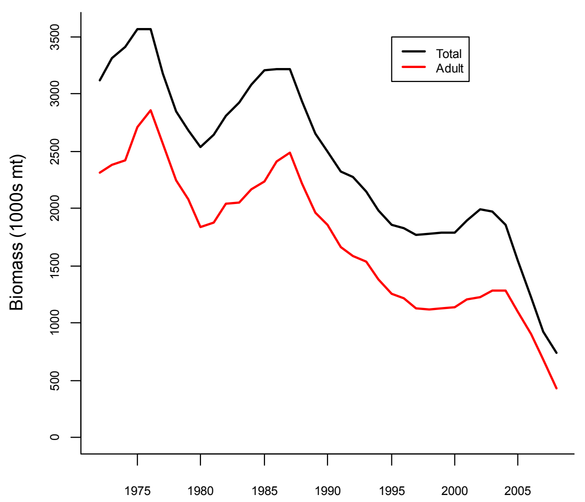


Figure 12. *Temporal trend in total and adult biomass (1000s mt) for the whole Indian Ocean.*

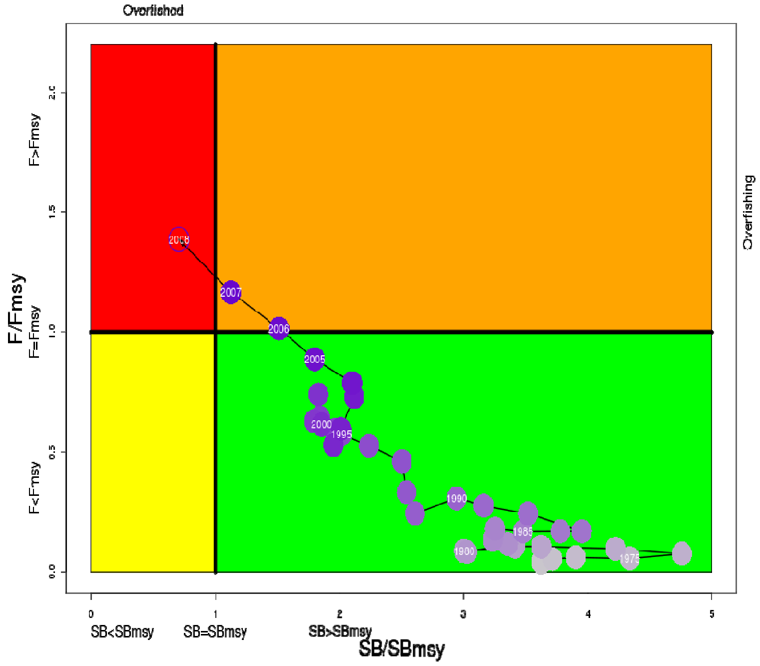


Figure 13. *Kobe plot for YFT (MFCL 2009 assessment, steepness 08). Estimates for 2008 are preliminary*

EXECUTIVE SUMMARY OF THE STATUS OF THE INDIAN OCEAN SWORDFISH RESOURCE

(AS ADOPTED BY THE SCIENTIFIC COMMITTEE, DECEMBER 2009)

BIOLOGY

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

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

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

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

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

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

FISHERIES

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

Exploitation of swordfish in the Indian Ocean was first recorded by the Japanese in the early 1950's as a by-catch in their tuna longline fisheries. Over the next thirty years, catches in the Indian Ocean increased slowly as the level of coastal state and distant water fishing nation longline effort targeted at tunas increased. In the 1990's, exploitation of swordfish, especially in the western Indian Ocean, increased markedly, peaking in 1998 at 35,100 t (Figure 2, Table 1). By 2002, twenty countries were reporting catches of swordfish (, Table 1). The average annual catch for the period from 2004 to 2008 was 29,900t and it was 28,100 t in 2007 and 22,300 in 2008. The highest catches are taken in the south west Indian Ocean; however, in recent years the fishery has been extending eastward (Figure 4).

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

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

STOCK STATUS

A stock assessment for swordfish was undertaken in 2009.

The longline Japanese and Taiwanese CPUE series have conflicting trends, with the Japanese (by-catch) fleet suggesting substantial decline in abundance prior to ~2000, and the Taiwanese (targeted) fleet suggesting stable abundance over this period.

The stock status reference points from the range of models varies considerably, but a number of general consistencies were evident. Given the limitations identified for each model, and the uncertainties associated with the data inputs, the SC felt that restricting the management advice to a single model would lead to an understatement of the uncertainty. This summary attempts a qualitative summary across models and data-based indicators.

The annual average sizes of swordfish in the respective Indian Ocean fisheries are variable but show no trend (Figure 6). It was considered encouraging that there are not yet clear signals of declines in the size-based indices, but these indices should be carefully monitored. It was noted that since females mature at a relatively large size, a reduction in the biomass of large animals could potentially have a strong effect on the spawning biomass.

When the current stock status estimates are compared among models, it is evident that there is a large degree of uncertainty. In recognition of the fact that MSY-related reference points are often difficult to quantify reliably, a number of management agencies prefer to use depletion-based biomass stock status indicators. Most approaches suggest that MSY could reasonably be in the range of ~28-34,000 tonnes, though this is the lower end of the range for some models and the upper end of the range for others. Similarly, all approaches suggest that depletion could be in the range of B2007/B0 = 0.4 – 0.5, though again this may be an upper or lower end of the plausible range depending on the model. Comparison across models suggest that current catches are probably near MSY (and F is probably near FMSY), but could be somewhat above or below.

The apparent fidelity of swordfish to particular areas is a matter for concern as this can lead to localised depletion. The CPUE of the Japanese fleet in the south west IO has the strongest decline of the four areas examined in 2009; furthermore, the La Reunion CPUE series shows a declining trend in this area over the last 10 years. In previous years, localised depletion was inferred on the basis of decreasing CPUEs following fine-scale analyses of the catch and effort data. Therefore the SC cannot discount the possibility that localised depletion is still occurring in some areas. Localised depletion has occurred in other parts of the world where swordfish have been heavily targeted

MANAGEMENT ADVICE

Given the general recent declining trend in all the CPUE series, and the fully exploited status of the stock, the WPB expects that abundance will likely decline further at current effort levels, especially considering that the issue of increases in efficiency has not been fully addressed in the current standardization. When combined with the uncertainty in the assessment, the WPB considers that there is a reasonably high probability that common target and limit reference points (*eg*. BMSY, 0.4B0) may be marginally exceeded, and this probability will increase over time if effort remains at current levels or increases further. Precautionary measures such as capacity control or catch limits will reduce the risk of creating an overcapacity problem or increasing the risk of exceeding common biomass limit reference points.

The SC recommended that catches of swordfish should not exceed the estimated MSY of 33,000t.

SWORDFISH SUMMARY

Management quantity	2008 Assessment	2009 Assessment
Most recent catch	28,100 t (2007)	22,300 t (2008)
Mean catch over the last 5 years (2004-2008)		29,900 t
Maximum Sustainable Yield		33,000 t Range: 32,000 – 34,000 t
F_{2007}/F_{MSY}		0.79 Range: 0.58 – 0.84
B_{2007}/B_{MSY}		1.31 Range: 1.13 – 1.46
SB_{2007}/SB_{MSY}		
B_{2007}/B_0		0.48 (0.19-0.87)
SB_{2007}/SB_0		
$B_{2007}/B_{2007,F=0}$		
$SB_{2007}/SB_{2007,F=0}$		

***Table 1**. Best scientific estimates of the catches of swordfish (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1957-2007 (in thousands of tonnes). Data as of July 2009 (Miguel)*

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Longline	China																											
	Taiwan,China	0.2	0.2	0.3	0.3	0.5	0.5	0.3	0.3	0.2	0.6	0.8	1.2	0.9	0.9	0.6	1.0	0.9	0.9	0.9	0.6	1.1	1.3	1.1	1.5	1.9	1.7	2.0
	Indonesia																0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
	Japan	0.5	0.6	0.7	0.8	0.6	0.8	1.0	1.1	1.6	1.1	1.1	1.2	1.1	0.9	0.8	0.8	0.8	0.4	0.3	0.9	0.6	0.6	0.8	1.0	1.2	1.3	2.2
	Korea, Rep							0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.3	0.5	0.6	0.7	0.8	0.6	0.3	0.4	0.3	0.3	0.1	0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.7*	*0.8*	*0.9*	*1.1*	*1.1*	*1.4*	*1.5*	*1.5*	*1.8*	*1.9*	*2.2*	*2.7*	*2.1*	*2.0*	*1.6*	*2.0*	*2.3*	*1.9*	*1.9*	*2.4*	*2.3*	*2.3*	*2.3*	*2.8*	*3.4*	*3.2*	*4.3*
Gillnet	India																						0.1	0.1	0.4	0.1	0.2	0.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.4*	*0.1*	*0.2*	*0.2*
Other gears	*Total*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.0*	*0.0*	*0.0*
All	*Total*	*0.7*	*0.8*	*0.9*	*1.1*	*1.1*	*1.4*	*1.5*	*1.5*	*1.8*	*1.9*	*2.2*	*2.7*	*2.1*	*2.0*	*1.6*	*2.0*	*2.3*	*1.9*	*1.9*	*2.4*	*2.3*	*2.4*	*2.4*	*3.2*	*3.6*	*3.5*	*4.4*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Longline	China	0.6	0.1										0.1	0.2	0.3	0.1	0.4	0.4	0.3	0.4	0.8	0.7	0.6	0.8	0.4	0.4
	Taiwan,China	7.5	5.2	3.2	3.8	5.4	4.1	3.8	4.7	9.0	15.3	12.5	18.3	17.6	17.2	16.8	14.7	15.2	12.9	13.5	14.4	12.3	7.5	6.8	6.0	4.7
	Spain	4.7	0.8								0.2	0.7	0.0	0.0	0.5	1.4	2.0	1.0	1.9	3.5	4.3	4.7	5.1	5.2	4.8	3.9
	NEI-Deep-freezing	2.8	1.5	0.2	0.2	0.8	0.6	0.8	0.9	1.4	4.2	3.6	5.4	7.7	5.5	7.3	6.5	6.0	2.9	3.1	2.6	5.4	5.4	1.9	1.2	0.4
	Indonesia	2.0	0.5	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.5	0.5	1.0	1.2	1.1	1.3	0.7	1.0	1.6	3.0	2.8	2.0	1.7	1.6	1.6
	Japan	1.7	1.2	1.3	1.4	1.5	1.0	1.0	0.9	1.7	1.4	2.6	1.7	2.1	2.8	2.2	1.5	1.6	1.2	1.3	1.1	1.2	1.5	1.8	2.2	1.6
	Portugal	1.3	0.2													0.1	0.2	0.2	0.6	0.8	0.9	0.9	1.1	2.2	2.0	0.5
	Seychelles	1.0	0.2										0.0	0.1	0.2	0.2	0.3	0.5	0.7	0.6	1.4	1.4	1.3	0.9	1.0	0.7
	France-Reunion	1.0	0.4						0.0	0.1	0.3	0.7	0.8	1.3	1.6	2.1	1.9	1.7	1.6	0.8	0.8	0.9	1.2	0.9	1.1	0.9
	India	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.4	0.1	0.0	0.0	0.0	0.8	0.5	0.9	1.2	1.1
	United Kingdom	0.8	0.1																			0.4	0.6	1.1	1.0	1.0
	Guinea	0.8	0.1																0.0	0.5	0.5	0.5	0.8	0.8	0.8	0.8
	Mauritius	0.6	0.1										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.7	0.6	0.7	0.5	0.4
	Tanzania	0.4	0.0																				0.5	0.5	0.5	0.4
	Korea, Republic of	0.2	0.2	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1	1.1	0.7	1.1	0.7	0.3	0.0	0.1	0.1	0.0	0.1	0.3	0.3	0.3	0.1	0.0
	Australia	0.1	0.2				0.0		0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.3	1.4	1.8	2.9	1.3	1.8	0.4	0.3			
	NEI-Fresh Tuna	0.1	0.2				0.5	0.7	0.6	0.7	0.7	1.1	0.9	0.9	1.1	1.0	0.9	0.9	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.2
	Other Fleets	1.0	0.3	0.0	0.1	0.1	0.3	0.4	0.4	0.5	0.4	0.5	0.3	0.1	0.2	1.2	0.5	0.1	1.5	1.8	1.6	0.6	1.1	1.1	1.2	1.3
	Total	*27.6*	*11.5*	*4.9*	*5.6*	*7.9*	*6.7*	*7.0*	*7.8*	*13.8*	*23.2*	*23.4*	*28.8*	*32.3*	*31.3*	*34.5*	*32.1*	*30.2*	*27.6*	*29.4*	*33.9*	*34.1*	*30.3*	*27.7*	*25.7*	*20.1*
Gillnet	Sri Lanka	1.2	0.5	0.0	0.0	0.0	0.0	0.1	0.2	0.3	1.9	0.9	0.9	1.0	1.3	0.9	1.1	2.8	2.1	2.1	2.3	2.1	0.8	1.6	0.9	0.8
	India	0.5	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.1	0.1	0.3	0.4	0.3	0.2	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.9	0.7
	Pakistan	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.5	0.5	0.5	0.5
	Other Fleets	0.1	0.0	0.0	0.1	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1
	Total	*2.2*	*0.7*	*0.2*	*0.3*	*0.5*	*0.4*	*0.4*	*0.3*	*0.5*	*2.1*	*1.0*	*1.0*	*1.3*	*1.7*	*1.2*	*1.4*	*3.1*	*2.5*	*2.6*	*2.8*	*2.6*	*1.7*	*2.4*	*2.3*	*2.1*
Other gears	*Total*	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*
All	*Total*	*29.9*	*12.2*	*5.1*	*5.9*	*8.4*	*7.1*	*7.5*	*8.1*	*14.3*	*25.3*	*24.5*	*29.8*	*33.7*	*33.2*	*35.8*	*33.5*	*33.4*	*30.2*	*32.2*	*36.8*	*36.8*	*32.1*	*30.2*	*28.1*	*22.3*

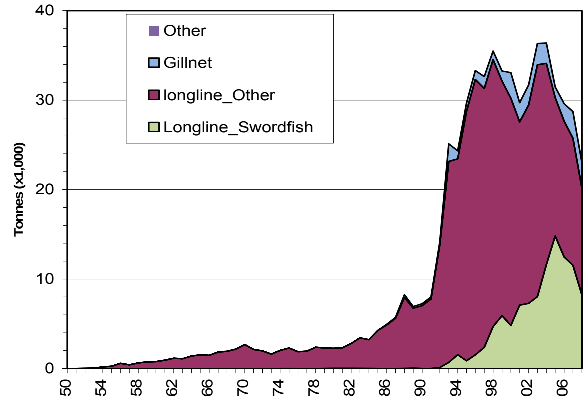


Figure 1. *Catches of Swordfish per gear and year recorded in the IOTC Database (19529-2008). Data as of July 2009*

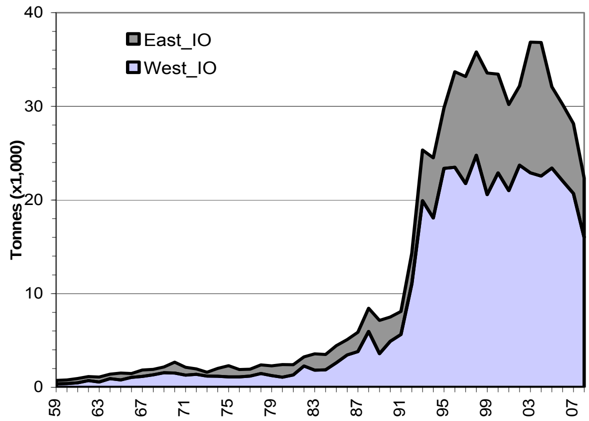


Figure 2. *Trends of the swordfish catches in the western and the eastern area of the Indian Ocean from 1959 – 2008. Data as of November 2009 (to be updated)*

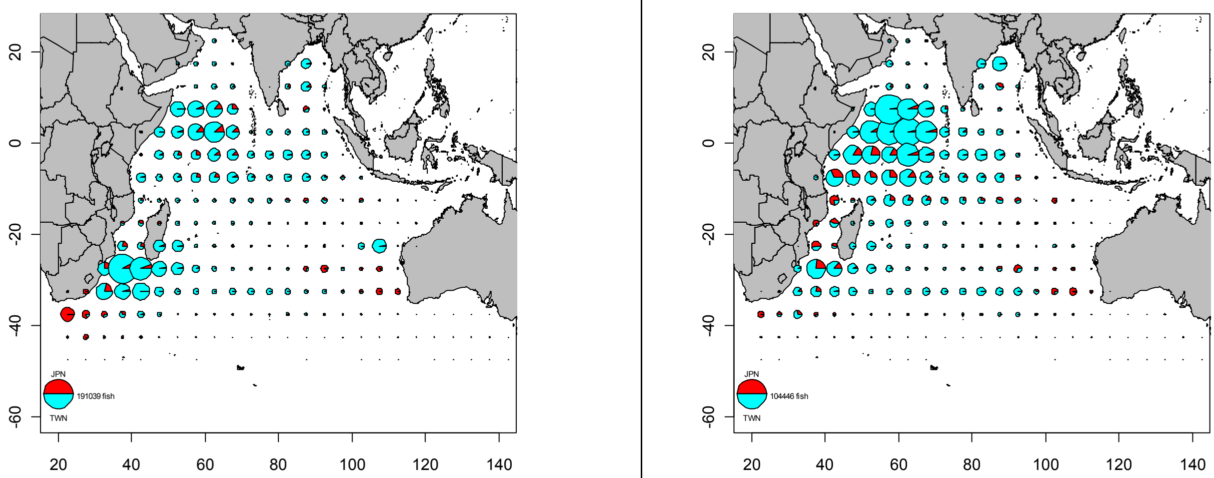


Figure 4. *Mean annual catches of swordfish (t) for the periods 1990 to 1999 and 2000 to 2007 for longline, gillnet and other fisheries in the Indian Ocean.*

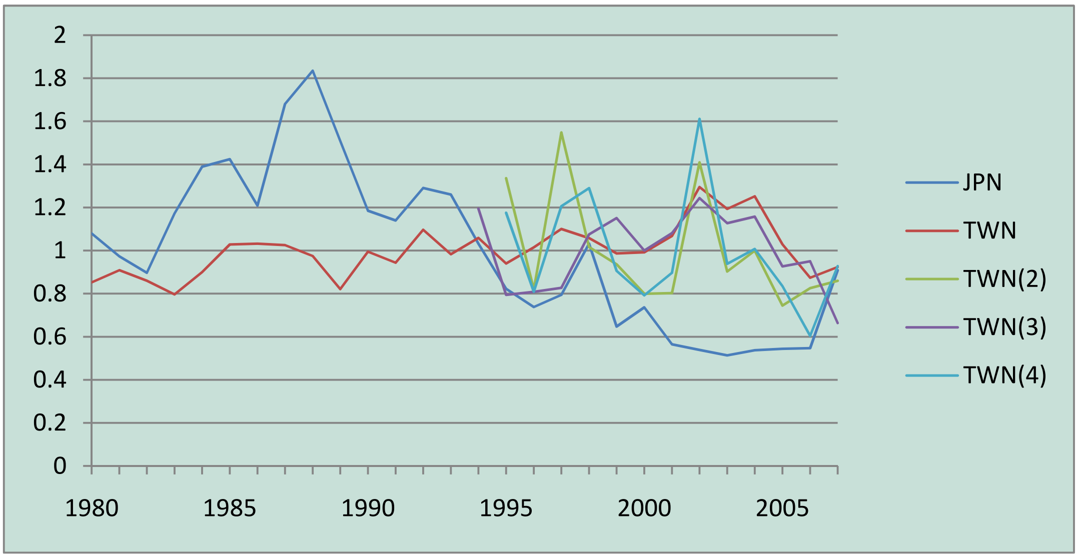


Figure 5: *Standardised CPUE index for the Japanese and Taiwanese longline fleets 1980 to 2007*

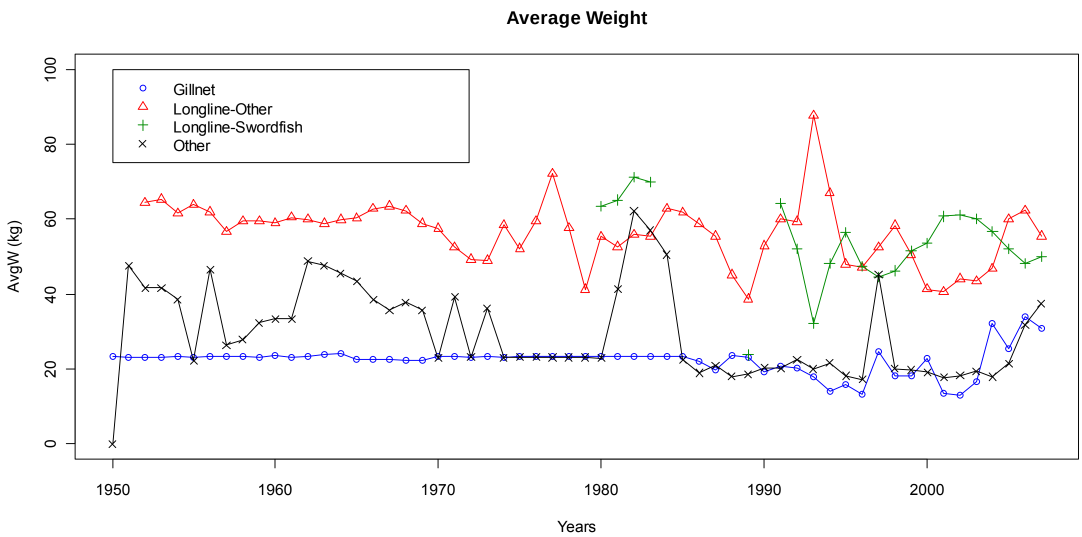


Figure 7. *Trends in average size of swordfish per gear in the Indian Ocean.*

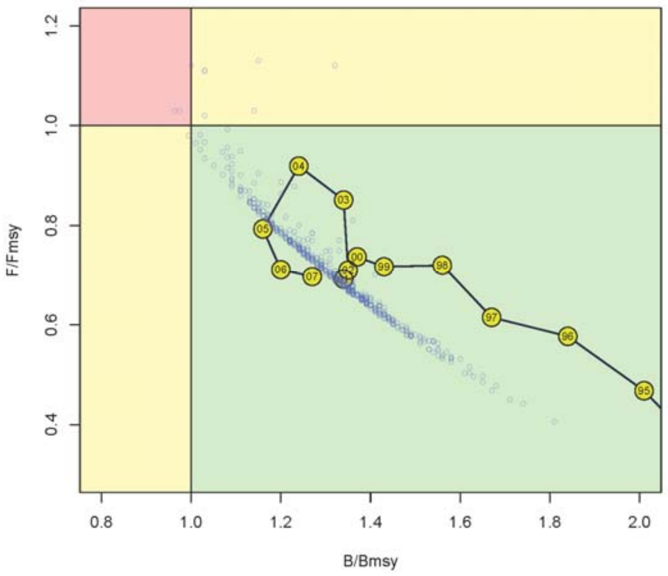


Figure 8. *Kobe plot illustrated the result of the ASPIC model (a. 80% CI, b. blue circles 500 bootstraps)*

EXECUTIVE SUMMARY OF THE STATUS OF BLACK MARLIN

(AS ADOPTED BY THE SCIENTIFIC COMMITTEE, DECEMBER 2009)

BIOLOGY

Black marlin (*Makaira indica*) is mainly found in the tropical and subtropical waters of the Pacific and the Indian Oceans. Individuals have been reported in the Atlantic Ocean but there is no information to indicate the presence of a breeding stock in this area. Black marlin is mainly found in oceanic surface waters above the thermocline and typically near land masses, islands, coral reefs etc; however, they may range to depths of 1000 m.

Little is known on the biology of the black marlin in the Indian Ocean. In other oceans, black marlin can grow up to 4.5 m long and weigh 750kg. Young fish grow very quickly in length then put on weight later in life. In eastern Australian waters black marlin grows from 13 mm long at 13 days old to 1800 mm and around 30 kg after 13 months. Males are in general smaller than females.

Sexual maturity is attained at around 100kg for the females and 50 to 80 kg for males, no spawning grounds have been identified but in Australia spawning individuals apparently prefer water temperatures around 27-28°C. Females may produce up to 40 million eggs.

FISHERIES

Black marlin is caught mainly by longliners and gillnetters in the Indian Ocean (Figure 1). Minimum catch estimates have been derived from very small amounts of information and are therefore highly uncertain. Difficulties in the identification of marlins also contribute to the uncertainties of the information available to the Secretariat.

The minimum average annual catch estimated for the period 2004 to 2008 is around 4,873 t. The distribution of black marlin catches has changed since the 1980's with most of the catch now taken in the western areas of the Indian Ocean (Figure 2). In recent years, the fleets of Taiwan,China (longline), Sri Lanka (gillnet) and India (gillnets) are attributed with the highest catches of black marlin.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is limited reliable information on the catches of black marlin and no information on the stock structure or growth and mortality of black marlin in the Indian Ocean. For example:

1. **Trends in catches**: catch estimates for black marlin are highly uncertain. Available catch data varies from year to year and mis-identification of marlins is probably common.
2. **Nominal CPUE Trends:** data is available from several fleets (mainly longline) and time periods but this species is not targeted therefore interpretation of catch rates may be problematic as they are likely to be affected by changes in the fisheries targeting other species.
3. **Average weight of fish in the catch:** the average weight of fish is derived from various weight and length information. The reliability of average weight estimates is reduced when relatively few fish out of the total catch are measured.
4. **Sex ratio:** such data are not available to the Secretariat
5. **Lengths of fish being caught –** fish size is derived from various length and weight information. The reliability of the size data is reduced when relatively few fish out of the total catch are measured.

No quantitative stock assessment on black marlin in the Indian Ocean is known to exist and no such assessment has been undertaken by the IOTC Working Party on Billfish. However, a preliminary estimation of stock indicators was attempted on the longline catch and effort datasets from Japan and Taiwan,China that represent the best available information. Nominal CPUE exhibited dramatic declines since the beginning of the fishery in two major fishing grounds (West Equatorial and north-west Australia) and the catches in the initial core areas also decreased substantially (Figures 3, 4 and 5). However, there is considerable uncertainty about the degree to which these indicators represent abundance as factors such as changes in targeting practices, discarding practices, fishing grounds and management practices are likely to interact in the depicted trends.

Further work must be undertaken to derive some stock indicators for this species, because in the absence of a quantitative stock assessment, such indicators represent the only means to monitor the status of the stock and assess the impacts of fishing.

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for black marlin in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

BLACK MARLIN SUMMARY

Management quantity	2008 Assessment	2009 assessment
Most recent catch	4,964 t (2007)	5,883 t (2008)
Mean catch over the last 5 years (2004-2008)		4,873 t
Maximum Sustainable Yield		
$F_{Current}/F_{MSY}$		
$B_{Current}/B_{MSY}$		
$SB_{Current}/SB_{MSY}$		
$B_{Current}/B_0$		
$SB_{Current}/SB_0$		
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

***Table 1**. Best scientific estimates of the catches of black marlin (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).* Data as of November 2009

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Longline	China																											
	Taiwan,China	0.5	0.3	0.5	0.3	0.4	0.4	0.3	0.2	0.2	0.6	0.9	1.2	0.9	0.9	0.5	0.9	0.7	0.3	0.3	0.2	0.2	0.5	0.4	0.3	0.7	0.5	0.7
	Indonesia															0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Japan	1.0	1.4	1.2	1.5	0.9	1.1	1.0	1.0	1.2	1.5	1.2	1.1	0.7	0.3	0.2	0.4	0.4	0.2	0.1	0.4	0.2	0.2	0.3	0.3	0.4	0.6	0.5
	India																									0.0	0.0	0.0
	Korea, Republic of							0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.3	0.4	0.3	0.3	0.4	0.4	0.5	0.4	0.3	0.4	0.3	0.3
	NEI-Deep-freezing																											0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*1.5*	*1.7*	*1.7*	*1.9*	*1.3*	*1.6*	*1.3*	*1.2*	*1.5*	*2.1*	*2.1*	*2.4*	*1.8*	*1.4*	*0.9*	*1.6*	*1.5*	*0.8*	*0.7*	*0.9*	*0.8*	*1.2*	*1.0*	*1.0*	*1.5*	*1.4*	*1.4*
Gillnet	India																						0.1	0.1	0.3	0.1	0.2	0.1
	Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pakistan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.2
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*	*0.3*	*0.1*	*0.4*	*0.2*	*0.3*	*0.4*
Other gears	India																						0.0	0.0	0.0	0.0	0.0	0.0
	Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sri Lanka	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.2*	*0.2*	*0.2*	*0.2*
All	*Total*	*1.5*	*1.7*	*1.7*	*1.9*	*1.3*	*1.6*	*1.4*	*1.3*	*1.5*	*2.1*	*2.1*	*2.4*	*1.8*	*1.4*	*0.9*	*1.6*	*1.5*	*0.8*	*0.8*	*1.0*	*1.1*	*1.5*	*1.2*	*1.6*	*1.9*	*1.9*	*2.0*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Longline	China																									
	Taiwan,China	0.8	0.6	0.8	1.0	0.8	0.7	0.3	0.5	1.1	0.4	0.5	0.6	0.4	0.4	0.5	0.4	0.6	0.6	0.6	0.9	0.7	0.9	1.0	0.7	0.8
	Indonesia	0.5	0.2	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.4	0.5	0.4	0.5	0.3	0.3	0.5	1.0	0.7	0.5	0.3	0.2	1.0
	NEI-Fresh Tuna	0.3	0.1				0.1	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.3	0.2	0.2	0.0	0.1	0.1	0.1	0.2	0.2	0.4	0.5
	Oman	0.2	0.0															0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2
	Japan	0.1	0.4	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1
	India	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2
	Korea, Republic of	0.0	0.1	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	NEI-Deep-freezing	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1
	NEI-Indonesia Fresh	0.0	0.0	0.0		0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0									
	Other Fleets	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2
	Total	*2.2*	*1.5*	*1.5*	*1.7*	*1.5*	*1.5*	*1.1*	*1.1*	*2.0*	*1.2*	*1.5*	*1.5*	*1.5*	*1.6*	*1.8*	*1.7*	*1.7*	*1.2*	*1.5*	*2.3*	*2.0*	*2.0*	*2.1*	*1.9*	*3.1*
Gillnet	Sri Lanka	0.8	0.3	0.1	0.1	0.1	0.1	0.2	0.2	0.4	0.5	1.3	0.9	1.1	1.4	1.0	1.0	1.2	1.6	0.7	0.7	0.6	1.1	1.2	0.6	0.6
	India	0.6	0.2	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.4	0.5	0.3	0.3	0.4	0.5	0.4	0.5	0.4	0.4	0.8	0.8	0.7
	Indonesia	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.1	0.7	0.7	0.7
	Pakistan	0.3	0.1	0.0	0.1	0.1	0.3	0.3	0.2	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.4	0.4	0.4	0.4
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*2.3*	*0.8*	*0.3*	*0.3*	*0.3*	*0.6*	*0.7*	*0.6*	*1.0*	*1.2*	*2.1*	*1.7*	*2.1*	*2.5*	*2.0*	*1.8*	*2.2*	*2.5*	*1.5*	*1.6*	*1.5*	*1.9*	*3.1*	*2.5*	*2.5*
Other gears	India	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.2
	Indonesia	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0		0.1	0.1	0.1
	Sri Lanka	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Total	*0.3*	*0.1*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.5*	*0.5*	*0.3*
All	*Total*	*4.9*	*2.5*	*1.9*	*2.2*	*1.9*	*2.3*	*2.0*	*2.0*	*3.2*	*2.7*	*3.9*	*3.5*	*3.9*	*4.4*	*4.0*	*3.8*	*4.0*	*4.0*	*3.2*	*4.1*	*3.7*	*4.1*	*5.7*	*5.0*	*5.9*

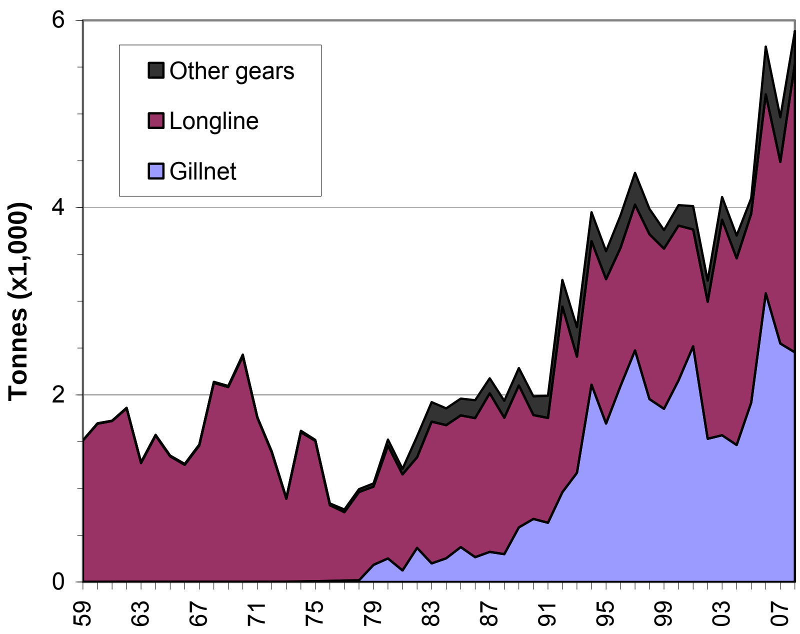


Figure 1: *Estimated catches of black marlin by gear recorded in the IOTC Database (1959-2008). Note, these are minimum catch estimates as they are derived from IOTC fleets only and the levels of catch by other fleets are unknown.*

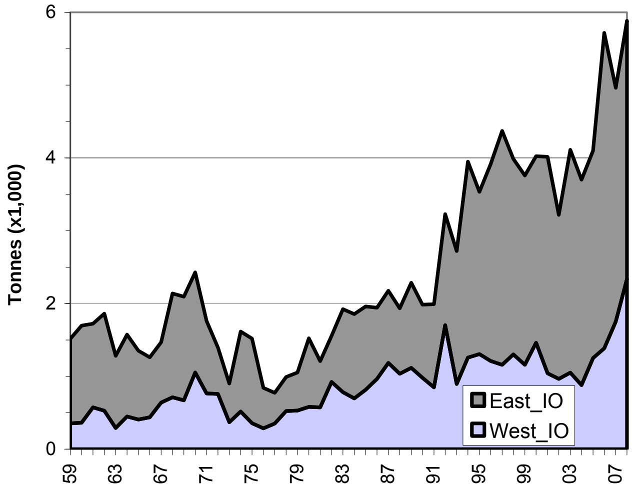


Figure 2. *Trends of the black marlin catches in the western and the eastern area of the Indian Ocean from 1959 – 2008. Data as of November 2009*

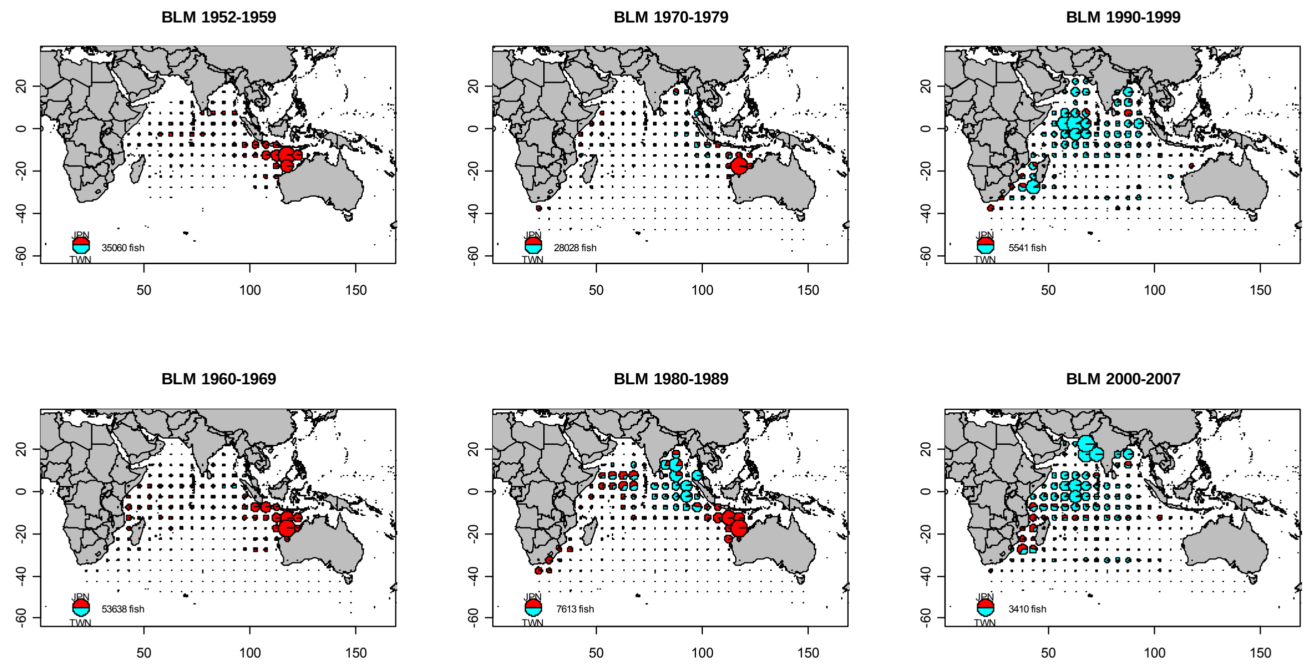


Figure 3: *Mean annual catches of black marlin (number) by Japanese and Taiwanese longline vessels operating in the Indian Ocean over the periods 1952 to 2007 per decade*

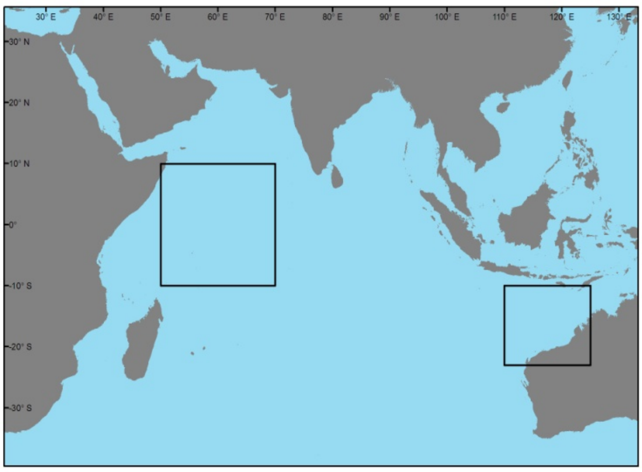


Figure 4. *Major marlin fishing areas (framed): Seychelles and NW Australia.*

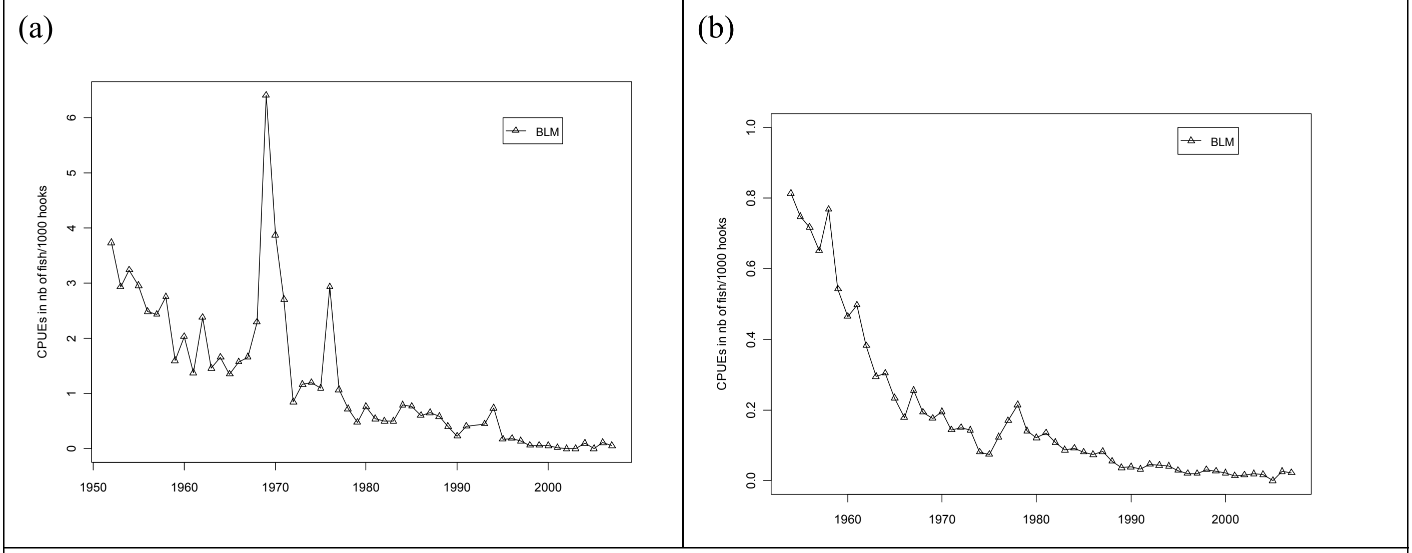


Figure 5. *(a) nominal yearly CPUE (in numbers of fishes / 1000 hooks) of Japanese longliners in the North West Australia area (10-20°S,110-120°E) for blue marlin (BUM), striped marlin (MLS) and black marlin (BLM) (b) nominal yearly CPUE (in numbers of fishes / 1000 hooks) of Japanese longliners in the area around Seychelles Islands (10°N-10°S,50-70°E).*

EXECUTIVE SUMMARY OF THE STATUS OF THE BLUE MARLIN

(AS ADOPTED BY THE SCIENTIFIC COMMITTEE, DECEMBER 2009)

BIOLOGY

Blue marlin[3] (*Makaira nigricans*) is found throughout the tropical and subtropical regions of the Pacific, Indian and Atlantic Oceans. Blue marlin is a solitary species and prefers the warm offshore surface waters (>24°C); it is scarce in waters less than 100m or close to land.

A highly migratory species, the blue marlin is known to make regular seasonal migrations, (in the Atlantic Ocean) moving toward the equator in winter and away again in summer. In the Pacific Ocean one tagged blue marlin is reported to have travelled 3000nm in 90 days.

Blue marlin may live up to 28 years. Females are typically grow larger than males, some attaining over 4 m and exceeding 900 kg. Males grow more slowly than females and generally do not exceed 3 m or 200 kg.

Sexual maturity is attained at between 2 and 4 years of age. A large female can produce in excess of 10 million eggs. Blue marlin is a serial spawner and in some environments females may spawn all year round.

FISHERIES

Blue marlin is caught mainly by longliners and gillnets in the Indian Ocean (Figure 1). Minimum catch estimates have been derived from very small amounts of information and are therefore highly uncertain. Difficulties in the identification of marlins also contribute to the uncertainties of the information available to the Secretariat.

The minimum average annual catch estimated for the period 2004 to 2008 is around 9500 t. The distribution of blue marlin catches has changed since the 1980's with most of the catch now taken in the western areas of the Indian Ocean (Figure 2). In recent years, the fleets of Taiwan,China (longline), Indonesia (longline), Sri Lanka (gillnet) and India (gillnet) are attributed with the highest catches of blue marlin.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is limited reliable information on the catches of blue marlin and no information on the stock structure or growth and mortality of blue marlin in the Indian Ocean. For example:

1. **Trends in catches**: catch estimates for blue marlin are highly uncertain. Available catch data varied from year to year and mis-identification of marlins is probably common.
2. **Nominal CPUE Trends:** data is available from several fleets (mainly longline) and time periods but this species is not targeted therefore interpretation of catch rates may be problematic as they are likely to be affected by changes in the fisheries targeting other species.
3. **Average weight of fish in the catch:** the average weight of fish is derived from various weight and length information. The reliability of average weight estimates is reduced when relatively few fish out of the total catch are measured.
4. **Sex ratio:** such data are not available to the Secretariat
5. **Lengths of fish being caught –** fish size is derived from various length and weight information. The reliability of the size data is reduced when relatively few fish out of the total catch are measured.

No quantitative stock assessment on blue marlin in the Indian Ocean is known to exist and no such assessment has been undertaken by the IOTC Working Party on Billfish. However, a preliminary estimation of stock indicators was attempted on the longline catch and effort datasets from Japan and Taiwan,China that represent the best available information. Nominal CPUE exhibited dramatic declines since the beginning of the fishery in two major fishing grounds (West Equatorial and north-west Australia) and the catches in the initial fishing grounds areas also decreased substantially (Figures 3, 4 and 5). There is considerable uncertainty about the degree to which those

[3] Some scientists consider that blue marlin comprises two different species, *M. mazara* and *M. nigricans* based on differences in the lateral line. More commonly, however, these two species are lumped together as a single species.

indicators represent abundance as factors such as changes in targeting practices, discarding practices, fishing grounds and management practices are likely to interact in the depicted trends.

Further work must be undertaken to derive some stock indicators for this species, because in the absence of a quantitative stock assessment, such indicators represent the only means to monitor the status of the stock and assess the impacts of fishing.

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for blue marlin in the Indian Ocean, and due to a lack of data for several gears, only preliminary stock indicators can be used. . Therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

BLUE MARLIN SUMMARY

Management quantity	2008 Assessment	2009 assessment
Most recent catch	7,900 t (2007)	7,100 t (2008)
Mean catch over the last 5 years (2004-2008)		9,500 t
Maximum Sustainable Yield		
$F_{Current}/F_{MSY}$		
$B_{Current}/B_{MSY}$		
$SB_{Current}/SB_{MSY}$		
$B_{Current}/B_0$		
$SB_{Current}/SB_0$		
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

***Table 1**. Best scientific estimates of the catches of blue marlin (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).* *Data as of November 2009*

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Longline	China																											
	Taiwan,China	0.4	0.3	0.3	0.4	0.6	0.7	0.4	0.3	0.7	1.6	1.7	2.8	2.3	2.3	1.3	1.3	1.5	1.0	1.0	1.3	1.5	1.4	1.3	1.4	1.7	2.3	2.1
	Indonesia															0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Japan	4.2	3.6	3.1	2.9	1.7	2.8	3.2	3.2	3.3	2.1	1.7	1.3	1.0	0.9	0.6	0.9	0.7	0.3	0.3	0.9	0.4	0.6	0.8	1.1	1.6	1.5	1.5
	India																									0.0	0.0	0.0
	NEI-Deep-freezing																											0.0
	Korea, Republic of							0.0	0.0	0.0	0.0	0.1	0.4	0.4	0.6	0.8	1.4	1.4	1.3	1.3	1.6	1.7	1.3	1.2	1.2	1.1	0.9	1.0
	Seychelles																									0.0	0.0	0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*4.5*	*3.9*	*3.4*	*3.3*	*2.2*	*3.5*	*3.7*	*3.6*	*4.1*	*3.8*	*3.5*	*4.4*	*3.6*	*3.8*	*2.7*	*3.7*	*3.6*	*2.6*	*2.6*	*3.9*	*3.6*	*3.5*	*3.4*	*3.8*	*4.5*	*4.8*	*4.7*
Gillnet	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Other gears	Sri Lanka	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.5	0.4	0.3	0.3
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.5*	*0.4*	*0.3*	*0.3*
All	*Total*	*4.6*	*3.9*	*3.5*	*3.3*	*2.3*	*3.5*	*3.8*	*3.6*	*4.1*	*3.8*	*3.5*	*4.4*	*3.6*	*3.8*	*2.7*	*3.7*	*3.7*	*2.7*	*2.7*	*3.9*	*3.7*	*3.6*	*3.5*	*4.3*	*5.0*	*5.1*	*5.1*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Longline	China																									
	Taiwan,China	3.0	2.1	3.7	4.3	2.9	2.7	1.3	2.0	3.2	3.8	1.7	2.4	2.3	3.4	4.1	3.1	3.6	3.0	3.3	4.4	3.6	3.2	3.3	2.5	2.3
	Indonesia	1.4	0.6	0.0	0.1	0.2	0.3	0.3	0.3	0.6	0.6	0.9	1.0	1.9	2.3	2.1	2.5	1.4	1.3	2.4	2.6	2.9	1.9	1.6	0.6	0.2
	NEI-Fresh Tuna	0.8	0.2				0.3	0.5	0.4	0.5	0.5	0.7	0.6	0.6	0.7	0.6	0.6	0.5	0.1	0.4	0.6	0.6	0.7	0.8	0.9	0.9
	Japan	0.6	1.2	1.2	0.9	0.8	0.4	0.3	0.2	0.3	0.3	0.6	0.4	0.6	1.2	1.2	0.8	1.0	0.4	0.5	0.4	0.5	0.5	0.7	0.8	0.6
	India	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.2	0.2	0.4	0.4	0.5
	NEI-Deep-freezing	0.2	0.3	0.2	0.2	0.4	0.4	0.3	0.4	0.5	1.0	0.5	0.7	1.0	1.1	1.8	1.4	1.2	0.6	0.5	0.4	0.2	0.3	0.2	0.1	0.1
	Korea, Republic of	0.2	0.5	1.3	1.2	1.2	1.0	0.9	0.3	0.5	0.4	0.5	0.3	0.5	0.4	0.2	0.0	0.1	0.1	0.0	0.1	0.2	0.2	0.1	0.2	0.2
	Seychelles	0.1	0.0										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.1	0.1	0.1
	NEI-Indonesia Fresh	0.0	0.1	0.0		0.2	0.6	0.8	0.8	0.9	0.8	1.0	0.5	0.2	0.2	0.0	0.0									
	Other Fleets	0.3	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.1	0.1	0.0	0.1	0.0	0.1	0.2	0.3	0.4	0.2	0.2	0.2	0.3	0.3	0.3	0.3
	Total	*6.9*	*5.2*	*6.6*	*6.8*	*5.7*	*5.7*	*4.4*	*4.7*	*6.8*	*7.5*	*6.0*	*6.0*	*7.2*	*9.4*	*10.3*	*8.9*	*8.2*	*5.9*	*7.4*	*8.8*	*8.5*	*7.4*	*7.5*	*5.8*	*5.2*
Gillnet	Sri Lanka	2.5	1.0	0.2	0.2	0.3	0.3	0.6	0.7	1.0	1.4	3.9	2.7	3.1	4.2	3.0	2.8	3.4	4.6	2.1	2.0	1.9	3.1	3.8	2.0	1.8
	Other Fleets	0.1	0.0	0.0	0.6	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
	Total	*2.6*	*1.0*	*0.2*	*0.9*	*0.3*	*0.3*	*0.6*	*0.8*	*1.1*	*1.5*	*3.9*	*2.7*	*3.1*	*4.2*	*3.0*	*2.8*	*3.5*	*4.7*	*2.2*	*2.1*	*1.9*	*3.1*	*3.9*	*2.1*	*1.9*
Other gears	Sri Lanka	0.0	0.1	0.3	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.3	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.0*	*0.1*	*0.3*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*0.5*	*0.5*	*0.4*	*0.4*	*0.3*	*0.3*	*0.2*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
All	*Total*	*9.5*	*6.4*	*7.1*	*8.0*	*6.3*	*6.4*	*5.3*	*5.9*	*8.3*	*9.4*	*10.4*	*9.1*	*10.7*	*13.9*	*13.5*	*11.7*	*11.7*	*10.6*	*9.6*	*10.9*	*10.4*	*10.5*	*11.4*	*7.9*	*7.1*

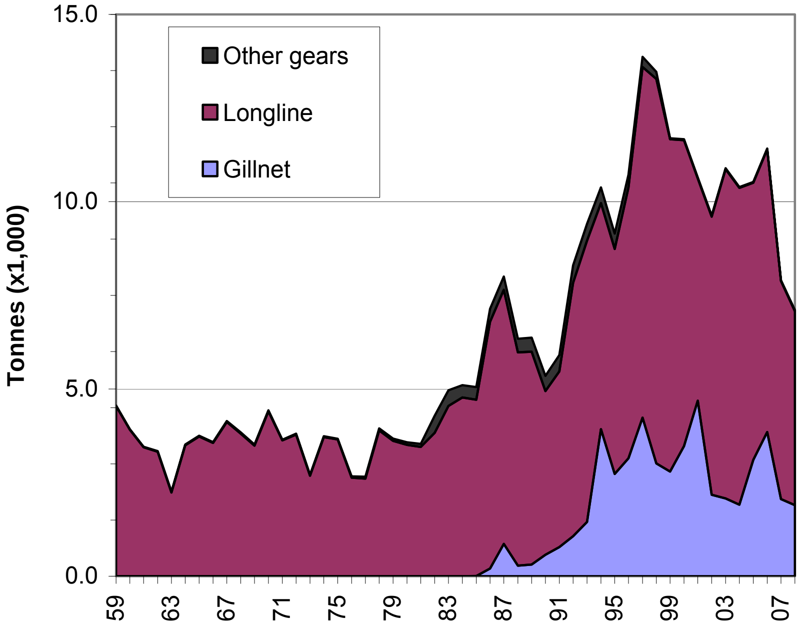


Figure 1: *Estimated catches of blue marlin by gear recorded in the IOTC Database (1959-2008). Note, these are minimum catch estimates as they are derived from IOTC fleets only and the levels of catch by other fleets are unknown*

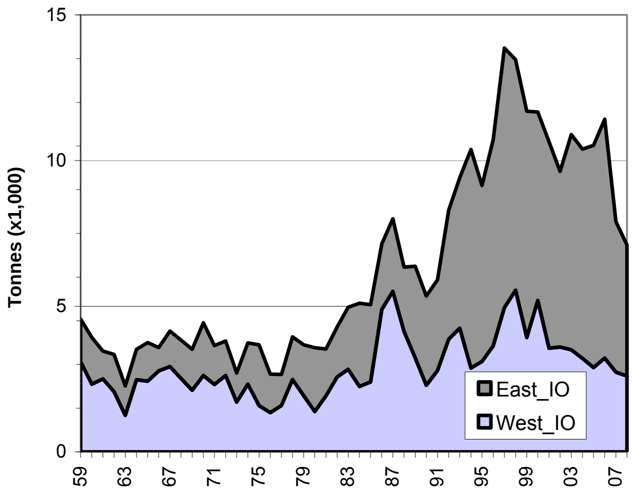


Figure 2. *Trends of the blue marlin catches in the western and the eastern area of the Indian Ocean from 1959 – 2008. Data as of November 2009*

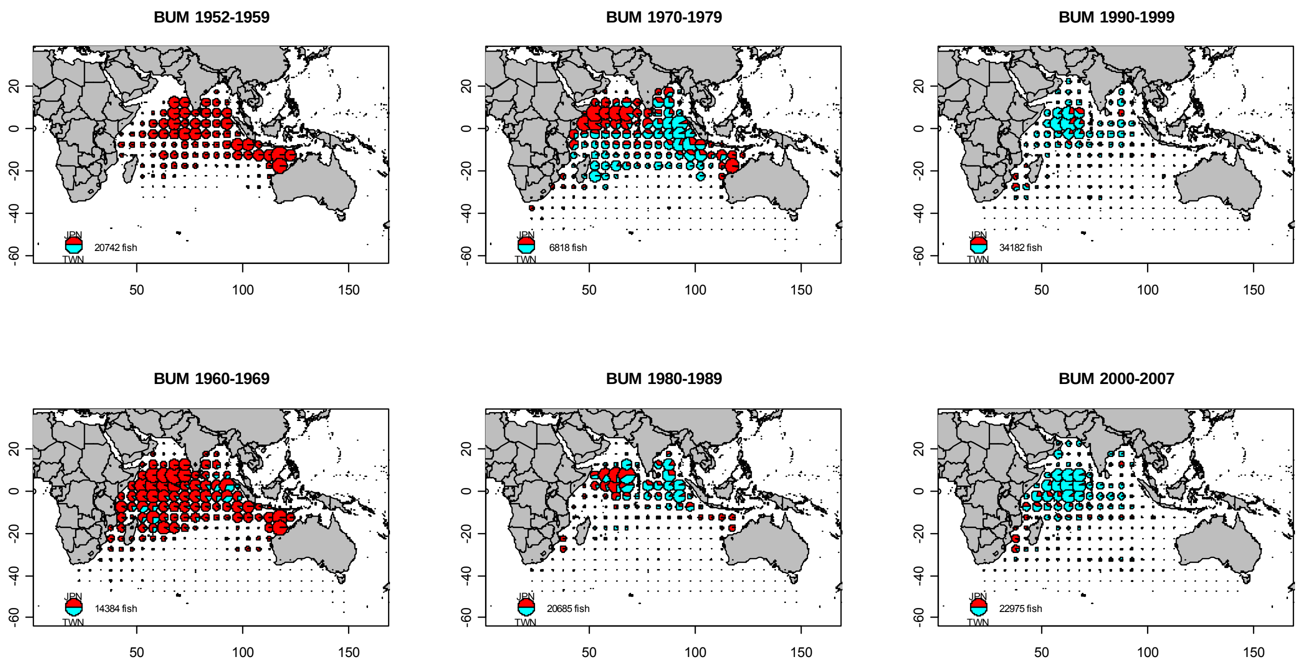


Figure 3: *Mean annual catches of blue marlin (number) by Japanese and Taiwanese longline vessels operating in the Indian Ocean over the periods 1952 to 200 per decade.*

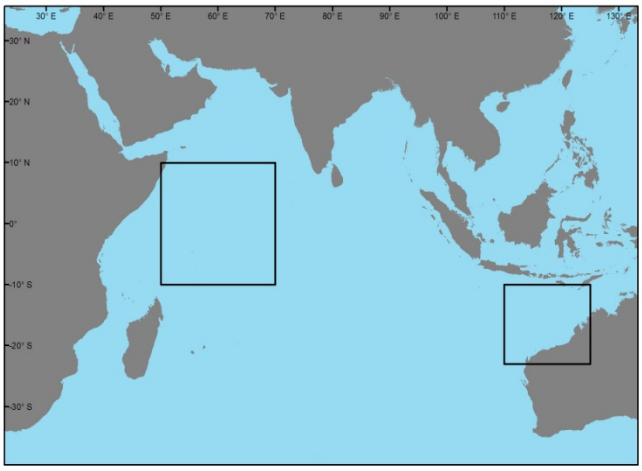
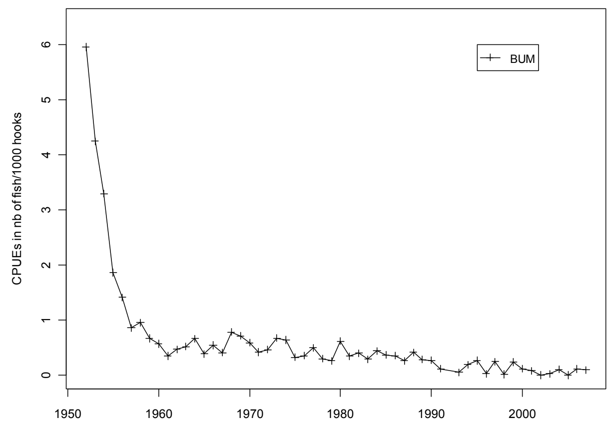


Figure 4. *Major marlin fishing areas (framed): Seychelles and NW Australia.*

(a)



(b)

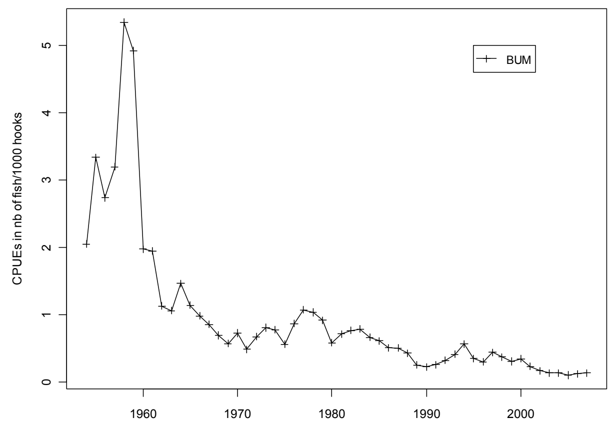


Figure 5. *(a) nominal yearly CPUE (in numbers of fishes / 1000 hooks) of Japanese longliners in the North West Australia area (10-20°S,110-120°E) for blue marlin (BUM), striped marlin (MLS) and black marlin (BLM) (b) nominal yearly CPUE (in numbers of fishes / 1000 hooks) of Japanese longliners in the area around Seychelles Islands (10°N-10°S,50-70°E).*

EXECUTIVE SUMMARY OF THE STATUS OF THE STRIPED MARLIN

(AS ADOPTED BY THE SCIENTIFIC COMMITTEE, DECEMBER 2009)

BIOLOGY

The striped marlin (*Tetrapturus audax*) occurs in both the Pacific and Indian Oceans. Its distribution is different from other marlins in that it prefers more temperate or cooler waters and tends to be less migratory. Striped marlin is rarely found in the Atlantic Ocean. In the Indian Ocean seasonal concentrations of striped marlin occur in four main regions: off the east African coast (0º-10ºS), the south and western Arabian Sea, the Bay of Bengal, and north-western Australian waters.

Striped marlins may live up to 10 years and are relatively fast growing. The larger individuals may exceed 3 m long and 240 kg. Striped marlin is the smallest of the marlin species; but unlike the other marlin species, striped marlin males and females grow to a similar size.

Sexual maturity is attained at between 2 and 3 years of age and a large female can produce in excess of 20 million eggs. Unlike the other marlins which are serial spawners, striped marlin appear to spawn once per season

Striped marlin belong to the genus *Tetrapturus* whereas black and blue marlins belong to the genus *Makaira*. Stripped marlins can be distinguished from the blue and black marlins by a range of morphological and genetic characteristics; however, the distinction between the striped marlin and the white marlin (*T. albidus*) is apparently less clear and is the subject ongoing debate among scientists.

The stock structure of striped marlin in the Indian Oceans is uncertain.

FISHERIES

Striped marlin is caught mainly by longliners in the Indian Ocean (Figure 1). Minimum catch estimates have been derived from very small amounts of information and are therefore highly uncertain. Difficulties in the identification of marlins also contribute to the uncertainties of the information available to the Secretariat.

The minimum average annual catch estimated for the period 2004 to 2008 is around 3,100 t. The distribution of striped marlin catches has changed since the 1980's with most of the catch now taken in the western areas of the Indian Ocean (Figure 2). In recent years, the fleets of Taiwan,China (longline) and to a lesser extent Indonesia (longline) are attributed with the highest catches of striped marlin.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is limited reliable information on the catches of striped marlin and no information on the stock structure or growth and mortality of striped marlin in the Indian Ocean. For example:

1. **Trends in catches**: catch estimates for striped marlin are highly uncertain. Available catch data varied from year to year and mis-identification of marlins is probably common.
2. **Nominal CPUE Trends:** data is available from several fleets (mainly longline) and time periods but this species is not targeted therefore interpretation of catch rates may be problematic as they are likely to be affected by changes in the fisheries targeting other species.
3. **Average weight of fish in the catch:** the average weight of fish is derived from various weight and length information. The reliability of average weight estimates is reduced when relatively few fish out of the total catch are measured.
4. **Sex ratio:** such data are not available to the Secretariat
5. **Lengths of fish being caught –** fish size is derived from various length and weight information. The reliability of the size data is reduced when relatively few fish out of the total catch are measured.

No quantitative stock assessment on striped marlin in the Indian Ocean is known to exist and no such assessment has been undertaken by the IOTC Working Party on Billfish. However, a preliminary estimation of stock indicators was attempted on the longline catch and effort datasets from Japan and Taiwan,China that represent the best available information. Nominal CPUE exhibited dramatic declines since the beginning of the fishery in two major fishing grounds (West Equatorial and north-west Australia) and the catches in the initial core areas also decreased substantially (Figures 3, 4 and 5). There is considerable uncertainty about the degree to which those indicators represent abundance as factors such as changes in targeting practices, discarding practices, fishing grounds and management practices are likely to interact in the depicted trends.

Further work must be undertaken to derive some stock indicators for this species, because in the absence of a quantitative stock assessment, such indicators represent the only means to monitor the status of the stock and assess the impacts of fishing.

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for striped marlin in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used .Therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

STRIPED MARLIN SUMMARY

Management quantity	2008 Assessment	2009 assessment
Most recent catch	2,800 t (2007)	2,500 t (2008)
Mean catch over the last 5 years (2004-2008)		3,100 t
Maximum Sustainable Yield		
$F_{Current}/F_{MSY}$		
$B_{Current}/B_{MSY}$		
$SB_{Current}/SB_{MSY}$		
$B_{Current}/B_0$		
$SB_{Current}/SB_0$		
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

***Table 1**. Best scientific estimates of the catches of striped marlin (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).* *Data as of November 2009*

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Longline	China																											
	Taiwan,China	0.5	0.3	0.3	0.2	0.6	0.7	0.4	0.3	0.3	1.0	1.9	2.0	1.1	1.1	0.7	1.3	1.3	2.1	3.2	4.0	2.4	3.9	4.4	1.9	2.6	2.1	3.1
	Indonesia															0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	India																									0.0	0.0	0.0
	NEI-Deep-freezing																											0.0
	Japan	2.1	2.0	2.4	1.8	1.3	1.4	3.0	3.9	4.2	2.3	2.2	1.6	1.0	0.8	0.5	1.4	0.9	0.5	0.5	1.8	1.1	1.1	0.9	0.6	0.6	1.0	1.0
	Seychelles																									0.0	0.0	0.0
	Korea, Republic of							0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.4	0.5	1.0	0.6	0.6	0.8	1.0	0.9	0.8	0.7	0.7	0.7	0.7	0.7
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*2.5*	*2.3*	*2.7*	*2.0*	*1.8*	*2.1*	*3.5*	*4.2*	*4.6*	*3.4*	*4.2*	*3.9*	*2.5*	*2.3*	*1.8*	*3.6*	*2.9*	*3.2*	*4.6*	*6.9*	*4.5*	*5.9*	*6.0*	*3.2*	*3.9*	*3.8*	*4.8*
Other gears	Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
All	*Total*	*2.5*	*2.3*	*2.7*	*2.0*	*1.8*	*2.1*	*3.5*	*4.2*	*4.6*	*3.4*	*4.2*	*3.9*	*2.5*	*2.3*	*1.8*	*3.6*	*2.9*	*3.2*	*4.6*	*6.9*	*4.5*	*5.9*	*6.0*	*3.2*	*3.9*	*3.8*	*4.8*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Longline	China																									
	Taiwan,China	1.7	2.1	4.8	4.4	3.0	2.7	1.0	2.3	2.1	5.2	3.1	3.8	3.0	2.4	2.5	2.0	1.8	2.1	2.0	2.2	2.5	1.8	1.8	1.4	1.2
	Indonesia	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.2
	India	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.3	0.3
	NEI-Fresh Tuna	0.2	0.1				0.3	0.5	0.4	0.5	0.5	0.7	0.5	0.6	0.7	0.6	0.5	0.5	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2
	NEI-Deep-freezing	0.1	0.2	0.3	0.2	0.4	0.4	0.2	0.4	0.3	1.4	0.9	1.1	1.3	0.8	1.2	0.9	0.7	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1
	Japan	0.1	0.9	1.0	0.7	0.3	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.3	0.4	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
	Seychelles	0.1	0.0										0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
	China	0.1	0.0										0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.0
	Korea, Republic of	0.1	0.4	1.1	1.0	1.0	0.8	0.7	0.2	0.4	0.4	0.4	0.4	0.6	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1
	France-Reunion	0.0	0.0						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Fleets	0.1	0.1	0.0	0.0	0.0	0.2	0.1	0.3	0.3	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Total	*3.0*	*4.0*	*7.2*	*6.3*	*4.7*	*4.6*	*2.6*	*3.8*	*3.8*	*7.8*	*5.5*	*6.3*	*6.1*	*4.8*	*5.3*	*4.3*	*3.9*	*3.1*	*3.1*	*3.1*	*3.7*	*3.0*	*3.2*	*2.7*	*2.4*
Other gears	Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
	Other Fleets	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Total	*0.1*	*0.0*	*0.0*	*0.1*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
All	*Total*	*3.1*	*4.0*	*7.2*	*6.4*	*4.8*	*4.6*	*2.7*	*3.9*	*3.8*	*7.9*	*5.6*	*6.4*	*6.2*	*4.9*	*5.3*	*4.4*	*4.0*	*3.2*	*3.2*	*3.2*	*3.8*	*3.1*	*3.3*	*2.8*	*2.5*

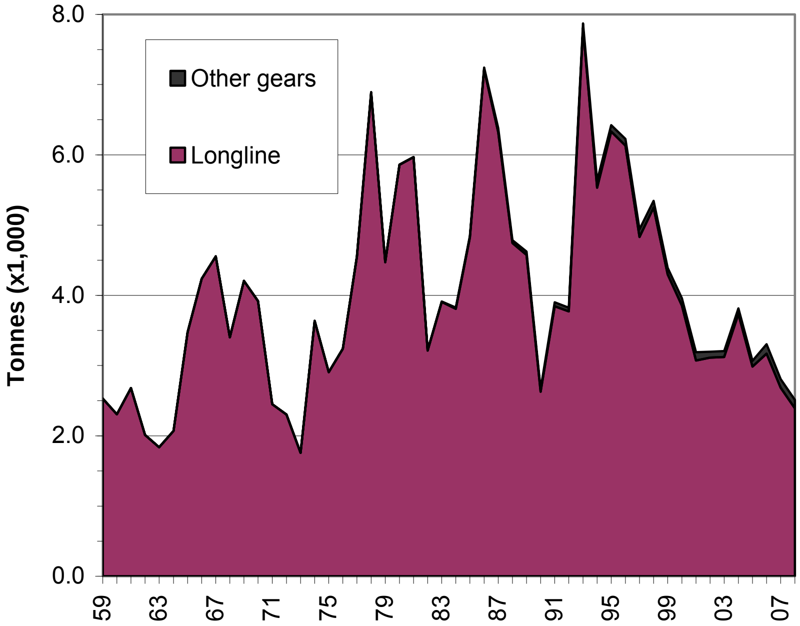


Figure 1: *Estimated catches of striped marlin by gear recorded in the IOTC Database (1959-2008). Note, these are minimum catch estimates as they are derived from IOTC fleets only and the levels of catch by other fleets are unknown*

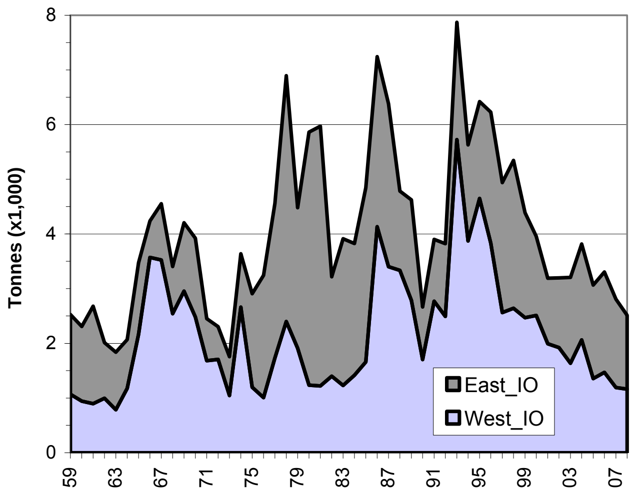


Figure 2. *Trends of the Striped marlin catches in the western and the eastern area of the Indian Ocean from 1959 – 2008. Data as of November 2009*

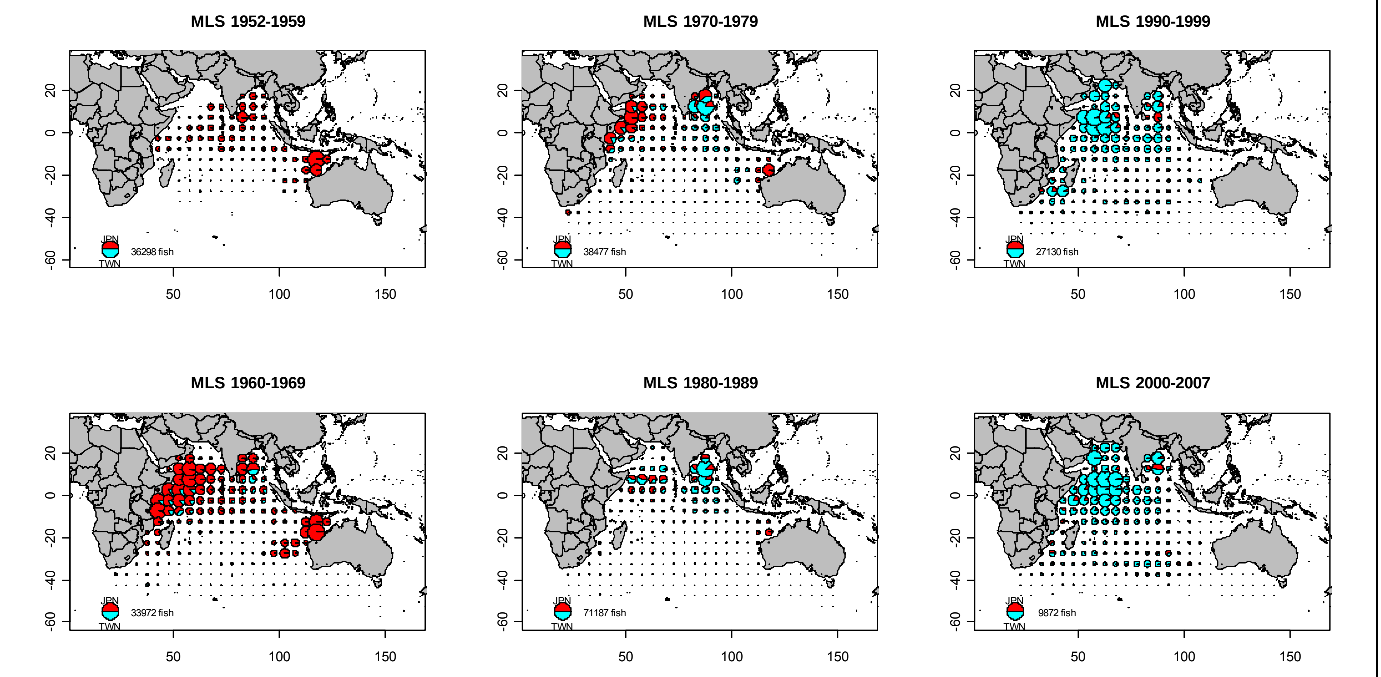


Figure 3: *Total annual catches of striped marlin (number) by Japanese and Taiwanese longline vessels operating in the Indian Ocean over the periods 1952 to 2007 per decade.*

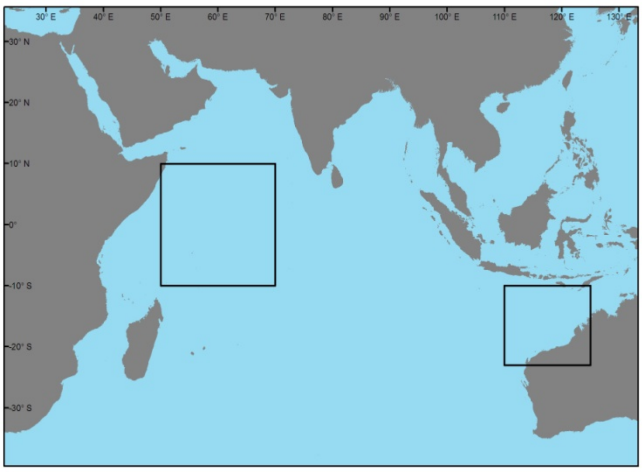


Figure 4. *Major marlin fishing areas (framed): Seychelles and NW Australia.*

(a) (b)

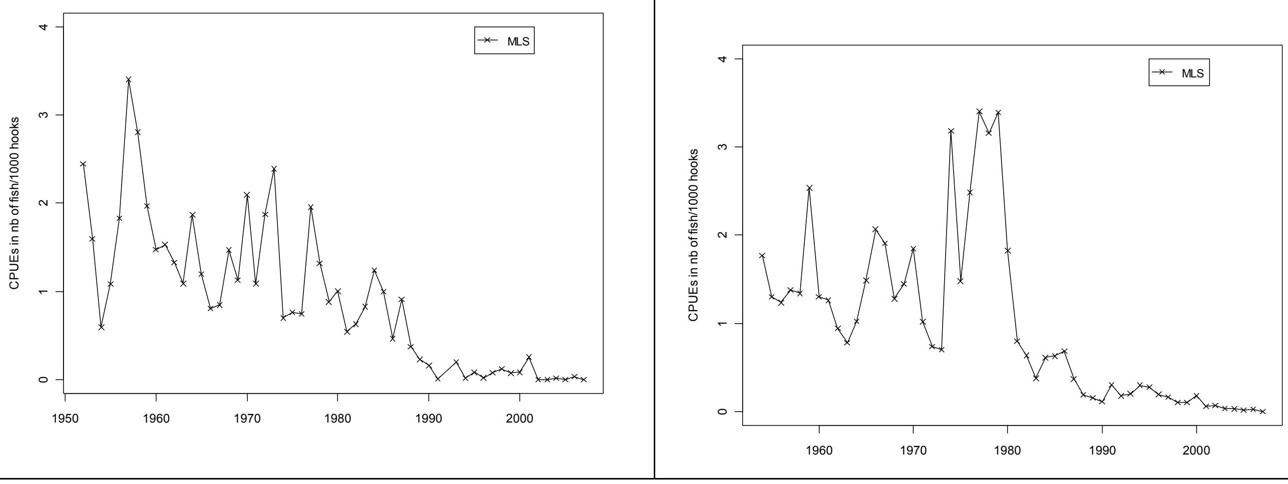


Figure 3. *(a) nominal yearly CPUE (in numbers of fishes / 1000 hooks) of Japanese longliners in the North West Australia area (10-20°S,110-120°E) for blue marlin (BUM), striped marlin (MLS) and black marlin (BLM) (b) nominal yearly CPUE (in numbers of fishes / 1000 hooks) of Japanese longliners in the area around Seychelles Islands (10°N-10°S,50-70°E).*

EXECUTIVE SUMMARY OF THE STATUS OF THE INDO-PACIFIC SAILFISH

(AS ADOPTED BY THE SCIENTIFIC COMMITTEE, DECEMBER 2009)

BIOLOGY

Indo-Pacific sailfish[4] (*Istiophorus platypterus*) is found throughout the tropical and subtropical regions of the Pacific and the Indian Oceans. It is mainly found in surface waters above the thermocline, close to coasts and islands. Indo–Pacific sailfish is a highly migratory species and renowned for its speed and (by recreational fishers) for its jumping behaviour — one individual has been reported swimming at speeds in excess of 110 km/h over short periods.

In the Indian Ocean, some sailfish make regular seasonal migrations to Arabian Gulf waters, aggregating around October to April each year before moving northwest into Iranian waters. It is not known, however, where the population goes over the period from July to September.

The Indo-Pacific sailfish is one of the smallest-sized billfish species, but is relatively fast growing. Individuals may grow to over 3 m and up to 100kg, and live to around 7 years.

The stock structure of Indo-Pacific sailfish in the Indian Oceans is uncertain.

FISHERIES

Indo-Pacific sailfish is caught mainly by gillnets and to a much lesser extent by troll and handlines, and longlines. This species is also a popular catch for sport fisheries, *e.g.* off Kenya.

Minimum catch estimates have been derived from very small amounts of information and are therefore highly uncertain. Unlike the other billfish, sailfish are probably more reliably identified because of the large and distinctive first dorsal fin that runs most of the length of the body.

The minimum average annual catch estimated for the period 2004 to 2008 is around 24,500 t (Figure 1, 2). In recent years, the countries attributed with the highest catches of Indo-Pacific sailfish are situated in the Arabian Sea and are Iran, Sri Lanka, India and Pakistan. Smaller catches are reported for line fishers in Comores and Mauritius and by Indonesia longliners.

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is no information on the stock structure of Indo-Pacific sailfish in the Indian Ocean, and no information on age and growth information in the Indian Ocean. Possible fishery indicators:

1. **Trends in catches**: catch estimates for Indo-Pacific sailfish are highly uncertain and there is little information available for the years prior to 1970. However, catches appear to have been rapidly increasing since the mid 1980's.
2. **Nominal CPUE Trends:** few data are available, furthermore this species is not generally targeted therefore interpretation of catch rates may be problematic as they are likely to be affected by changes in the fisheries targeting other species.
3. **Average weight in the catch by fisheries:** few data are available to the Secretariat.
4. **Sex ratio:** such data are not available to the Secretariat
5. **Number of squares fished:** such data are not available to the Secretariat.

No quantitative stock assessment on Indo-Pacific sailfish in the Indian Ocean is known to exist and no such assessment has been undertaken by the IOTC Working Party on Billfish.

[4] There is some debate on whether there is a single worldwide sailfish species, *I. Platypterus*; or two species, being an Indo–Pacific sailfish (*I. platypterus*) and an Atlantic species *I. albicans*.

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for Indo-Pacific sailfish in the Indian Ocean, and due to a paucity of data there a no stock indicators that are considered to be reliable, therefore the stock status is uncertain. However, aspects of the biology, productivity and fisheries for this species combined with the lack of data on which to base a more formal assessment is a cause for considerable concern. Research emphasis on improving indicators and exploration of stock assessment approaches for data poor fisheries are warranted.

Management quantity	2008 Assessment	2009 assessment
Most recent catch	20,000 t (2007)	20,100 t (2008)
Mean catch over the last 5 years (2004-2008)		24,500 t
Maximum Sustainable Yield		
$F_{Current}/F_{MSY}$		
$B_{Current}/B_{MSY}$		
$SB_{Current}/SB_{MSY}$		
$B_{Current}/B_0$		
$SB_{Current}/SB_0$		
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

***Table 1**. Best scientific estimates of the catches of Indo-Pacific Sailfish (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).* *Data as of November 2009*

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Longline	Indonesia															0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Japan	0.7	1.0	0.9	0.8	0.7	0.7	0.7	0.8	0.9	0.9	0.7	0.4	0.6	0.4	0.2	0.2	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1
	Korea, Republic of							0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	Total	*0.7*	*1.0*	*0.9*	*0.8*	*0.7*	*0.7*	*0.7*	*0.8*	*0.9*	*1.0*	*0.7*	*0.5*	*0.7*	*0.5*	*0.3*	*0.4*	*0.5*	*0.5*	*0.3*	*0.3*	*0.3*	*0.4*	*0.3*	*0.3*	*0.3*	*0.2*	*0.3*
Gillnet	Iran, Islamic Republic																							0.0				0.0
	India																						0.5	0.3	1.0	0.5	0.6	0.4
	Pakistan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.8	0.1	0.2	0.2	0.1	1.4
	Tanzania												0.1		0.0		0.1	0.1	0.1	0.1	0.1	0.2	0.0	0.2	0.5	0.2	0.2	0.2
	Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Oman	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2
	United Arab Emirates																									0.1	0.1	0.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.1	0.1
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.0*	*0.1*	*0.0*	*0.2*	*0.2*	*0.3*	*0.4*	*0.4*	*1.7*	*1.6*	*1.0*	*2.0*	*1.3*	*1.4*	*2.5*
Line	India																						0.2	0.1	0.2	0.2	0.2	0.1
	Mauritius																										0.0	0.1
	Oman	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1
	Sri Lanka	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.4	0.4
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.2*	*0.4*	*0.3*	*0.9*	*0.8*	*0.8*	*0.8*
Other gears	*Total*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*	*0.2*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.0*	*0.1*	*0.1*
All	*Total*	*0.7*	*1.0*	*1.0*	*0.9*	*0.8*	*0.8*	*0.8*	*0.9*	*1.0*	*1.1*	*0.8*	*0.8*	*0.8*	*0.7*	*0.4*	*0.9*	*0.9*	*1.0*	*1.0*	*1.0*	*2.3*	*2.5*	*1.7*	*3.3*	*2.4*	*2.6*	*3.7*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Longline	NEI-Fresh Tuna	0.4	0.1				0.1	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.2	0.2	0.0	0.2	0.3	0.3	0.4	0.4	0.5	0.5
	Indonesia	0.4	0.2	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.5	0.6	0.6	0.7	0.4	0.3	0.5	1.3	0.2	0.3	0.1	0.7	0.5
	Japan	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.4	0.5	0.5
	Korea, Republic of	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.0	0.1	0.0			0.0	0.0							0.0			0.0	0.0
	Pakistan	0.0	0.1						0.7	1.0	0.7	0.9	0.9	1.0	0.0	0.0	0.0									
	Other Fleets	0.4	0.1	0.1	0.0	0.1	0.3	0.2	0.3	0.3	0.3	0.3	0.2	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.3	0.5	0.4	0.5	0.6
	Total	*1.6*	*0.9*	*0.4*	*0.3*	*0.3*	*0.7*	*0.7*	*1.4*	*1.8*	*1.5*	*1.8*	*1.7*	*1.9*	*1.3*	*1.2*	*1.2*	*0.9*	*0.8*	*1.1*	*2.0*	*0.9*	*1.4*	*1.4*	*2.2*	*2.0*
Gillnet	Iran, Islamic Republic	9.4	1.6	0.0	0.0				0.2	0.2	0.7	1.1	3.6	2.3	2.3	1.8	3.2	3.1	3.2	4.3	7.3	12.1	12.6	10.6	6.2	5.6
	Sri Lanka	4.3	1.1	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.7	1.8	1.3	2.0	2.7	1.9	3.6	5.7	3.9	4.6	4.8	9.0	4.0	4.3	2.3	2.1
	India	3.2	0.9	0.5	0.4	0.4	0.5	0.5	0.7	1.1	1.3	1.1	0.9	2.5	2.8	2.1	1.9	2.3	2.8	2.6	2.9	2.7	2.3	5.0	2.4	3.4
	Pakistan	2.0	0.9	0.6	0.6	1.1	1.9	1.7	2.0	1.7	1.9	2.4	2.3	2.3	1.9	2.0	2.1	2.0	1.0	0.7	0.7	0.7	2.3	2.3	2.5	2.5
	Tanzania	0.6	0.3	0.3	0.1	0.3	0.3	0.4	0.2	0.2	0.4	0.6	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.7	0.7	0.7	0.7
	Indonesia	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.6	0.6
	Oman	0.1	0.2	0.2	0.4	0.8	0.4	0.4	0.1	0.4	0.3	0.1	0.3	0.4	0.6	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3
	United Arab Emirates	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1
	Other Fleets	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Total	*20.4*	*5.2*	*1.9*	*1.8*	*2.9*	*3.5*	*3.5*	*3.9*	*4.5*	*5.8*	*7.6*	*9.4*	*10.5*	*11.5*	*9.4*	*12.2*	*14.4*	*12.2*	*13.3*	*16.9*	*25.6*	*22.5*	*23.7*	*14.8*	*15.3*
Line	India	0.9	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.2	0.5	0.6	0.4	0.4	0.5	0.6	0.6	0.6	0.6	0.6	1.3	1.2	0.9
	Yemen	0.5	0.0																				0.6	0.6	0.6	0.6
	Comoros	0.4	0.2				0.7	0.7	0.7	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5
	Mauritius	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.6	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	Oman	0.1	0.1	0.1	0.2	0.4	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2
	Sri Lanka	0.0	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.3	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Fleets	0.4	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.4	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4
	Total	*2.6*	*1.0*	*0.9*	*0.9*	*1.3*	*1.7*	*1.7*	*1.8*	*1.7*	*1.7*	*1.7*	*1.6*	*1.9*	*2.4*	*1.7*	*1.5*	*1.7*	*1.6*	*1.5*	*1.7*	*1.7*	*2.3*	*3.1*	*2.9*	*2.8*
Other gears	*Total*	*0.0*	*0.1*	*0.1*	*0.1*	*0.3*	*0.1*	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
All	*Total*	*24.5*	*7.1*	*3.3*	*3.2*	*4.8*	*6.0*	*6.0*	*7.0*	*8.0*	*9.0*	*11.1*	*12.8*	*14.4*	*15.2*	*12.4*	*15.0*	*17.0*	*14.7*	*16.0*	*20.7*	*28.2*	*26.2*	*28.2*	*20.0*	*20.1*

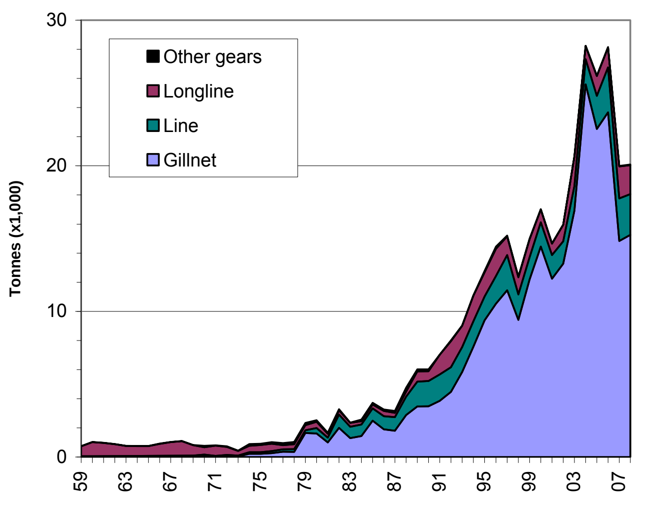


Figure 1. *Estimated catches of Indo-Pacific sailfish by gear recorded in the IOTC Database (1959-2008).*

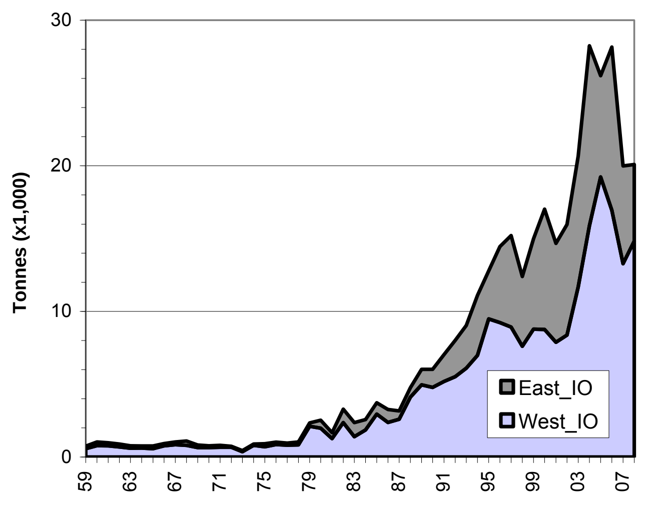


Figure 2. *Trends of the Indo-Pacific sailfish catches in the western and the eastern area of the Indian Ocean from 1959 – 2008. Data as of November 2009*

EXECUTIVE SUMMARY OF THE STATUS OF THE BULLET TUNA RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

BIOLOGY

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

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

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

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

FISHERIES

Bullet tuna is caught mainly by gillnet and line across the broader Indian Ocean area (Figure 1). This species is also an important catch for artisanal purse seiners. The catch estimates for bullet tuna were derived from very small amounts of information and are therefore highly uncertain[5] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. Estimated catches of bullet tuna reached around 1,000 t in the early 1990's and peaked at 6,400 t in 2007. The average annual catch estimated for the period 2004 to 2008 is 3,500 t. In recent years, the countries attributed with the highest catches of bullet tuna are India, Indonesia and Sri Lanka (Table 1).

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

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

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

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

Possible fishery indicators:

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

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

STOCK ASSESSMENT

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

MANAGEMENT ADVICE

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

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

The SC **recommended** that bullet tuna be reviewed at the first meeting of the IOTC Working Party on NeriticTunas.

BULLET TUNA SUMMARY

Management quantity	2008 assessment	2009 assessment
Most recent catch	6,400 t (2007)	3,700 t (2008)*
Mean catch over the last 5 years (2004-2008)		3,500 t
Maximum Sustainable Yield		
$F_{Current}/F_{MSY}$		
$B_{Current}/B_{MSY}$ (1)		
$SB_{Current}/SB_{MSY}$ (2)		
$B_{Current}/B_0$ (1)		
$SB_{Current}/SB_0$ (2)		
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

* Preliminary catch estimates

Table 1. *Best scientific estimates of the catches of bullet tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).*
Data as of November 2009

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Gillnet	India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.0*	*0.1*
Line	India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.1*	*0.0*	*0.0*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Other gears	India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
All	*Total*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.1*	*0.2*	*0.2*	*0.2*	*0.3*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Gillnet	Sri Lanka	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.5	0.5	0.8	1.2	1.1	0.3	0.3	0.1	0.9	0.2	0.7	0.3	0.9	1.2	0.8
	India	0.4	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.2	0.1	0.2	0.1	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.4		1.1	0.4	0.6	0.1
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*1.2*	*0.3*	*0.2*	*0.1*	*0.1*	*0.2*	*0.2*	*0.3*	*0.3*	*0.2*	*0.7*	*0.6*	*1.1*	*1.4*	*1.4*	*0.6*	*0.6*	*0.3*	*1.2*	*0.6*	*0.7*	*1.4*	*1.3*	*1.8*	*0.9*
Line	India	2.1	0.4	0.4	0.2	0.3	0.3	0.3	0.3	0.4	0.2	0.5	0.3	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.8	0.5	1.2	1.7	4.5	2.6
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*2.1*	*0.4*	*0.4*	*0.2*	*0.3*	*0.3*	*0.3*	*0.3*	*0.4*	*0.3*	*0.5*	*0.3*	*0.5*	*0.5*	*0.5*	*0.4*	*0.5*	*0.5*	*0.6*	*0.8*	*0.6*	*1.2*	*1.7*	*4.5*	*2.6*
Other gears	India	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.2	0.1	0.3	0.1	0.2
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.2*	*0.3*	*0.2*	*0.1*	*0.3*	*0.1*	*0.2*
All	*Total*	*3.5*	*0.8*	*0.7*	*0.4*	*0.5*	*0.6*	*0.6*	*0.7*	*0.8*	*0.6*	*1.4*	*1.0*	*1.8*	*2.0*	*2.0*	*1.1*	*1.2*	*1.0*	*1.9*	*1.7*	*1.5*	*2.7*	*3.4*	*6.4*	*3.7*

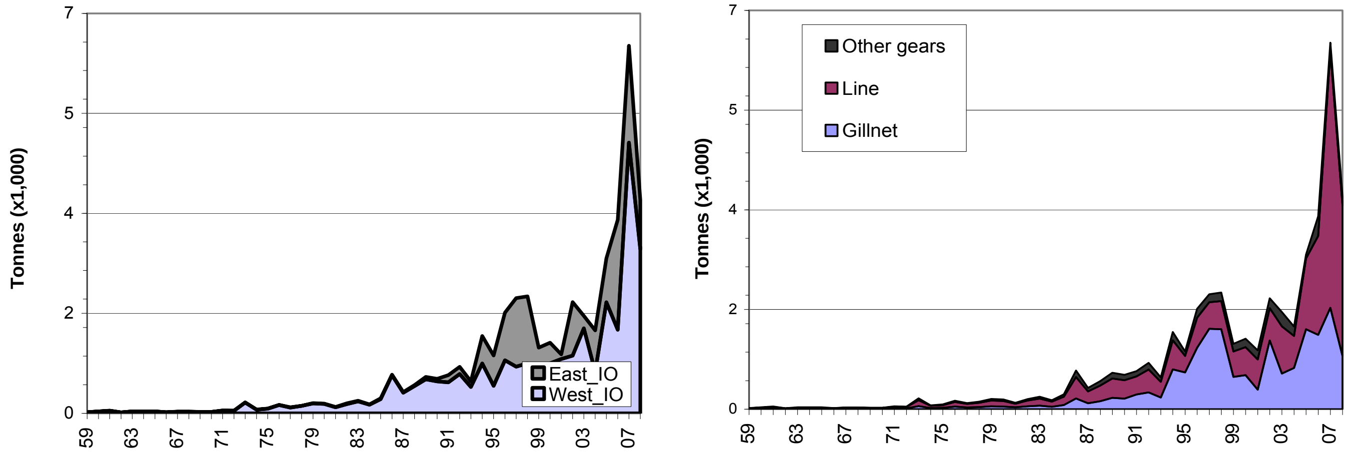


Figure 1*. Bullet tuna: annual catches from 1959 to 2008 by area (left) and gear (right).* *Data as per November 2009*

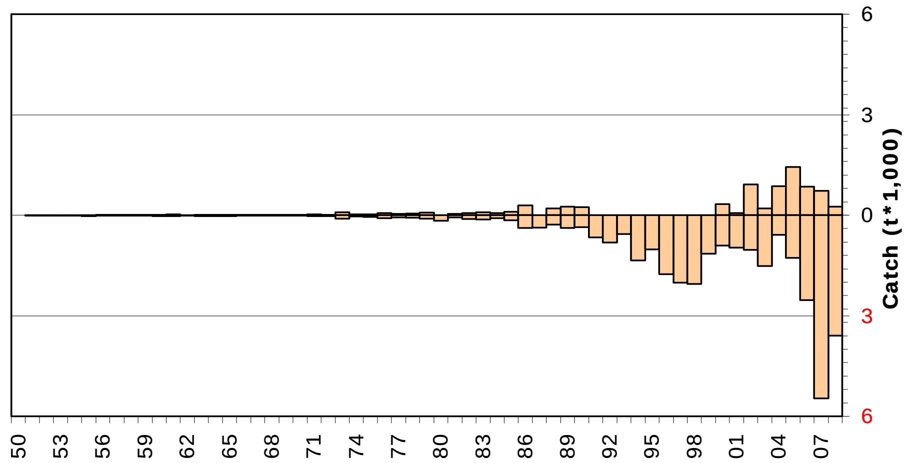


Figure 2*. Bullet tuna: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text.*

EXECUTIVE SUMMARY OF THE STATUS OF THE FRIGATE TUNA RESOURCE

(*AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009*)

BIOLOGY

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

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

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

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

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

FISHERIES

Frigate tuna is taken from across the Indian Ocean area using gillnets, bait boats and lines (Figure 1). This species is also an important catch for industrial purse seiners. The catch estimates for frigate tuna were derived from very small amounts of information and are therefore highly uncertain[6] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. Estimated catches have increased steadily since the late 1970's, reaching around 10,000 t in the early 1980's and over 30,000 t by the mid-1990's. The average annual catch estimated for the period 2004 to 2008 is 32,500 t. In recent years, the countries attributed with the highest catches are India, Indonesia, Maldives and Iran and Sri Lanka (Table 1).

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

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

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

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

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for frigate tuna are highly uncertain. Catches fluctuate from year to year but have been steadily increasing since the mid 1950's.

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

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

STOCK ASSESSMENT

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

MANAGEMENT ADVICE

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

This species is a relatively productive species with high fecundity and rapid growth and this makes it relatively resilient and not prone to overfishing. Nevertheless, frigate tuna appears to be an important prey species for other pelagic species including the commercial tunas.

The SC **recommended** that frigate tuna be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

FRIGATE TUNA SUMMARY

Management quantity	2008 assessment	2009 assessment
Most recent catch	31,800 t (2007)	33,900 t (2008)*
Mean catch over the last 5 years (2004-2008)		32,500 t
Maximum Sustainable Yield		
$F_{Current}/F_{MSY}$		
$B_{Current}/B_{MSY}$ (1)		
$SB_{Current}/SB_{MSY}$ (2)		
$B_{Current}/B_0$ (1)		
$SB_{Current}/SB_0$ (2)		
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

* Preliminary catch estimates

Table 1. *Best scientific estimates of the catches of frigate tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).*
(Data as of November 2009)

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Baitboat	Maldives	0.9	0.9	1.4	1.4	1.4	1.4	2.3	2.8	2.8	2.8	2.8	1.7	1.7	1.8	3.9	3.5	2.3	1.5	1.8	0.9	0.9	0.8	0.8	1.2	2.0	1.7	1.3
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
	Total	*0.9*	*0.9*	*1.4*	*1.4*	*1.4*	*1.4*	*2.3*	*2.8*	*2.8*	*2.8*	*2.8*	*1.7*	*1.7*	*1.8*	*3.9*	*3.5*	*2.4*	*1.5*	*1.8*	*0.9*	*0.9*	*0.8*	*0.8*	*1.2*	*2.0*	*1.8*	*1.3*
Gillnet	India	0.2	0.3	0.5	0.1	0.3	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	1.6	0.4	0.6	0.9	0.6	0.9	1.2	1.1	0.7	1.1	1.5	1.0	1.7
	Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.3	0.1	0.0	0.1
	UAE																0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.0	0.4	0.4	0.4
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.3	0.3
	Total	*0.2*	*0.4*	*0.5*	*0.2*	*0.3*	*0.4*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.2*	*0.4*	*0.4*	*1.7*	*0.7*	*0.9*	*1.3*	*1.1*	*1.2*	*1.6*	*1.5*	*1.2*	*2.6*	*2.2*	*1.8*	*2.5*
Line	India	0.1	0.2	0.3	0.1	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.9	0.2	0.3	0.5	0.3	0.5	0.6	0.6	0.3	0.5	0.8	0.5	0.9
	Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	Maldives	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.3
	Sri Lanka	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.7	0.7	0.5	0.6
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
	Total	*0.2*	*0.3*	*0.4*	*0.2*	*0.3*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*0.4*	*0.3*	*0.3*	*0.3*	*1.0*	*0.5*	*0.5*	*0.8*	*0.7*	*0.8*	*1.0*	*1.0*	*0.9*	*1.6*	*1.8*	*1.5*	*2.1*
Other gears	Indonesia	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	1.0	2.2	0.7	1.5	1.2	1.6	3.2	1.4	0.5	1.8
	India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2
	Thailand												0.2	0.5	0.4	0.7	0.5	1.2	0.8	0.7	0.9	0.1	0.0	0.1	1.3	0.5	0.6	1.7
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.3	0.2	0.1	0.2	0.3	0.4
	Total	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.7*	*0.8*	*0.8*	*1.2*	*1.0*	*1.7*	*2.0*	*3.1*	*1.9*	*1.9*	*1.7*	*1.9*	*4.8*	*2.3*	*1.6*	*4.1*
All	Total	*1.5*	*1.8*	*2.5*	*2.0*	*2.3*	*2.5*	*3.3*	*3.7*	*3.8*	*3.7*	*3.7*	*2.9*	*3.2*	*3.4*	*7.8*	*5.7*	*5.5*	*5.7*	*6.7*	*4.8*	*5.4*	*5.1*	*4.9*	*10.2*	*8.3*	*6.6*	*10.0*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Baitboat	Maldives	3.7	2.5	0.8	1.0	1.4	1.9	3.0	2.3	3.1	5.0	3.8	3.7	6.1	2.3	3.8	3.1	3.7	3.7	3.9	4.1	3.3	4.6	3.2	3.5	3.8
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
	Total	*3.7*	*2.5*	*0.9*	*1.0*	*1.5*	*2.0*	*3.1*	*2.3*	*3.2*	*5.1*	*3.8*	*3.7*	*6.1*	*2.3*	*3.9*	*3.1*	*3.7*	*3.7*	*3.9*	*4.2*	*3.3*	*4.6*	*3.3*	*3.6*	*3.9*
Gillnet	India	4.8	2.7	4.8	2.5	3.4	4.2	4.0	3.9	4.9	3.3	6.1	3.4	6.6	5.8	6.3	5.7	6.2	6.8	7.2	10.1	8.0	2.7	9.1	1.8	2.5
	Iran, Islamic R.	3.6	0.6	0.3	0.4	0.3	0.2	0.1	0.5	0.3	0.4	0.2	4.4	0.7	0.6	0.5	0.6	0.8	0.6	0.6	1.1	1.5	1.6	2.4	5.2	7.2
	Sri Lanka	1.0	0.6	0.0	0.0	0.0	0.3	0.3	0.2	0.4	1.2	1.7	1.7	2.7	3.9	3.8	1.8	0.6	0.9	2.7	2.1	1.7	1.0	0.7	1.0	0.7
	Indonesia	0.8	0.3	0.0	0.1	0.2	0.1	0.2	0.3	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.5	0.6	0.6	0.6	0.9	0.8	0.8	0.8
	UAE	0.2	0.3	0.5	0.5	0.5	0.5	0.6	0.5	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
	Other Fleets	0.4	0.3	0.2	0.4	0.5	0.7	0.5	0.2	0.3	0.3	0.3	0.6	0.6	0.8	0.6	0.6	0.5	0.6	0.3	0.3	0.4	0.4	0.4	0.4	0.4
	Total	*10.8*	*4.7*	*5.8*	*3.9*	*5.0*	*6.0*	*5.6*	*5.6*	*6.8*	*6.2*	*9.5*	*11.2*	*11.7*	*12.2*	*12.3*	*9.9*	*9.1*	*9.8*	*11.7*	*14.5*	*12.3*	*6.8*	*13.6*	*9.5*	*11.7*
Line	India	2.6	1.4	2.4	1.3	1.7	2.1	2.0	2.0	2.5	1.7	3.1	1.7	3.4	3.0	3.2	2.9	3.1	3.4	3.7	4.9	4.4	0.8	6.9	0.5	0.3
	Indonesia	0.4	0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.8	0.1	0.5	0.5
	Maldives	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.5	0.3	0.3	0.4	0.2	0.4	0.3	0.3	0.3	0.3	0.2	0.3	0.4	0.3	0.3	0.2
	Sri Lanka	0.0	0.3	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.1	1.1	1.0	0.8	0.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other Fleets	0.2	0.1	0.2	0.2	0.3	0.4	0.3	0.2	0.2	0.3	0.4	0.4	0.2	0.4	0.3	0.3	0.3	0.3	0.2	0.1	0.2	0.2	0.2	0.2	0.2
	Total	*3.5*	*2.2*	*3.5*	*2.4*	*3.1*	*3.6*	*3.7*	*3.7*	*4.4*	*3.8*	*5.2*	*3.7*	*5.1*	*4.5*	*4.6*	*3.8*	*4.1*	*4.4*	*4.4*	*5.6*	*5.2*	*2.2*	*7.4*	*1.5*	*1.2*
Other gears	Indonesia	10.3	3.4	0.4	0.8	2.7	1.6	2.7	4.4	4.6	6.0	7.3	7.1	7.6	7.8	7.5	8.1	8.6	7.0	7.6	7.8	7.8	10.1	11.4	11.0	11.0
	India	1.6	0.4	0.6	0.3	0.4	0.5	0.5	0.5	0.6	0.4	0.7	0.4	0.8	0.7	0.8	0.7	0.8	0.8	0.9	1.3	0.8	0.1	0.2	3.6	3.5
	Thailand	1.5	0.8	0.8	7.5	1.4	1.1	0.9	0.9	1.2	1.2	0.9	1.4	0.9	0.9	0.6	0.4	1.0	1.0	0.8	1.1	1.1	1.6	1.5	1.6	1.5
	Sri Lanka	0.7	0.3		0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.6	0.6	0.7	0.8	1.0	1.0	0.9	1.0	0.9	0.9	0.4	0.7	0.8	0.9
	Other Fleets	0.4	0.2	0.4	0.4	0.1	0.4	0.1	0.1	0.0	0.0	0.0	0.1	1.4	0.2	0.0	0.0	0.9	0.5	1.1	0.4	0.4	0.7	0.7	0.2	0.2
	Total	*14.5*	*5.2*	*2.2*	*8.9*	*4.7*	*3.7*	*4.4*	*6.0*	*6.8*	*7.9*	*9.4*	*9.6*	*11.3*	*10.3*	*9.7*	*10.2*	*12.2*	*10.3*	*11.3*	*11.5*	*11.0*	*12.8*	*14.4*	*17.3*	*17.2*
All	*Total*	*32.5*	*14.6*	*12.4*	*16.2*	*14.2*	*15.3*	*16.7*	*17.7*	*21.1*	*23.0*	*27.9*	*28.2*	*34.3*	*29.3*	*30.5*	*27.1*	*29.2*	*28.2*	*31.4*	*35.8*	*31.9*	*26.3*	*38.8*	*31.8*	*33.9*

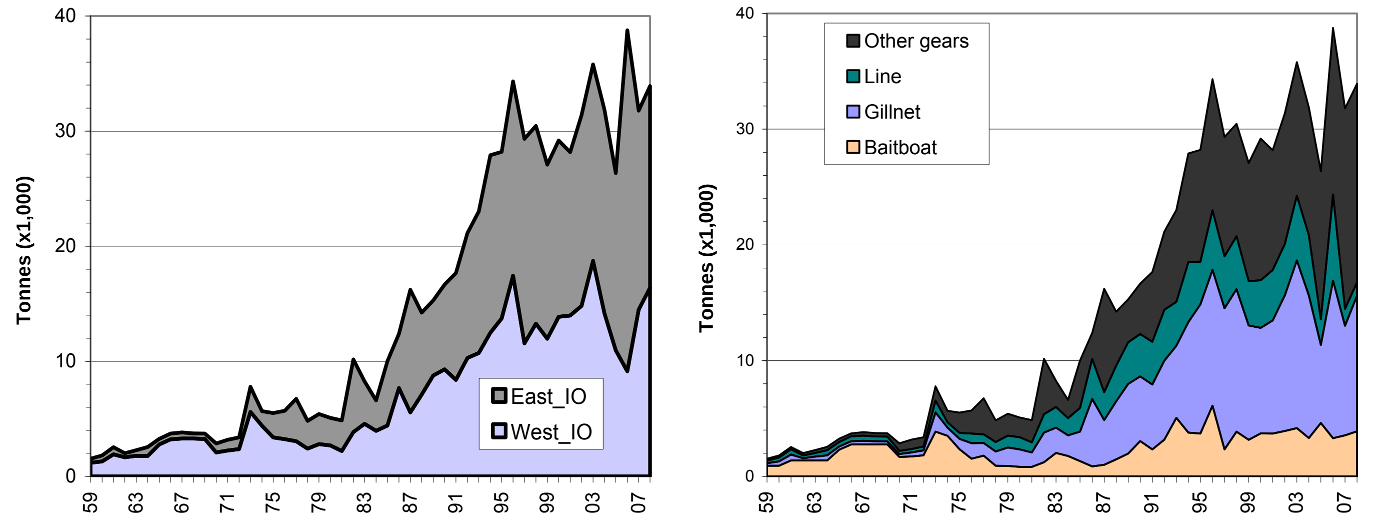


Figure 1*. Frigate tuna: annual catches from 1959 to 2008 by area (left) and gear (right).* *Data as per November 2009*

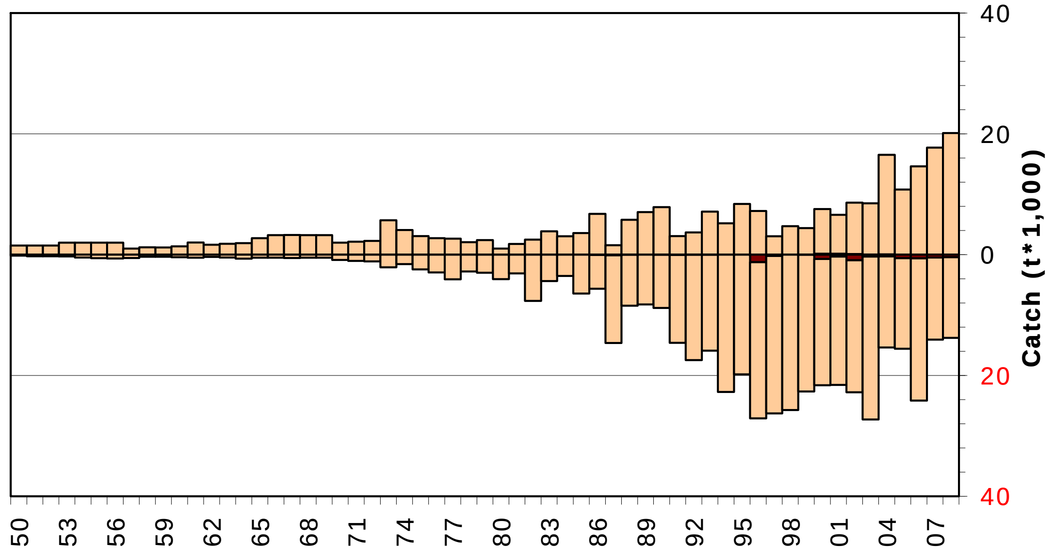


Figure 2*. Frigate tuna: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text. Dark sections represent estimates of catches by industrial fleets.*

EXECUTIVE SUMMARY OF THE STATUS OF THE INDO-PACIFIC KING MACKEREL RESOURCE

(*AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009*)

BIOLOGY

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

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

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

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

FISHERIES

The Indo-Pacific king mackerel is mostly caught by gillnet fisheries in the Indian Ocean (Figure 1), in particular artisanal fleets from India and more recently Indonesia (Table 1). The catch estimates for Indo-Pacific king mackerel were derived from very small amounts of information and are therefore highly uncertain[7] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. Estimated catches have increased steadily since the mid 1960's, reaching around 10,000 t in the early 1970's and over 30,000 t by 1989. The average annual catch estimated for the period 2004 to 2008 is 36,200 t. In recent years, the countries attributed with the highest catches are Indonesia, India and Iran (Table 1).

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

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

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

Possible fishery indicators:

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

---

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

STOCK ASSESSMENT

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

MANAGEMENT ADVICE

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

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

INDO-PACIFIC KING MACKEREL SUMMARY

Management quantity	2008 assessment	2009 assessment
Most recent catch	40,800 t (2007)	43,200 t (2008)*
Mean catch over the last 5 years (2004-2008)		36,200 t
Maximum Sustainable Yield		
$F_{Current}/F_{MSY}$		
$B_{Current}/B_{MSY}$ (1)		
$SB_{Current}/SB_{MSY}$ (2)		
$B_{Current}/B_0$ (1)		
$SB_{Current}/SB_0$ (2)		
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

* Preliminary catch estimates

Table 1. *Best scientific estimates of the catches of Indo-Pacific king mackerel (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).* *Data November 2009*

	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Gillnet	India	1.8	2.3	3.1	2.9	2.4	3.2	2.7	2.9	2.9	3.5	3.2	3.8	4.8	6.0	3.9	7.0	6.2	6.9	5.3	4.9	7.6	8.2	7.7	7.8	7.8	11.2	9.8
	Indonesia	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.4	0.6	0.3	0.2	0.2	0.2	0.3	0.3	0.5	0.5	0.5	0.7
	Iran, Islamic R.																								1.4	1.6	0.9	0.5
	Saudi Arabia																							0.0	0.0	0.0	0.0	0.0
	Malaysia	0.2	0.2	0.2	0.2	0.2	0.5	0.6	0.7	0.6	0.6	0.6								1.3	1.4	1.6	1.3	1.5	1.8	1.5	1.0	1.2
	Thailand												0.0		0.0	0.2	0.1	0.1	0.2	0.6	0.4	0.6	0.5	0.6	0.2	0.1	0.2	0.3
	Pakistan	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.4	0.3	0.3	0.2	0.2	0.3	0.3	0.5	0.1	0.4	0.4	0.4	0.4	0.4
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1
	Total	*2.2*	*2.7*	*3.6*	*3.5*	*3.0*	*4.1*	*3.8*	*4.2*	*4.0*	*4.7*	*4.3*	*4.3*	*5.3*	*6.8*	*4.7*	*7.7*	*7.0*	*7.6*	*7.7*	*7.2*	*10.5*	*10.3*	*10.5*	*12.2*	*12.1*	*14.1*	*13.0*
Line	Indonesia	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.5	0.3	0.2	0.2	0.2	0.2	0.3	0.5	0.5	0.4	0.7
	India	0.3	0.3	0.5	0.4	0.4	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.7	0.9	0.6	1.0	0.9	1.0	0.8	0.7	1.1	1.2	1.1	1.1	1.1	1.6	1.4
	Yemen	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.5	0.5	0.6	0.6	0.7	0.6	0.7	0.6	0.5	0.1	0.8	0.6
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.6*	*0.6*	*0.7*	*0.8*	*0.7*	*0.8*	*0.8*	*0.8*	*0.9*	*1.0*	*0.9*	*0.9*	*1.1*	*1.4*	*1.1*	*1.9*	*2.0*	*1.9*	*1.6*	*1.6*	*2.0*	*2.2*	*2.0*	*2.2*	*1.8*	*2.9*	*2.8*
Other gears	India	1.1	1.4	1.9	1.8	1.5	2.0	1.6	1.8	1.7	2.2	1.9	2.3	3.0	3.7	2.4	4.3	3.8	4.2	3.2	3.0	4.6	5.0	4.7	4.8	4.8	6.9	6.0
	Thailand												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Malaysia																				0.0	0.0	0.0		0.0	0.0	0.0	
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
	Total	*1.1*	*1.4*	*1.9*	*1.8*	*1.5*	*2.0*	*1.6*	*1.8*	*1.7*	*2.2*	*1.9*	*2.3*	*3.0*	*3.7*	*2.4*	*4.3*	*3.8*	*4.2*	*3.2*	*3.0*	*4.7*	*5.0*	*4.7*	*4.8*	*4.9*	*6.9*	*6.0*
All	*Total*	*3.8*	*4.8*	*6.2*	*6.1*	*5.2*	*6.9*	*6.2*	*6.8*	*6.6*	*7.8*	*7.1*	*7.5*	*9.4*	*11.8*	*8.1*	*13.9*	*12.8*	*13.7*	*12.5*	*11.8*	*17.2*	*17.5*	*17.2*	*19.2*	*18.8*	*23.9*	*21.8*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Gillnet	India	11.0	7.1	5.5	7.1	8.6	10.3	7.5	11.4	9.9	12.1	9.3	9.8	7.2	8.2	12.8	7.9	7.8	8.5	9.3	8.7	7.0	6.1	5.9	17.1	19.0
	Indonesia	5.4	2.3	0.7	0.8	4.8	5.9	2.8	2.4	1.0	4.6	2.9	5.5	7.1	6.1	6.1	5.8	6.0	6.8	4.9	5.4	7.3	4.9	4.9	4.9	4.9
	Iran, Islamic R.	3.8	1.4	0.5	0.7	0.7	1.7	2.3	2.5	2.2	1.6	1.6	5.4	4.3	2.3	3.9	3.5	4.1	2.5	4.0	3.7	4.3	3.1	4.0	3.7	4.0
	Saudi Arabia	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.6	1.0	1.1	1.1
	Malaysia	0.5	0.8	1.6	1.7	1.5	1.1	1.2	1.3	1.6	1.3	1.3	0.9	1.0	1.0	1.4	0.3	0.4	0.5	0.8	0.7	0.6	0.4	0.5	0.4	0.4
	Thailand	0.1	0.3	0.2	0.4	0.4	0.3	0.3	0.3	0.4	0.5	0.4	0.6	0.5	0.5	0.6	0.8	0.2	0.4	0.5	0.5	0.2	0.1	0.1	0.2	0.1
	Pakistan	0.0	0.2	0.6	0.6	0.7	0.0	0.1	0.9	0.0					0.1	0.1	0.4	0.3	0.2							
	Other Fleets	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.0	0.1	0.2	0.1	0.2	0.2	0.3	0.2	0.3	0.3	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.1
	Total	*21.8*	*12.3*	*9.2*	*11.6*	*16.7*	*19.5*	*14.4*	*18.9*	*15.3*	*20.3*	*15.6*	*22.3*	*20.3*	*18.7*	*25.5*	*19.1*	*19.5*	*19.3*	*20.1*	*19.5*	*20.0*	*15.3*	*16.6*	*27.5*	*29.6*
Line	Indonesia	5.1	2.2	0.7	0.8	4.5	5.6	2.6	2.3	0.9	4.3	2.8	5.1	6.7	5.8	5.7	5.4	5.7	6.4	4.6	5.1	6.9	4.6	4.6	4.6	4.6
	India	0.8	1.0	0.8	1.0	1.3	1.5	1.1	1.7	1.4	1.8	1.4	1.4	1.1	1.2	1.9	1.1	1.1	1.2	1.4	1.3	1.0	1.2	0.9	0.6	0.4
	Yemen	0.2	0.4	0.7	0.6	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.1	0.1
	Other Fleets	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1
	Total	*6.2*	*3.5*	*2.2*	*2.4*	*6.3*	*7.6*	*4.3*	*4.5*	*2.9*	*6.6*	*4.8*	*7.1*	*8.2*	*7.4*	*8.0*	*7.0*	*7.2*	*8.0*	*6.3*	*6.7*	*8.3*	*6.1*	*5.7*	*5.5*	*5.3*
Other gears	India	4.3	4.1	3.4	4.4	5.3	6.3	4.6	7.0	6.1	7.4	5.7	6.0	4.4	5.0	7.9	4.8	4.8	5.2	5.7	5.3	4.6	4.9	3.8	3.7	4.4
	Thailand	3.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	1.8	1.8	2.0	0.1	1.3	1.6	1.9	1.9	2.5	3.0	3.4	3.1	2.9
	Malaysia	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.2	0.8	0.7	0.7	0.6	0.6	0.7	0.7	0.6
	Other Fleets	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.3
	Total	*8.2*	*4.9*	*3.4*	*4.4*	*5.3*	*6.4*	*4.6*	*7.1*	*6.1*	*7.4*	*5.7*	*6.0*	*6.2*	*6.8*	*9.8*	*5.9*	*7.4*	*7.6*	*8.4*	*7.9*	*7.8*	*8.7*	*8.2*	*7.9*	*8.2*
All	*Total*	*36.2*	*20.7*	*14.8*	*18.4*	*28.3*	*33.5*	*23.3*	*30.5*	*24.3*	*34.3*	*26.1*	*35.5*	*34.7*	*32.9*	*43.3*	*32.1*	*34.1*	*34.9*	*34.9*	*34.1*	*36.1*	*30.1*	*30.5*	*40.8*	*43.2*

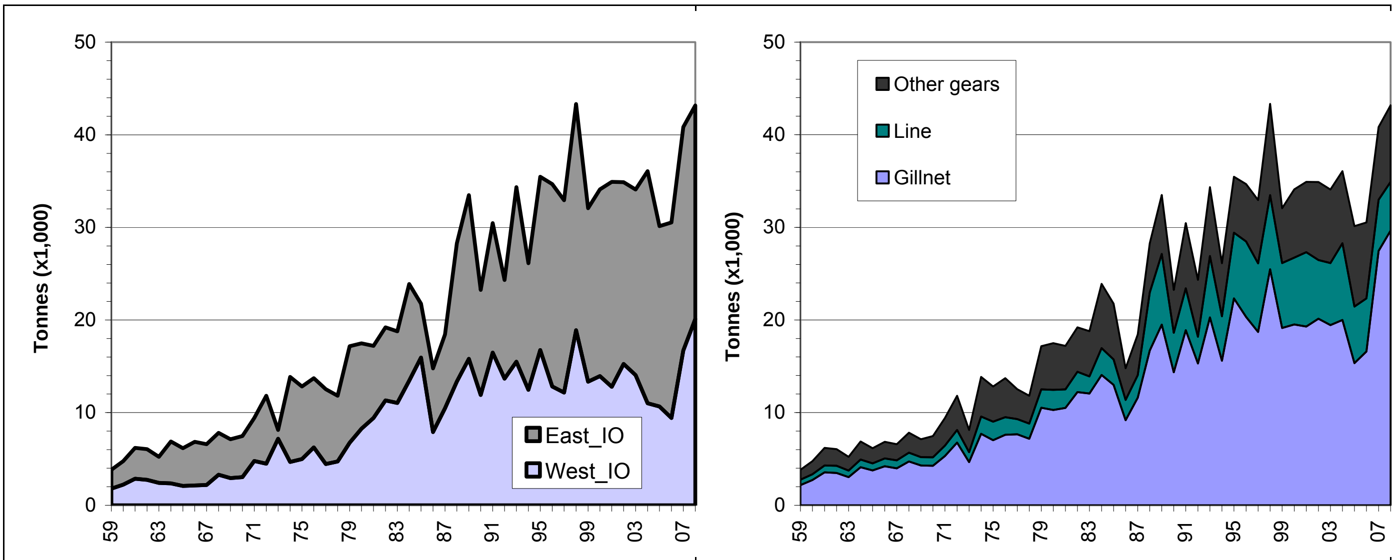


***Figure 1**. Indo-Pacific king mackerel: annual catches from 1959 to 2008 by area (left) and gear (right).* Data as of November 2009

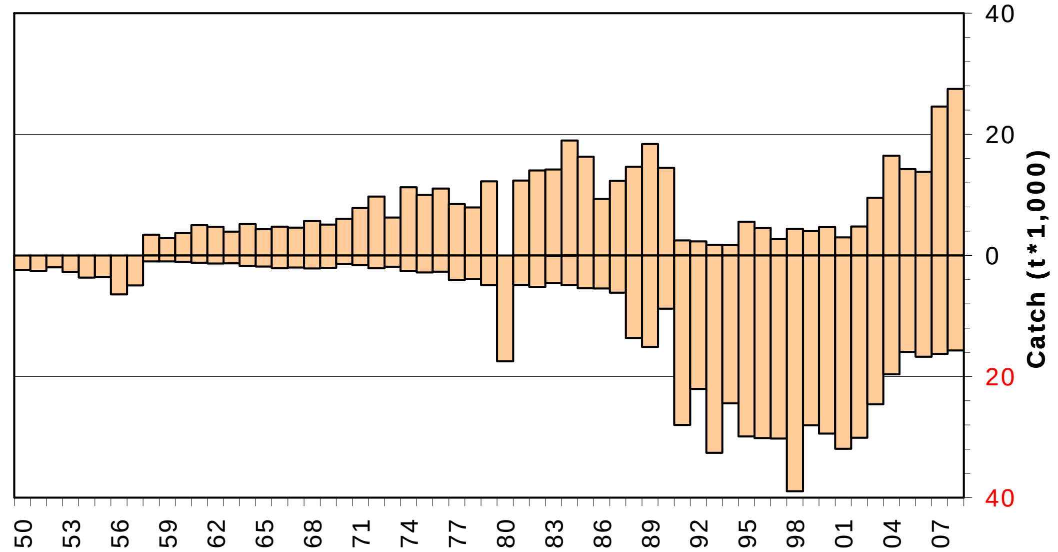


***Figure 2**. Indo-Pacific king mackerel: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text.*

EXECUTIVE SUMMARY OF THE STATUS OF THE KAWAKAWA RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

BIOLOGY

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

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

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

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

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

FISHERIES

Kawakawa is caught mainly by gillnets and purse seiners (Table 1 and Figure 1) and may be an important by-catch of the industrial purse seiners. The catch estimates for kawakawa were derived from very small amounts of information and are therefore highly uncertain[8] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. Annual estimates of catch kawakawa increased markedly from around 10,000 t in the late 1970's to reach the 50,000 t mark in the mid-1980's. Since 1997, catches have been around 100,000 t. The average annual catch estimated for the period 2004 to 2008 is 113,100 t. In recent years, the countries attributed with the highest catches are Indonesia, India and Iran (Table 1).

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

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

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

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

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

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for kawakawa are highly uncertain. The trend in catches indicates a large and continuous increase in the catches from the mid-1980's to 2002 (Figure 1). The estimated catches decreased over the period 2002-2005.
2. **Nominal CPUE Trends:** data not available to the Secretariat.
3. **Average weight in the catch by fisheries:** data not available to the Secretariat.
4. **Number of squares fished:** data not available to the Secretariat.

STOCK ASSESSMENT

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

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for kawakawa in the Indian Ocean, therefore the stock status is uncertain. The SC notes the catches have been relatively stable for the past 10 years.

The SC **recommended** that Kawakawa be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

KAWAKAWA SUMMARY

Management quantity	2008 assessment	2009 assessment
Most recent catch	121,400 t (2007)	126,700 t (2008)*
Mean catch over the last 5 years (2004-2008)		113,100 t
Maximum Sustainable Yield		
$F_{Current}/F_{MSY}$		
$B_{Current}/B_{MSY}$ (1)		
$SB_{Current}/SB_{MSY}$ (2)		
$B_{Current}/B_0$ (1)		
$SB_{Current}/SB_0$ (2)		
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

* Preliminary catch estimates

Table 1. *Best scientific estimates of the catches of kawakawa (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes). Data as of November 2009.*

	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Purse seine	Indonesia	1.1	1.1	1.1	1.4	1.4	1.5	1.6	1.8	1.9	1.8	1.9	2.1	1.4	1.4	2.2	2.4	3.8	7.8	9.7	11.9	8.7	9.8	13.9	16.8	15.2	18.8	17.7
	Malaysia	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.5	0.4	0.3	1.2	0.8	1.0	0.5	0.8	1.3	0.8	0.9	1.7	1.1	2.5	1.1	0.9	1.5	1.7	2.6
	Thailand												0.1	0.4	0.4	0.6	0.5	1.1	0.7	0.6	0.8	0.1	0.0	0.0	1.2	0.4	0.6	1.5
	India	0.1	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	1.1	0.3	0.4	0.8	0.5	0.7	0.9	1.6	0.9	0.9	0.7	0.9	1.3
	Other Fleets	0.0	0.0	0.0	0.0	0.2	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*1.3*	*1.4*	*1.5*	*1.6*	*1.9*	*2.6*	*2.3*	*2.2*	*2.5*	*2.3*	*2.3*	*3.6*	*2.9*	*3.0*	*4.4*	*3.9*	*6.6*	*10.0*	*11.8*	*15.1*	*10.8*	*13.9*	*16.0*	*19.7*	*17.9*	*22.0*	*23.0*
Gillnet	India	1.0	1.9	2.6	0.8	1.5	1.4	1.2	1.0	1.4	1.4	1.2	1.2	2.4	2.2	10.4	3.1	3.9	7.1	4.9	6.6	8.9	14.1	8.6	8.8	6.9	8.6	12.1
	Iran, Islamic R.												0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3		0.2	0.2	0.4	0.7	2.5	3.9	1.7
	Pakistan	0.4	0.4	0.4	0.6	0.9	1.3	1.4	1.8	1.8	1.8	1.6	1.5	1.2	1.4	1.1	1.5	1.7	1.6	1.4	0.8	1.4	0.7	1.0	1.3	0.4	0.5	0.8
	Oman	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.4	0.5	0.5	0.6	0.5	0.7	0.6	0.5	0.2	0.6	0.5
	UAE												0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2.0	0.9	0.9	0.8
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.3	0.7	0.4	0.3	0.3	0.4	0.8	0.8	0.4	0.7	0.6
	Total	*1.5*	*2.4*	*3.1*	*1.5*	*2.5*	*2.8*	*2.7*	*3.0*	*3.4*	*3.3*	*2.9*	*3.1*	*3.9*	*4.2*	*12.1*	*5.5*	*6.7*	*10.3*	*7.6*	*8.4*	*11.4*	*16.2*	*11.6*	*14.0*	*11.4*	*15.2*	*16.5*
Line	India	0.3	0.5	0.8	0.2	0.4	0.5	0.3	0.3	0.4	0.4	0.3	0.3	0.6	0.6	2.8	0.8	1.1	1.9	1.3	1.7	2.3	3.5	2.1	2.4	1.8	2.3	3.2
	Indonesia	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.3	0.4	0.8	1.0	1.3	0.9	1.0	1.5	1.8	1.6	2.0	1.9
	Yemen	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.4	0.5	0.6	0.6	0.7	0.6	1.8	0.9	0.9	0.8	1.1	2.1
	Maldives									0.3	0.3	0.4	0.4	0.3	0.4	0.6	0.5	0.3	0.9	0.9	0.7	0.6	0.9	1.0	1.2	1.3	0.7	1.4
	Other Fleets	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.4	0.6	0.5	0.5	0.4	0.6	0.6	0.9	0.9	1.3	1.1	1.4	1.2
	Total	*0.9*	*1.1*	*1.3*	*0.8*	*1.0*	*1.1*	*1.0*	*1.0*	*1.5*	*1.4*	*1.5*	*1.7*	*1.8*	*1.9*	*4.5*	*2.6*	*2.8*	*4.6*	*4.2*	*5.0*	*5.1*	*8.1*	*6.4*	*7.5*	*6.5*	*7.5*	*9.8*
Other gears	Maldives									0.2	0.2	0.2	0.3	0.2	0.3	0.6	0.4	0.2	0.2	0.2	0.2	0.2	0.3	0.5	1.0	1.1	0.8	1.0
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.2
	Total	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*	*0.2*	*0.3*	*0.3*	*0.3*	*0.3*	*0.7*	*0.6*	*0.3*	*0.4*	*0.4*	*0.3*	*0.4*	*0.6*	*0.7*	*1.1*	*1.3*	*1.2*	*1.1*
All	*Total*	*3.7*	*4.9*	*5.9*	*4.0*	*5.5*	*6.5*	*6.0*	*6.2*	*7.6*	*7.3*	*7.0*	*8.6*	*8.9*	*9.5*	*21.7*	*12.6*	*16.3*	*25.3*	*23.9*	*28.8*	*27.7*	*38.7*	*34.7*	*42.4*	*37.1*	*45.9*	*50.5*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Purse seine	Indonesia	34.0	16.9	18.4	17.4	19.5	22.4	16.6	20.5	17.0	27.8	33.6	33.0	35.0	35.9	34.5	37.5	39.6	32.6	35.0	36.1	39.5	24.1	37.4	34.4	34.4
	Malaysia	10.0	3.0	2.2	1.4	1.9	2.1	3.1	3.4	5.5	3.4	1.9	2.4	4.0	4.2	6.1	5.4	6.9	6.0	10.1	8.7	8.5	7.8	11.4	12.4	10.0
	Thailand	8.5	2.9	0.7	4.5	2.2	2.2	4.5	7.0	7.7	7.2	5.7	8.6	6.4	5.9	4.3	2.6	6.3	6.2	4.9	7.0	7.0	9.7	9.0	8.5	8.4
	India	4.5	1.2	1.4	1.0	1.2	2.1	2.6	1.2	1.5	1.2	0.9	1.1	1.0	1.3	1.2	1.6	1.6	1.4	1.6	1.7	1.0	0.4	1.0	8.5	11.8
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	Total	*57.1*	*24.1*	*22.8*	*24.3*	*24.7*	*28.8*	*26.8*	*32.1*	*31.7*	*39.6*	*42.2*	*45.2*	*46.4*	*47.4*	*46.2*	*47.1*	*54.5*	*46.2*	*51.6*	*53.6*	*56.0*	*42.1*	*58.9*	*64.0*	*64.7*
Gillnet	India	15.3	9.5	13.3	10.1	11.1	19.3	24.0	13.8	17.4	13.8	9.7	12.1	11.1	15.3	14.1	17.8	18.5	15.8	18.3	18.0	12.4	17.4	20.8	11.0	15.1
	Iran, Islamic R.	14.4	3.7	1.9	0.6	2.2	0.8	0.7	0.7	0.7	0.5	2.1	3.9	5.7	7.8	7.9	10.9	13.5	12.5	16.4	14.1	11.6	11.8	12.6	15.6	20.4
	Pakistan	3.0	1.7	1.6	2.0	4.1	1.4	2.1	1.9	1.5	1.5	1.7	1.4	3.0	2.9	3.0	3.6	3.1	2.3	2.0	2.2	2.4	2.9	3.2	3.2	3.2
	Sri Lanka	2.0	0.5	0.0	0.0	0.0	0.2	0.1	0.1	0.2	0.1	1.1	1.2	1.5	2.2	2.2	1.4	0.4	1.2	0.8	0.6	1.3	1.6	2.2	3.0	2.0
	Oman	1.3	0.7	0.6	1.4	1.9	1.1	1.2	0.4	1.0	0.6	0.5	1.2	1.5	1.8	1.3	1.0	1.1	1.3	1.0	2.1	1.6	1.2	1.4	1.3	1.2
	UAE	0.6	0.8	1.2	1.8	1.9	2.0	2.1	2.0	2.1	1.2	2.3	2.1	2.1	2.2	2.2	2.2	0.7	0.9	0.7	0.7	0.6	0.6	0.6	0.6	0.6
	Other Fleets	2.2	0.8	0.6	0.7	1.0	0.8	1.0	1.2	1.3	1.1	1.2	1.4	1.2	1.7	2.0	1.4	1.4	1.1	1.3	2.2	1.6	1.2	2.6	2.7	2.7
	Total	*38.9*	*17.7*	*19.2*	*16.8*	*22.2*	*25.6*	*31.2*	*20.0*	*24.1*	*18.8*	*18.7*	*23.3*	*26.1*	*33.8*	*32.6*	*38.4*	*38.7*	*35.1*	*40.5*	*39.9*	*31.5*	*36.7*	*43.3*	*37.4*	*45.4*
Line	India	5.2	2.8	3.5	2.8	3.0	4.9	6.1	4.3	5.5	4.3	3.0	3.8	3.5	4.8	4.4	5.6	5.8	4.9	5.7	5.4	4.2	4.5	8.8	4.4	4.3
	Indonesia	3.6	1.8	1.9	1.8	2.0	2.4	1.7	2.2	1.8	2.9	3.5	3.5	3.7	3.8	3.6	3.9	4.2	3.4	3.7	3.8	4.1	6.2	0.3	3.6	3.6
	Yemen	2.8	1.2	1.4	1.3	1.7	1.3	1.6	1.7	1.7	0.6	1.2	1.3	1.5	1.7	1.9	2.0	2.2	2.4	2.6	1.5	3.0	2.9	2.5	2.8	2.8
	Maldives	0.5	0.6	0.7	0.9	0.6	0.8	1.0	0.8	1.2	1.9	0.9	1.0	1.2	0.6	1.4	0.5	0.5	0.4	0.4	0.5	0.5	0.6	0.3	0.9	0.4
	Other Fleets	1.8	1.1	1.3	3.3	2.2	1.7	1.8	2.3	2.1	1.6	2.3	2.0	1.6	2.0	1.4	1.4	1.1	1.3	1.0	1.3	1.4	1.7	1.9	1.9	1.9
	Total	*13.9*	*7.5*	*8.8*	*10.2*	*9.5*	*11.1*	*12.3*	*11.2*	*12.2*	*11.3*	*11.0*	*11.5*	*11.4*	*12.8*	*12.7*	*13.4*	*13.8*	*12.5*	*13.4*	*12.5*	*13.2*	*15.8*	*13.8*	*13.7*	*13.0*
Other gears	Maldives	1.8	0.8	0.6	0.5	0.6	0.6	1.0	0.8	1.3	1.7	1.7	1.7	2.6	1.5	2.2	1.2	1.4	1.7	1.8	1.9	1.8	2.1	1.3	1.8	1.7
	Other Fleets	1.5	0.3	0.2	0.5	0.6	0.3	0.4	0.0	0.1	0.1	0.1	0.3	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.2	0.4	4.6	1.9
	Total	*3.2*	*1.1*	*0.8*	*1.0*	*1.2*	*0.9*	*1.3*	*0.9*	*1.4*	*1.7*	*1.8*	*2.1*	*3.1*	*1.6*	*2.4*	*1.3*	*1.5*	*1.8*	*1.9*	*2.2*	*2.1*	*2.4*	*1.7*	*6.4*	*3.6*
All	*Total*	*113.1*	*50.4*	*51.5*	*52.2*	*57.7*	*66.4*	*71.6*	*64.3*	*69.4*	*71.4*	*73.7*	*82.0*	*87.0*	*95.5*	*93.9*	*100.2*	*108.5*	*95.7*	*107.4*	*108.2*	*102.8*	*97.0*	*117.8*	*121.4*	*126.7*

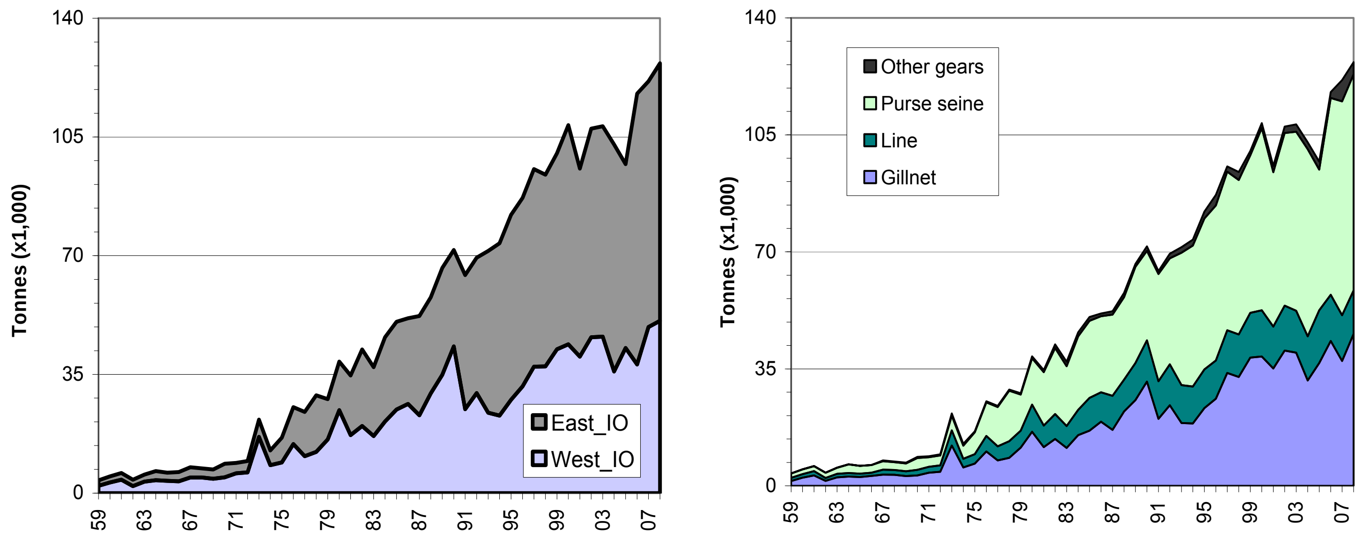


***Figure 1**. Kawakawa: (a) annual catches from 1959 to 2008 by (on the left) area i.e. Eastern and Western Indian Ocean and (on the right) gear.* Data as of November 2009

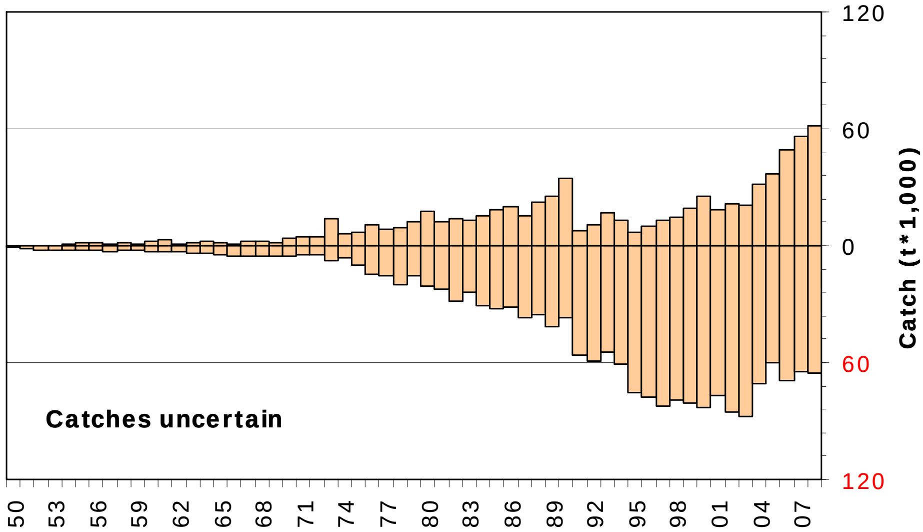


***Figure 2**. Kawakawa: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text.*

EXECUTIVE SUMMARY OF THE STATUS OF THE LONGTAIL TUNA RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

BIOLOGY

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

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

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

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

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

FISHERIES

Longtail tuna is caught mainly by gillnet and in a lesser extent by artisanal purse seiners and most of the catch is taken in the western Indian Ocean area (Figure 1). The catch estimates for longtail tuna were derived from very small amounts of information and are therefore highly uncertain[9] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. Estimated catches of longtail tuna increased steadily from the mid 1950's, reaching around 9,000 t in the early 1970's and over 50,000 t by the mid-1980's and peaking at 119,600 t in 2000. The average annual catch estimated for the period 2004 to 2008 is 94,800 t . In recent years, the countries attributed with the highest catches of longtail tuna are Indonesia, Iran, Oman, Yemen and Pakistan (Table 1).

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

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

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

Possible fishery indicators:

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

STOCK ASSESSMENT

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

---

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

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for longtail tuna in the Indian Ocean, therefore the stock status is uncertain. The SC notes the catches of longtail tuna are increasing.

The SC **recommended** that longtail tuna be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

LONGTAIL TUNA SUMMARY

Management quantity	2008 assessment	2009 assessment
Most recent catch	102,000 t (2007)	104,400 t (2008)*
Mean catch over the last 5 years (2004-2008)		94,800 t
Maximum Sustainable Yield		
$F_{Current}/F_{MSY}$		
$B_{Current}/B_{MSY}$ (1)		
$SB_{Current}/SB_{MSY}$ (2)		
$B_{Current}/B_0$ (1)		
$SB_{Current}/SB_0$ (2)		
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

* Preliminary catch estimates

Table 1. *Best scientific estimates of the catches of longtail tuna (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).*
Data as of November 2009

Gear	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Purse seine	Malaysia	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.3	0.2	0.6	0.4	0.5	0.3	0.4	0.7	0.4	0.5	0.9	0.6	1.3	0.6	0.4	0.8	0.9	1.4
	Indonesia	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.5	0.7	0.8	0.6	0.7	1.0	1.2	1.1	1.3	1.2
	Thailand												0.0	0.2	0.2	0.3	0.2	0.5	0.3	0.3	0.4	1.8	0.6	1.1	6.9	6.8	5.9	2.2
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	*0.1*	*0.1*	*0.2*	*0.2*	*0.2*	*0.3*	*0.3*	*0.4*	*0.5*	*0.4*	*0.4*	*0.8*	*0.7*	*0.8*	*0.7*	*0.8*	*1.4*	*1.3*	*1.4*	*2.1*	*3.0*	*2.6*	*2.6*	*8.5*	*8.6*	*8.1*	*4.9*
Gillnet	Indonesia	1.0	1.0	1.0	1.2	1.3	1.3	1.4	1.6	1.7	1.6	1.7	1.9	1.2	1.2	2.0	2.1	3.4	6.9	8.7	10.7	7.8	8.8	12.4	15.0	13.6	16.8	15.8
	Iran, Islamic R												0.6	0.1	0.7	0.9	0.9	0.9	1.4	1.6		0.8	1.0	2.2	2.9	5.6	6.1	11.8
	Pakistan	1.0	1.2	1.1	1.7	2.5	3.5	3.8	5.0	4.9	4.9	4.4	4.0	3.3	3.9	3.1	4.2	4.7	4.4	3.9	2.3	3.9	1.8	2.8	3.5	1.2	1.3	2.1
	India	0.4	0.8	1.1	0.3	0.6	1.1	0.5	0.5	0.5	0.4	0.4	0.3	0.5	0.6	3.0	0.8	1.0	1.5	1.0	1.6	2.0	2.9	1.7	2.6	1.2	1.8	4.5
	Oman	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.6	2.0	2.4	2.7	2.9	3.1	2.9	3.6	3.4	2.5	1.1	3.3	3.6
	UAE	1.3	1.3	1.3	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	0.9	0.9	0.9	0.9	1.5	1.5	1.4	1.4	1.4	1.4	1.4	0.4	4.0	2.6	2.6	2.4
	Other Fleets	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.2	0.4	0.1	0.3	0.5	0.8	0.6	0.3	0.4	0.6	1.4	1.0	0.4	0.5	0.7
	Total	*4.2*	*4.7*	*4.8*	*5.2*	*6.4*	*7.8*	*7.8*	*9.2*	*9.5*	*9.3*	*8.9*	*8.5*	*6.7*	*8.3*	*10.5*	*11.8*	*14.4*	*19.2*	*20.1*	*19.3*	*19.3*	*20.0*	*24.3*	*31.5*	*25.7*	*32.3*	*41.0*
Line	Yemen	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.5	1.1	1.3	1.4	1.5	1.6	1.5	1.7	1.3	1.2	0.3	1.0	1.0
	Oman	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	1.1	1.3	1.4	1.5	1.6	1.5	1.9	1.8	1.3	0.6	1.7	1.9
	India	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.2	0.2	0.4	0.3	0.3	0.5	0.7	0.4	0.6	0.3	0.4	1.2
	Other Fleets	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.5	0.7	0.7
	Total	*0.9*	*0.8*	*0.9*	*0.8*	*0.9*	*0.8*	*0.9*	*0.9*	*1.0*	*1.0*	*1.0*	*0.7*	*0.8*	*0.9*	*1.3*	*2.4*	*2.8*	*3.3*	*3.3*	*3.7*	*3.6*	*4.3*	*3.7*	*3.3*	*1.7*	*3.8*	*4.7*
Other gears	Indonesia	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.5	0.6	0.7	0.5	0.6	0.9	1.1	1.0	1.2	1.1
	Oman	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.7	0.8	0.9	1.0	1.0	1.0	1.2	1.1	0.8	0.4	1.1	1.2
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.0
	Total	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.3*	*0.8*	*1.0*	*1.4*	*1.6*	*1.8*	*1.5*	*1.8*	*2.0*	*1.9*	*1.6*	*2.6*	*2.3*
All	*Total*	*5.5*	*5.8*	*6.1*	*6.5*	*7.6*	*9.2*	*9.3*	*10.8*	*11.3*	*11.0*	*10.6*	*10.3*	*8.5*	*10.3*	*12.9*	*15.8*	*19.7*	*25.1*	*26.4*	*27.0*	*27.4*	*28.7*	*32.6*	*45.2*	*37.7*	*46.8*	*52.8*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Purse seine	Malaysia	4.3	1.4	1.2	0.8	0.8	1.1	1.3	1.5	2.4	1.5	0.8	1.0	1.7	1.8	2.6	2.3	3.0	2.6	4.3	3.7	3.6	3.4	4.9	5.3	4.3
	Indonesia	2.3	1.2	1.3	1.2	1.4	1.6	1.2	1.4	1.2	1.9	2.4	2.3	2.5	2.5	2.4	2.6	2.8	2.3	2.5	2.5	2.8	0.8	3.5	2.2	2.2
	Thailand	2.2	1.9	1.5	1.4	1.2	1.4	1.0	5.3	2.0	3.2	2.0	3.4	4.0	3.7	9.9	5.1	4.4	1.0	2.7	3.2	2.8	1.8	2.6	1.9	1.8
	Iran, Islamic R	2.0	0.7							0.6	1.0	0.8	1.3	0.7	0.8	1.5	2.1	2.7	3.0	5.8	3.6	1.5	1.2	2.3	2.3	2.7
	Other Fleets	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.3	0.1	0.1	0.1	1.2	1.3
	Total	*11.4*	*5.2*	*4.0*	*3.4*	*3.4*	*4.1*	*3.5*	*8.2*	*6.2*	*7.6*	*6.0*	*8.1*	*8.9*	*8.8*	*16.5*	*12.2*	*14.0*	*8.9*	*15.4*	*13.3*	*10.9*	*7.3*	*13.4*	*13.0*	*12.4*
Gillnet	Indonesia	29.4	15.0	16.5	15.5	17.4	20.0	14.8	18.3	15.2	24.8	30.1	29.5	31.3	32.1	30.9	33.5	35.4	29.1	31.2	32.2	35.3	27.3	27.7	28.4	28.4
	Iran, Islamic R	23.1	9.9	11.7	12.1	16.9	19.4	14.9	14.6	9.8	8.2	11.5	27.2	16.5	17.9	18.2	21.3	38.7	31.9	24.1	26.7	18.0	17.3	22.8	25.9	31.2
	Pakistan	5.5	4.2	4.4	6.0	6.3	4.9	6.2	6.1	5.8	4.5	5.8	5.0	4.6	5.6	5.5	6.3	6.0	5.2	5.1	6.1	5.3	5.2	5.6	5.7	5.7
	India	4.5	2.4	1.6	3.3	2.4	2.8	3.6	2.9	1.9	2.9	3.0	4.2	3.1	3.3	3.7	6.6	7.3	6.5	4.6	3.0	1.4	3.4	6.1	6.7	4.8
	Oman	4.3	2.7	4.0	9.3	8.5	4.7	3.8	1.4	3.2	4.2	1.8	2.2	3.4	3.6	3.2	3.2	3.4	4.0	4.6	5.8	5.1	4.1	4.3	4.2	4.0
	UAE	2.0	2.2	3.4	3.1	3.4	3.4	3.4	3.3	3.4	3.4	3.8	4.9	5.0	3.2	3.2	3.2	1.5	1.5	1.9	2.9	2.0	2.0	1.9	1.9	1.9
	Other Fleets	0.5	0.6	0.9	1.5	1.2	0.7	0.6	0.8	0.7	1.0	0.7	0.8	1.9	1.8	1.4	1.4	1.2	1.0	1.3	1.1	0.4	0.5	0.5	0.6	0.6
	Total	*69.3*	*37.1*	*42.5*	*50.9*	*56.1*	*55.8*	*47.3*	*47.3*	*40.0*	*49.0*	*56.8*	*73.9*	*65.8*	*67.5*	*66.1*	*75.6*	*93.5*	*79.2*	*72.9*	*77.9*	*67.5*	*59.8*	*68.9*	*73.4*	*76.6*
Line	Yemen	6.6	1.9	0.5	0.6	0.7	0.6	1.3	0.7	1.4	1.8	2.4	2.3	2.6	2.9	3.3	3.6	4.0	4.3	4.7	3.7	5.4	6.3	7.6	7.0	7.0
	Oman	3.1	1.5	2.1	4.9	4.5	2.5	2.0	2.8	1.8	2.5	3.4	1.2	0.8	1.3	0.8	1.5	1.9	1.9	2.1	1.6	2.6	3.2	3.3	3.3	3.2
	India	0.4	0.7	0.4	0.8	0.7	0.7	0.9	1.2	0.8	1.2	1.2	1.7	1.3	1.3	1.5	2.7	3.0	2.6	1.9	1.3	0.5	1.1	0.0	0.0	0.2
	Other Fleets	0.8	0.5	0.8	2.2	0.7	0.7	0.7	0.7	0.7	0.7	1.4	1.2	1.1	0.9	0.9	0.9	0.6	0.6	0.7	0.8	0.7	0.4	0.8	1.0	0.9
	Total	*10.9*	*4.6*	*3.8*	*8.5*	*6.5*	*4.6*	*4.9*	*5.4*	*4.6*	*6.2*	*8.4*	*6.4*	*5.7*	*6.5*	*6.6*	*8.7*	*9.4*	*9.5*	*9.4*	*7.3*	*9.2*	*11.1*	*11.8*	*11.4*	*11.2*
Other gears	Indonesia	2.1	1.0	1.2	1.1	1.2	1.4	1.0	1.3	1.1	1.7	2.1	2.1	2.2	2.2	2.2	2.3	2.5	2.0	2.2	2.3	2.5	2.6	1.2	2.0	2.0
	Oman	0.4	0.6	1.3	3.1	2.8	1.6	1.3	0.1	0.2	0.2	0.3	0.7	1.2	0.2	0.3	0.1	0.1	0.2	0.2	0.6	0.5	0.4	0.4	0.4	0.4
	Other Fleets	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	1.9	1.8
	Total	*3.3*	*1.8*	*2.5*	*4.2*	*4.0*	*3.0*	*2.3*	*1.5*	*1.3*	*1.9*	*2.4*	*2.7*	*3.4*	*2.4*	*2.5*	*2.5*	*2.7*	*2.3*	*2.4*	*3.0*	*3.0*	*3.1*	*1.8*	*4.2*	*4.2*
All	*Total*	*94.8*	*48.7*	*52.8*	*66.9*	*70.1*	*67.5*	*58.1*	*62.3*	*52.2*	*64.8*	*73.6*	*91.1*	*83.7*	*85.2*	*91.6*	*99.1*	*119.6*	*99.9*	*100.0*	*101.5*	*90.6*	*81.3*	*95.9*	*102.0*	*104.4*

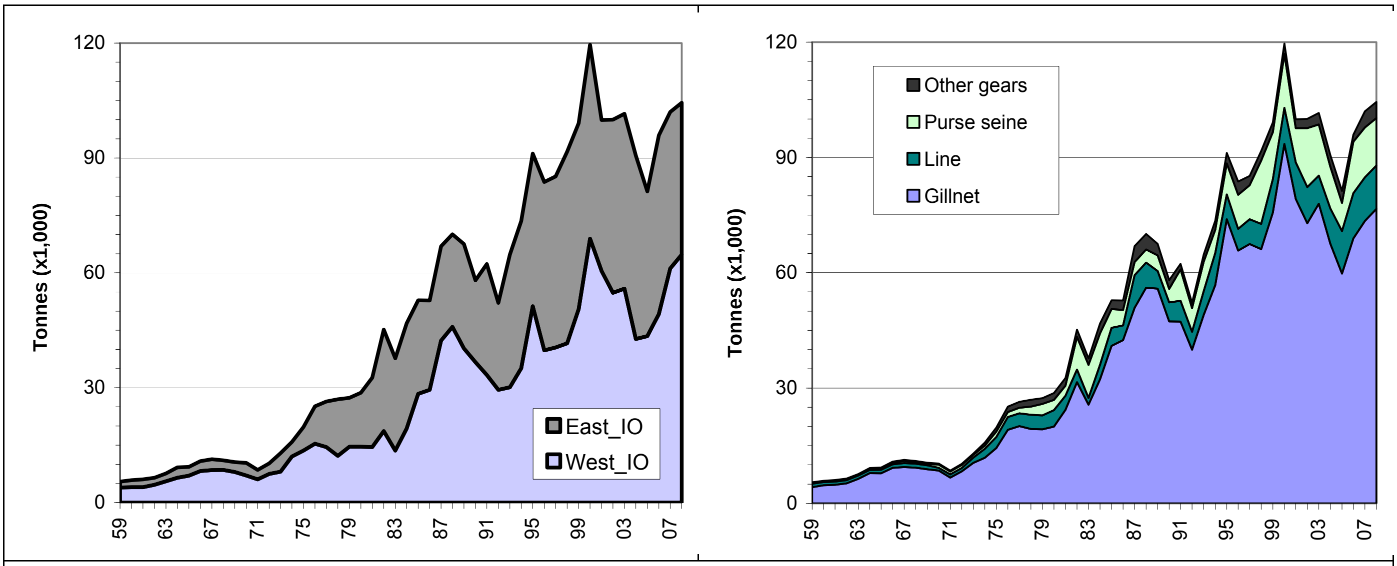


Figure 1. *Longtail tuna: annual catches from 1959 to 2008 by area (left) and gear (right).* *Data as per November 2009*

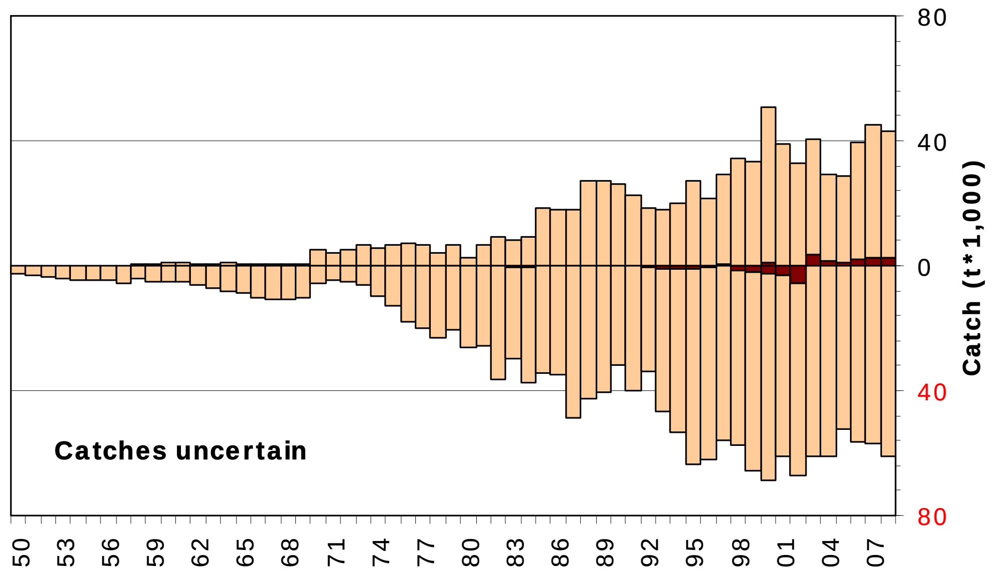


Figure 2. *Longtail tuna: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text. Dark sections represent estimates of catches by industrial fleets*

EXECUTIVE SUMMARY OF THE STATUS OF THE NARROW-BARRED SPANISH MACKEREL RESOURCE

(*AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009*)

BIOLOGY

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

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

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

FISHERIES

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

The catch estimates for Spanish mackerel were derived from very small amounts of information and are therefore highly uncertain[10] (Figure 2). The catches provided in Table 1 are based on the information available at the Secretariat and the following observations on the catches cannot currently be verified. The catches of Spanish mackerel increased from around 50,000 t the mid-1970's to 100,000 t by the mid-1990's. The current average annual catch is around 116,800 t (for the period 2004 to 2008), with most of the catch obtained taken from the west Indian Ocean area. (Figures 1, and Table 1). In recent years, the countries attributed with the highest catches of Spanish mackerel are Indonesia, Madagascar, Pakistan, Iran and Saudi Arabia.

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

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

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

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

Possible fishery indicators:

---

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

1. **Trends in catches**: The catch estimates for narrow-barred Spanish mackerel are highly uncertain. The trend in catches indicate a large and continuous increase in the catches from the 1970's to 2000, followed by a period of relatively stable catches at around 120,000 t (Figure 1).
2. **Nominal CPUE Trends:** data not available to the Secretariat.
3. **Average weight in the catch by fisheries:** data not available to the Secretariat.
4. **Number of squares fished:** data not available to the Secretariat.

STOCK ASSESSMENT

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

MANAGEMENT ADVICE

No quantitative stock assessment is currently available for narrow-barred Spanish mackerel tuna in the Indian Ocean, therefore the stock status is uncertain. The SC notes that Spanish mackerel is a relatively productive species with high fecundity and this makes it relatively resilient and less prone to overfishing.

The SC **recommended** that narrow-barred Spanish mackerel be reviewed at the first meeting of the IOTC Working Party on Neritic Tunas.

NARROW-BARRED SPANISH MACKEREL SUMMARY

Management quantity	2008 assessment	2009 assessment
Most recent catch	124,000 t (2007)	118,200 t (2008)*
Mean catch over the last 5 years (2004-2008)		116,800 t
Maximum Sustainable Yield		
$F_{Current}/F_{MSY}$		
$B_{Current}/B_{MSY}$ (1)		
$SB_{Current}/SB_{MSY}$ (2)		
$B_{Current}/B_0$ (1)		
$SB_{Current}/SB_0$ (2)		
$B_{Current}/B_{Current,F=0}$		
$SB_{Current}/SB_{Current,F=0}$		

* Preliminary catch estimates

Table 1. *Best scientific estimates of the catches of narrow-barred Spanish mackerel (as adopted by the IOTC Scientific Committee) by gear and main fleets for the period 1959-2008 (in thousands of tonnes).* *Data as of November 2009*

	Fleet	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
Gillnet	India	2.0	2.6	3.4	3.2	2.7	3.1	2.6	2.8	2.7	3.8	3.3	3.8	5.5	6.0	6.1	6.6	6.3	7.3	5.3	5.1	7.9	9.3	7.8	11.0	10.0	10.6	9.3
	Indonesia	1.8	1.8	1.8	2.4	2.4	2.4	2.4	3.0	3.0	3.0	3.0	2.4	3.0	3.6	3.6	4.6	6.5	2.2	3.0	2.6	2.3	3.7	2.7	3.4	4.2	3.5	3.4
	Iran, Islamic R																								0.1	1.4	0.6	0.7
	Pakistan	1.1	1.3	1.2	1.8	2.7	3.7	4.0	5.4	5.3	5.3	4.8	4.3	3.4	7.5	4.8	4.4	3.1	3.7	5.4	5.8	9.1	1.9	7.2	7.3	7.9	6.8	7.3
	UAE	1.6	1.6	1.6	1.8	1.8	1.8	2.0	2.0	2.1	2.1	2.1	2.2	2.4	2.4	2.4	3.7	3.7	3.6	3.6	3.6	3.6	3.6	3.5	6.5	5.4	5.4	4.2
	Sri Lanka	1.2	1.2	1.3	2.1	3.0	2.6	2.2	3.8	5.4	5.3	5.2	3.9	2.6	2.9	3.3	3.2	3.1	3.9	3.8	3.8	4.4	6.1	5.0	4.4	4.0	3.7	3.8
	Saudi Arabia																							0.6	0.5	0.7	0.8	7.1
	Qatar																								0.2	0.2	0.3	0.3
	Oman	0.9	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.9	0.9	0.9	0.9	0.9	1.0	1.1	3.6	4.2	4.8	5.1	5.5	5.1	6.3	6.0	4.4	2.0	5.8	10.9
	Malaysia	0.4	0.4	0.5	0.5	0.5	1.1	1.4	1.6	1.3	1.4	1.4								3.0	3.2	3.5	2.9	3.4	4.0	3.5	2.2	2.7
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.2	0.1	0.0	0.0	0.7	0.7	0.8	0.9	0.8	1.0	1.7	2.8	1.9	2.3	1.8	3.3	2.8	2.7	1.8	2.6
	Total	*8.9*	*9.5*	*10.4*	*12.6*	*13.8*	*15.5*	*16.0*	*19.5*	*20.8*	*21.8*	*20.7*	*18.2*	*18.6*	*24.2*	*22.2*	*26.9*	*27.9*	*27.1*	*31.8*	*31.6*	*38.3*	*35.5*	*39.5*	*44.7*	*41.9*	*41.5*	*52.4*
Line	Indonesia	1.3	1.3	1.3	1.8	1.8	1.8	1.8	2.2	2.2	2.2	2.2	1.8	2.2	2.7	2.7	3.4	4.8	1.6	2.2	1.9	1.7	2.7	2.0	2.5	3.1	2.6	2.5
	India	0.3	0.4	0.5	0.5	0.4	0.5	0.4	0.4	0.4	0.5	0.5	0.6	0.8	0.9	0.9	1.0	0.9	1.1	0.8	0.7	1.1	1.4	1.1	1.6	1.5	1.5	1.4
	Saudi Arabia																							0.2	0.2	0.3	0.4	1.2
	Yemen	1.0	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.0	1.0	0.8	0.9	1.0	1.1	2.6	3.1	3.5	3.7	4.0	3.7	4.1	3.3	2.9	0.9	4.5	3.5
	Oman	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.6	1.9	2.2	2.5	2.7	2.9	2.7	3.3	3.1	2.3	1.0	3.0	5.7
	Other Fleets	0.8	0.6	0.6	0.8	1.1	1.0	1.0	1.4	1.7	1.8	1.7	1.1	0.9	0.9	1.0	1.0	1.1	1.3	1.4	1.4	1.5	2.6	2.0	1.5	2.4	2.2	2.0
	Total	*3.9*	*3.5*	*3.6*	*4.3*	*4.5*	*4.4*	*4.5*	*5.3*	*5.8*	*6.0*	*5.9*	*4.7*	*5.3*	*5.9*	*6.2*	*9.9*	*12.0*	*9.9*	*10.6*	*11.0*	*10.7*	*14.1*	*11.8*	*11.0*	*9.2*	*14.2*	*16.3*
Other gears	India	1.2	1.6	2.1	2.0	1.7	1.9	1.6	1.7	1.7	2.3	2.0	2.3	3.4	3.6	3.7	4.0	3.8	4.5	3.2	3.1	4.8	5.7	4.8	6.7	6.1	6.5	5.7
	Thailand												0.1	0.5	0.3	0.1	0.0	0.1	0.7	0.2	0.1	0.1	0.5	0.4	1.3	1.4	0.7	0.9
	Indonesia	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.4	0.5	0.6	0.6	0.8	1.1	0.4	0.5	0.4	0.4	0.6	0.4	0.6	0.7	0.6	0.6
	Oman	0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	1.2	1.4	1.6	1.7	1.8	1.7	2.1	2.0	1.5	0.6	1.9	3.6
	Other Fleets	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.9	0.6	0.3	0.5	0.4	0.6	0.8	0.7	0.6	0.4	0.0	0.6	0.1	0.1	0.0
	Total	*1.8*	*2.1*	*2.6*	*2.6*	*2.3*	*2.5*	*2.3*	*2.5*	*2.5*	*3.1*	*2.9*	*3.9*	*5.6*	*5.5*	*5.1*	*6.5*	*6.8*	*7.8*	*6.4*	*6.2*	*7.5*	*9.2*	*7.7*	*10.7*	*9.0*	*9.7*	*10.8*
All	*Total*	*14.5*	*15.1*	*16.6*	*19.5*	*20.6*	*22.5*	*22.7*	*27.2*	*29.1*	*30.9*	*29.5*	*26.8*	*29.4*	*35.7*	*33.5*	*43.3*	*46.7*	*44.8*	*48.8*	*48.7*	*56.5*	*58.8*	*58.9*	*66.4*	*60.1*	*65.5*	*79.5*

Gear	Fleet	Av04/08	Av59/08	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
Gillnet	India	19.4	10.2	13.3	10.3	11.7	12.3	9.1	9.8	13.9	11.8	14.0	16.3	14.0	14.5	18.3	17.7	20.8	15.7	20.6	19.4	15.7	13.7	21.4	25.9	20.3
	Indonesia	12.7	5.6	4.2	4.7	5.6	5.4	4.9	5.7	6.1	7.7	7.1	7.4	8.6	8.0	8.9	8.5	10.0	11.5	9.4	9.9	12.4	1.6	24.1	12.8	12.8
	Iran, Islamic R	8.0	2.4	0.7	1.1	1.0	2.5	3.4	3.7	3.3	2.9	3.1	11.1	3.6	3.9	4.0	4.6	7.1	6.1	8.6	8.1	7.1	5.9	8.3	8.9	9.9
	Pakistan	7.6	6.6	7.5	7.7	10.1	6.8	6.2	10.0	8.4	8.4	7.2	8.6	10.1	12.5	12.7	13.1	10.6	9.3	7.9	8.5	8.8	7.2	7.0	7.4	7.4
	UAE	4.1	4.4	6.7	5.7	6.1	6.4	6.3	6.0	6.2	6.2	6.9	6.8	7.1	8.3	8.6	9.0	8.2	9.0	3.3	4.9	4.4	4.0	4.0	4.0	4.0
	Sri Lanka	3.7	3.8	3.9	4.1	4.2	4.3	4.3	4.1	4.1	4.1	4.1	4.7	3.9	4.1	4.6	4.9	4.9	4.7	4.8	4.6	4.2	1.9	3.8	4.2	4.6
	Saudi Arabia	3.0	2.6	7.7	7.0	7.1	6.7	7.6	7.8	7.9	8.3	8.5	6.0	5.0	3.6	4.7	3.7	3.5	4.8	4.0	3.1	2.9	3.0	2.9	3.1	3.1
	Qatar	1.8	0.4	0.1	0.1	0.1	0.2	0.6	0.7	0.8	0.6	0.4	0.3	0.3	0.4	0.6	0.5	0.8	1.0	1.0	1.9	1.5	1.9	2.0	1.8	1.8
	Oman	1.7	3.2	7.7	13.6	15.0	6.0	4.2	1.1	2.2	1.9	1.3	3.3	3.3	4.2	2.3	2.2	1.6	1.8	1.4	2.0	2.0	1.8	1.6	1.7	1.6
	Malaysia	1.1	1.8	3.6	3.9	3.3	2.5	2.8	2.9	3.6	2.9	2.8	2.0	2.2	2.4	3.1	0.7	0.9	1.0	1.8	1.6	1.5	0.8	1.1	1.0	1.0
	Other Fleets	3.1	2.0	2.8	2.9	2.7	2.6	3.4	3.1	3.5	3.1	2.7	3.3	3.5	3.3	3.7	4.0	2.8	3.4	3.4	3.3	2.8	2.7	3.2	3.5	3.5
	Total	*66.3*	*43.2*	*58.3*	*61.2*	*67.1*	*55.8*	*52.8*	*55.2*	*59.9*	*57.9*	*58.0*	*69.7*	*61.5*	*65.1*	*71.6*	*69.0*	*71.2*	*68.5*	*66.1*	*67.4*	*63.2*	*44.5*	*79.4*	*74.2*	*70.0*
Line	Madagascar	12.0	4.6	3.8	7.9	0.4	8.5	10.0	8.0	8.0	10.0	10.0	10.0	10.0	10.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
	Indonesia	9.4	4.1	3.1	3.5	4.1	4.0	3.6	4.2	4.5	5.7	5.2	5.5	6.3	5.9	6.6	6.3	7.3	8.5	6.9	7.3	9.1	18.8	0.1	9.4	9.4
	India	3.7	1.6	1.9	1.5	1.7	1.8	1.3	1.4	2.0	1.7	2.0	2.4	2.0	2.1	2.7	2.6	3.0	2.3	3.0	2.8	2.3	2.8	3.2	5.3	4.7
	Saudi Arabia	2.3	1.0	1.4	2.0	2.3	2.5	1.3	1.4	2.2	2.6	2.9	0.9	1.0	2.3	2.4	2.7	2.4	2.3	2.3	2.7	2.2	2.3	2.2	2.4	2.4
	Yemen	1.7	2.2	3.8	3.3	2.6	2.3	3.1	3.2	2.6	3.1	3.3	3.0	2.4	2.3	2.2	2.2	2.1	2.0	1.9	1.8	1.8	1.8	1.7	1.5	1.5
	Oman	1.3	1.7	4.1	7.2	7.9	3.1	2.2	2.4	1.2	1.1	2.4	1.8	0.7	1.6	0.6	1.1	0.9	0.9	0.6	0.5	1.0	1.4	1.2	1.3	1.3
	Other Fleets	2.3	1.9	2.4	3.5	2.5	2.6	3.0	3.0	2.5	2.4	2.8	2.4	2.5	2.9	2.8	2.3	2.2	2.6	1.7	2.1	2.1	2.0	2.4	2.5	2.5
	Total	*32.6*	*17.1*	*20.6*	*28.8*	*21.5*	*24.8*	*24.5*	*23.6*	*23.0*	*26.6*	*28.6*	*26.1*	*25.1*	*27.0*	*29.2*	*29.1*	*30.0*	*30.6*	*28.5*	*29.3*	*30.6*	*41.1*	*22.9*	*34.5*	*33.9*
Other gears	India	10.1	6.1	8.1	6.3	7.2	7.5	5.5	6.0	8.5	7.2	8.6	9.9	8.6	8.9	11.2	10.8	12.7	9.6	12.6	11.9	10.2	11.7	13.7	7.6	7.1
	Thailand	3.9	1.3	1.4	1.4	0.7	1.6	1.8	1.8	2.4	2.3	1.8	2.8	3.5	3.4	3.1	2.2	2.1	2.1	2.9	2.9	3.3	3.8	4.4	4.1	3.8
	Indonesia	2.1	0.9	0.7	0.8	0.9	0.9	0.8	1.0	1.0	1.3	1.2	1.2	1.4	1.3	1.5	1.4	1.7	1.9	1.6	1.6	2.1	4.1	0.2	2.1	2.1
	Oman	0.2	0.9	2.5	4.5	5.0	2.0	1.4	0.1	0.2	0.1	0.2	1.0	1.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1
	Other Fleets	1.7	0.6	0.4	0.6	0.3	0.4	0.1	0.3	0.4	0.4	0.5	0.2	0.2	0.5	0.6	1.7	1.8	1.2	1.8	1.5	1.1	1.7	3.3	1.3	1.2
	Total	*17.9*	*9.8*	*13.2*	*13.6*	*14.1*	*12.3*	*9.7*	*9.2*	*12.6*	*11.3*	*12.3*	*15.1*	*14.8*	*14.3*	*16.6*	*16.2*	*18.3*	*14.9*	*18.9*	*18.1*	*16.8*	*21.4*	*21.6*	*15.3*	*14.3*

All	*Total*	*116.8*	*70.1*	*92.1*	*103.6*	*102.6*	*92.9*	*87.0*	*87.9*	*95.5*	*95.8*	*99.0*	*110.8*	*101.4*	*106.5*	*117.5*	*114.3*	*119.4*	*113.9*	*113.5*	*114.9*	*110.6*	*107.1*	*124.0*	*124.0*	*118.2*

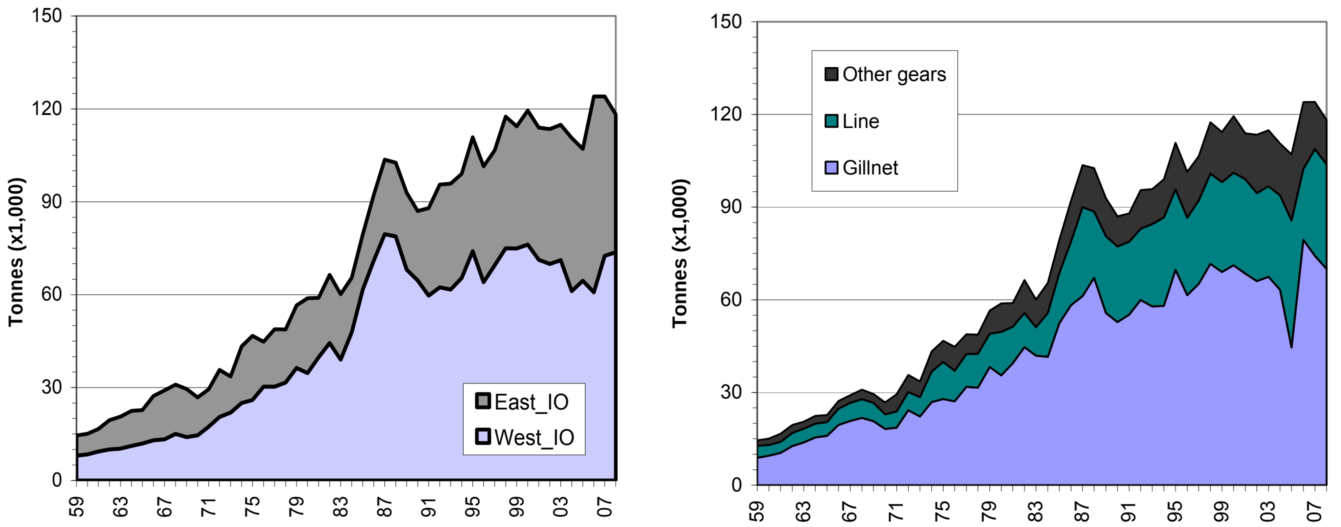


Figure 1. *Narrow-barred Spanish mackerel: (a) annual catches from 1959 to 2008 by (on the left) area i.e. Eastern and Western Indian Ocean and (on the right) gear.* Data as of November 2009

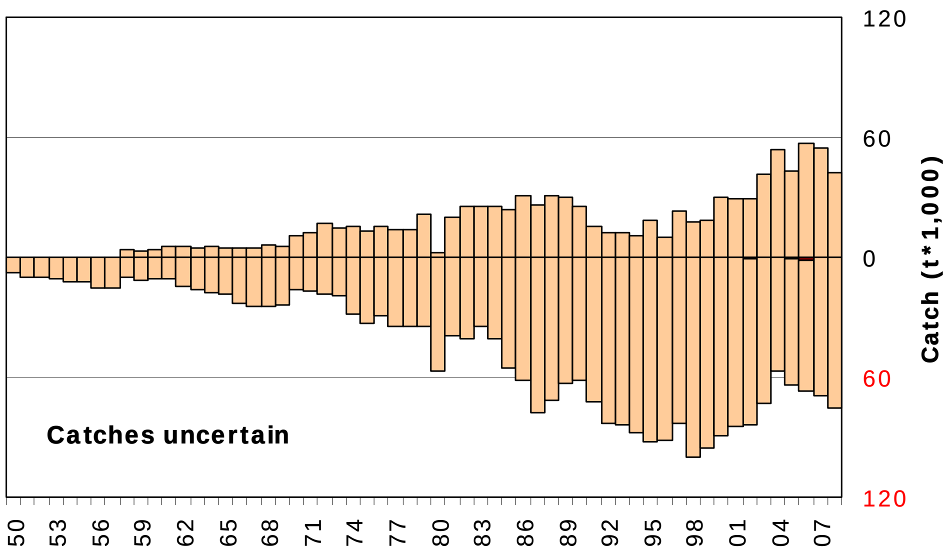


Figure 2*. Narrow-barred Spanish mackerel: uncertainty of annual catch estimates. The amount of the catch below the zero-line has been categorised as uncertain according to the criteria given in the text.*

EXECUTIVE SUMMARY OF THE STATUS OF THE BLUE SHARK RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

Blue shark. *Prionace glauca* (Linnaeus, 1758)

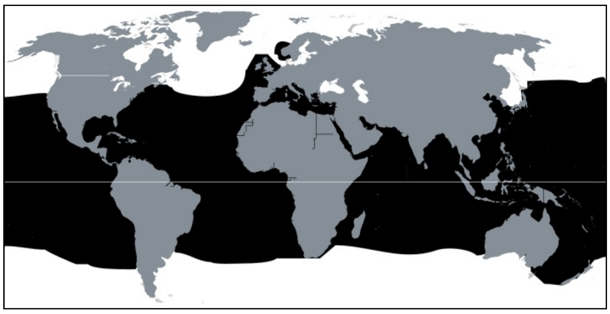
FAO code: **BSH**

Vulnerability and conservation status

Species	IUCN status [1]		
	Global status	WIO	EIO
Prionace glauca	NT	-	-

BIOLOGY

The blue shark (*Prionace glauca*) is common in pelagic oceanic waters throughout the tropical and temperate oceans worldwide. It has one of the widest ranges of all the shark species. It may also be found close inshore and in estuaries. Blue shark is most common in relatively cool waters (7 to 16°C) often close to the surface. In the tropical Indian Ocean, the greatest abundance of blue sharks occurs at depths of 80 to 220 m, in temperatures ranging from 12 to 25°C. The distribution and movements of blue shark are strongly influenced by seasonal variations in water temperature, reproductive condition, and availability of prey.



The worldwide distribution of the blue shark

The blue shark is often found in large single sex schools containing individuals of similar size. Adult blue sharks have no known predators; however, subadults and juveniles are eaten by both shortfin makos and white sharks as well as by sea lions. Fishing is likely to be a major contributor to adult mortality.

In the Atlantic Ocean, the oldest blue sharks reported were a 16 year old male and a 15 year old female [20]. Longevity is estimated to be between 20-26 years of age and maximum size is around 3.8 m FL. Preliminary data for Indian Ocean shows that male may reach 25 and females 21 years old [17]. Length–weight relationship for both sexes combined in the Indian Ocean is $TW=0.159*10^{-4} * FL^{2.84554}$ [18]. Size increases when latitude decreases.

Sexual maturity is attained at 5 years of age in both sexes. Blue shark is a viviparous species, with a yolk-sac placenta. Once the eggs have been fertilised there is a gestation period of between 9 and 12 months. Litter size is quite variable, ranging from four to 135 pups and may be dependent on the size of the female. The average litter size observed from the Indian Ocean is 38. New-born pups are around 40 to 51 cm in length. Generation time is about eight years. In Indian Ocean, between latitude 2 ºN and 6 ºS, pregnant females are present for most of the year.

- Fecundity: **high** (25-50)
- Generation time: 8.1
- Gestation Period: 9-12 months

Biological parameters in the Indian Ocean

Parameters	Status	Area	References
Reproduction cycle	Partially known	Equator SWIO	[13] [14]
Size at first maturity	Partially known Study in progress	Maldives SWIO	[15]
Nursery ground	Partially known	South from 20°S	[16]
Growth	Studies in progress	SWIO	[17, 18]
Migration pattern	Study in progress	Ocean wide	[19]

FISHERIES

Blue sharks are often targeted by some semi-industrial, artisanal and recreational fisheries and are a bycatch of industrial fisheries (pelagic longline tuna and swordfish fisheries and purse seine fishery). The blue shark appears to have a similar distribution to swordfish. Typically, the fisheries take blue sharks between 1.8-2.4 m fork length or 30 to 52 kg. Males are slightly smaller than the females. In other Oceans, angling clubs are known for organising sharks fishing competitions where blue sharks and mako sharks are targetted. Sport fisheries for sharks are apparently not so common in the Indian Ocean.

There is little information on the fisheries prior to the early 1970's, and some countries continue not to collect shark data while others do collect it but do not report it to IOTC. It appears that significant catches of sharks have gone unrecorded in several countries. Furthermore, many catch records probably under-represent the actual catches of sharks because they do not account for discards (i.e. do not record catches of sharks for which only the fins are kept or of sharks usually discarded because of their size or condition) or they reflect dressed weights instead of live weights.

In 2005, seven countries reported catches of blue sharks in the IOTC region. These are not given in this summary because their representativeness is highly uncertain. Apparently, as other shark stocks have declined less blue sharks are being discarded.

FAO also compiles landings data on elasmobranchs, but the statistics are limited by the lack of species-specific data and data from the major fleets.

- Finning practice: **often** (<u>and increasing</u>) [11, 12]
- Area overlap with IOTC management area: **high** (map to be updated)

Estimated abundance [2, 3, 4, 5, 6] and by-catch mortality [7, 8, 9, 10] in the Indian Ocean pelagic fisheries

Gears	PS	LL		BB/TROL/HAND	GILL	UNCL
		SWO	TUNA			
Abundance	absent	abundant		rare	rare	unknown
Fishing Mortality		13 to 51 %	0 to 31%			
Post release mortality		19%				

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is little information on blue shark biology and no information is available on stock structure.

Possible fishery indicators:

5. **Trends in catches**: The catch estimates for blue shark are highly uncertain as is their utility in terms of minimum catch estimates.
6. **Nominal CPUE Trends:** Data not available. There are no surveys specifically designed to assess shark catch rates in the Indian Ocean. Trends in localised areas might be possible in the future (for example, from

the Kenyan recreational fishery). Historical research data shows overall decline in CPUE while mean weight of blue shark in this time series are relatively stable [4]

7. **Average weight in the catch by fisheries:** data not available.
8. **Number of squares fished:** CE data not available.

STOCK ASSESSMENT

No quantitative stock assessment has been undertaken by the IOTC Working Party on Ecosystems and Bycatch.

MANAGEMENT ADVICE

There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. There is no quantitative stock assessment or basic fishery indicators currently available for blue shark in the Indian Ocean therefore the stock status is highly uncertain.

Blue sharks are commonly taken by a range of fisheries in the Indian Ocean and in some areas they are fished in their nursery grounds. Because of their life history characteristics – they are relatively long lived (16-20 years), mature at 4-6 years, and have relativity few offspring (25-50 pups every two years), the blue shark is vulnerable to overfishing.

EXECUTIVE SUMMARY OF THE STATUS OF THE SILKY SHARK RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

Silky shark. Carcharhinus falciformis (Müller & Henle, 1839)

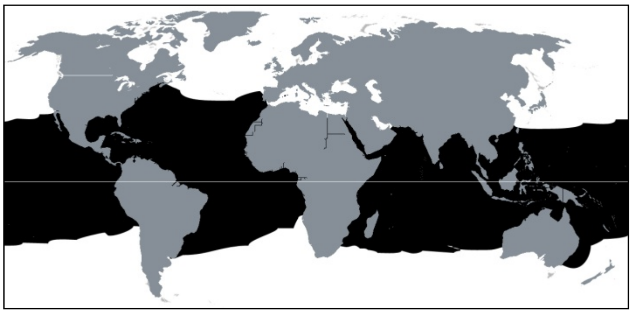
FAO code: **FAL**

Vulnerability and conservation status

Species	IUCN status [1]		
	Global status	WIO	EIO
Carcharhinus falciformis	LC/NT	NT	NT

BIOLOGY

The silky shark (*Carcharhinus falciformis*) is one of the most abundant large sharks inhabiting warm tropical and subtropical waters throughout the world.



The worldwide distribution of the silky shark

Essentially pelagic, the silky shark is distributed from slopes to the open ocean. It also ranges to inshore areas and near the edges of continental shelves and over deepwater reefs. It also demonstrates strong fidelity to seamounts and natural or man-made objects (like FADs) floating at the sea surface. Silky sharks live down to 500 m but has been caught as deep as 4000 m. Typically, smaller individuals are found in coastal waters. Small silky sharks are also commonly associated with schools of tuna.

Silky sharks often form mixed-sex schools containing similar sized individuals. Maximum age is estimated at 20+ years for males and 22+ years for females and maximum size is over 3 m long.

The age of sexual maturity is variable. In the Atlantic Ocean, off Mexico, silky sharks mature at 10-12 years. By contrast in the Pacific Ocean, males mature at around 5-6 years and females mature at around 6-7 year. The silky shark is a viviparous species with a gestation period of around 12 months. Females give birth possibly every two years. The number of pups per litter ranges from 9-14 in the western Indian Ocean, and 2-11 in the central Indian Ocean. Pups measure around 75-80 cm TL at birth and spend first their first few months in near reefs before moving to the open ocean. Generation time is estimated to be 8 years. Length–weight relationship for both sexes combined in the Indian Ocean is $TW=0.160*10^{-4} * FL^{2.91497}$ [18]

- Fecundity: **medium** (<20 pups)
- Gestation Period: 12 months

Biological parameters in Indian Ocean

Parameters	Status	Area	References
Reproduction cycle	Study in progress	SWIO	
Size at first maturity	Partially known Study in progress	Maldives SWIO	[15]
Nursery ground	Partially known	Maldives	[15]
Growth	Unknown		
Migration pattern	Study in progress	Ocean wide	[19]

FISHERIES

Silky sharks are often targeted by some semi-industrial, artisanal and recreational fisheries and are a bycatch of industrial fisheries (pelagic longline tuna and swordfish fisheries and purse seine fishery). Sri Lanka has had a large fishery for small sized silky shark for over 40 years.

There is little information on the fisheries prior to the early 1970's, and some countries continue not to collect shark data while others do collect it but do not report it to IOTC. It appears that significant catches of sharks have gone unrecorded in several countries. Furthermore, many catch records probably under-represent the actual catches of sharks because they do not account for discards (i.e. do not record catches of sharks for which only the fins are kept or of sharks usually discarded because of their size or condition) or they reflect dressed weights instead of live weights.

Catches of silky shark in the IOTC region are not given in this summary because their representativeness is highly uncertain.

FAO also compiles landings data on elasmobranchs, but the statistics are limited by the lack of species-specific data and data from the major fleets.

Estimated abundance and by-catch mortality in the Indian Ocean pelagic fisheries [2, 3, 4, 5, 6]

Gears	PS	LL		BB/TROL/HAND	GILL	UNCL
		SWO	TUNA			
Abundance	common	abundant		common	unknown, probably common	unknown
Fishing Mortality	Study in progress	Study in progress	Study in progress			
Post release mortality	Study in progress					

- Finning practice: **often** [11, 12]
- Area overlap with IOTC management area: **high** (Fig.)

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is little information available on silky shark biology and no information is available on stock structure.

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for silky shark are highly uncertain as is their utility in terms of minimum catch estimates.
2. **Nominal CPUE Trends:** data not available.
3. **Average weight in the catch by fisheries:** data not available.
4. **Number of squares fished:** CE data not available.

STOCK ASSESSMENT

No quantitative stock assessment has been undertaken by the IOTC Working Party on Ecosystems and Bycatch.

MANAGEMENT ADVICE

There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. There is no quantitative stock assessment or basic fishery indicators currently available for silky shark in the Indian Ocean therefore the stock status is highly uncertain. Although the Sri Lankan fishery for small sized silky shark has been sustained for over 40 years, the level of catch over this period is uncertain.

Silky sharks are commonly taken by a range of fisheries in the Indian Ocean and in some areas they are fished in their nursery grounds. Because of their life history characteristics – they are relatively long lived (over 20 years), mature at 6-12 years, and have relativity few offspring (<20 pups every two years), the silky shark is vulnerable to overfishing.

EXECUTIVE SUMMARY OF THE STATUS OF THE OCEANIC WHITETIP SHARK RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

Oceanic whitetip shark. *Carcharhinus longimanus* (Poey, 1861)

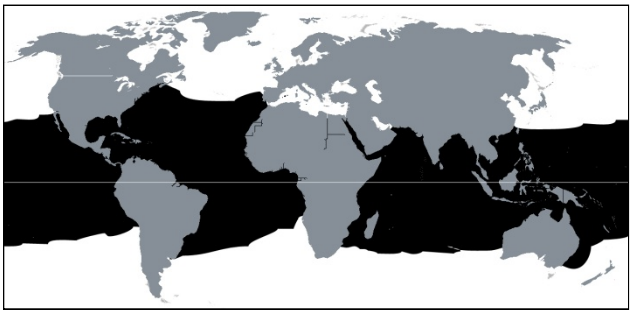
FAO code: **OCS**

Vulnerability and conservation status

Species	IUCN status [1]		
	Global status	WIO	EIO
Carcharhinus longimanus	VU	-	-

BIOLOGY

The oceanic whitetip shark (*Carcharhinus longimanus*) is one of the most common large sharks in warm oceanic waters. It is typically found in open ocean but also close to reefs and near oceanic islands.



The worldwide distribution of the oceanic whitetip shark

Oceanic whitetip sharks are relatively large sharks and grow to up to 4 m. Females grow larger than males. The maximum weight reported for this species is 167.4 kg. Length–weight relationship for both sexes combined in the Indian Ocean is $TW=0.386*10^{-4} * FL^{2.75586}$ [18]

Both males and females mature at around 4 to 5 years old or about 1.8-1.9 m TL. Oceanic whitetip sharks are viviparous. Litter sizes range from 1-15 pups, with larger sharks producing more offspring. Each pup is approximately 60-65 cm at birth. In the south western Indian Ocean, whitetips appear to mate and give birth in the early summer, with a gestation period which lasts about one year. The reproductive cycle is believed to be biennial. The locations of the nursery grounds are not well known but they are thought to be in oceanic areas.

The population dynamics and stock structure of the oceanic whitetip shark in the Indian Ocean are not known.

- Fecundity: **medium** (<20 pups)
- Gestation Period: 12 months

Biological parameters in Indian Ocean

Parameters	Status	Area	References
Reproduction cycle	Study in progress	SWIO	
Size at first maturity	Study in progress	SWIO	
Nursery ground	Unknown		
Growth	Study in progress	SWIO	
Migration pattern	Trans-equatorial	SWIO	[19]

FISHERIES

Oceanic whitetip sharks are often targeted by some semi-industrial, artisanal and recreational fisheries and are a bycatch of industrial fisheries (pelagic longline tuna and swordfish fisheries and purse seine fishery).

There is little information on the fisheries prior to the early 1970's, and some countries continue not to collect shark data while others do collect it but do not report it to IOTC. It appears that significant catches of sharks have gone unrecorded in several countries. Furthermore, many catch records probably under-represent the actual catches of sharks because they do not account for discards (i.e. do not record catches of sharks for which only the fins are kept or of sharks usually discarded because of their size or condition) or they reflect dressed weights instead of live weights.

Catches of oceanic whitetip sharks in the IOTC region are not given in this summary because their representativeness is highly uncertain.

FAO also compiles landings data on elasmobranchs, but the statistics are limited by the lack of species-specific data and data from the major fleets.

Estimated abundance and by-catch mortality in the Indian Ocean pelagic fisheries [2, 3, 4, 5, 6, 8]

Gears	PS	LL		BB/TROL/HAND	GILL	UNCL
		SWO	TUNA			
Abundance	common	common		common	unknown,	unknown
Fishing Mortality	Study in progress	58%				
Post release mortality	Study in progress					

- Finning practice: **often** [11, 12]
- By-catch/release injury rate: **unknown**
- Area overlap with IOTC management area: **high** (Fig.)

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is little information available on oceanic whitetip shark biology and no information is available on stock structure.

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for oceanic whitetip shark are highly uncertain as is their utility in terms of minimum catch estimates.
2. **Nominal CPUE Trends:** data not available. Historical research data shows overall decline in CPUE and mean weight of oceanic whitetip shark [4].
3. **Average weight in the catch by fisheries:** data not available.
4. **Number of squares fished:** CE data not available.

STOCK ASSESSMENT

No quantitative stock assessment has been undertaken by the IOTC Working Party on Ecosystems and Bycatch.

MANAGEMENT ADVICE

There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. There is no quantitative stock assessment or basic fishery indicators currently available for oceanic whitetip shark in the Indian Ocean therefore the stock status is highly uncertain.

Oceanic whitetip sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived, mature at 4-5 years, and have relativity few offspring (<20 pups every two years), the oceanic whitetip shark is vulnerable to overfishing.

EXECUTIVE SUMMARY OF THE STATUS OF THE SHORTFIN MAKO SHARK RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

Shortfin mako shark. *Isurus oxyrinchus* (Rafinesque, 1810)

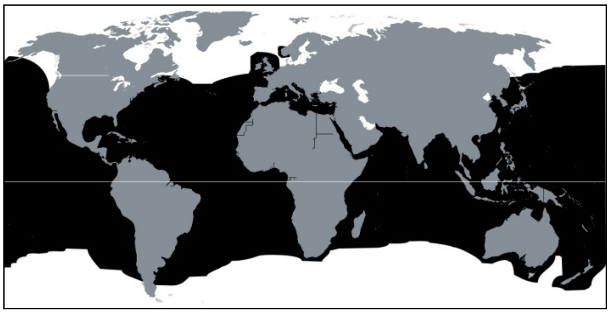
FAO code: **SMA**

Vulnerability and conservation status

Species	IUCN status [1]		
	Global status	WIO	EIO
Isurus oxyrinchus	NT	-	-

BIOLOGY

The shortfin mako shark (*Isurus oxyrinchus*) is widely distributed in tropical and temperate waters above 16°C. Makos prefer epipelagic and littoral waters from the surface down to depths of 500 meters. Shortfin mako is not known to school. It has a tendency to follow warm water masses polewards in the summer. Tagging results from the North Atlantic Ocean showed that makos migrated over long distances and this suggests that there is a single well-mixed population in this area. No information is available on stock structure of shortfin mako in Indian Ocean



The worldwide distribution of the shortfin mako shark

The shortfin mako shark is a large and active shark and one of the fastest swimming shark species. It is known to leap out of the water when hooked and is often found in the same waters as swordfish. This species is at the top of the food chain, feeding on other sharks and fast-moving fishes such as swordfish and tunas.

The maximum age of shortfin makos in Northwest Atlantic Ocean is estimated to be over 24 years with the largest individuals reaching 4 m and 570 kg. Length–weight relationship for both sexes combined in the Indian Ocean is $TW=0.349*10^{-4} * FL^{2.76544}$ [18].

Sexual maturity is attained at 7 to 8 years or at around 2.7-3.0 m TL for females and 2.0-2.2 m TL for males. The length at maturity of female shortfin makos differs between the Northern and Southern hemispheres. The nursery areas are apparently in deep tropical waters. Female shortfin makos are ovoviviparous. Developing embryos feed on unfertilized eggs in the uterus during the gestation period which lasts 15-18 months. Litter size ranges from 4 to 25 pups, with larger sharks producing more offspring. Growth of the pups is very fast to reach 70 cm (TL) at birth. The length of the reproductive cycle is around three years. Generation time is estimated to be 14 years.

- Fecundity: **medium** (<30 pups)
- Gestation Period: 15-18 months

Biological parameters in Indian Ocean

Parameters	Status	Area	References
Reproduction cycle	Partially known	off KwaZulu-Natal	[20]
Size at first maturity	Partially known	off KwaZulu-Natal	[20]
Nursery ground	Unknown		
Growth	Unknown		
Migration pattern	Study in progress	Ocean wide	[19]

FISHERIES

Shortfin mako sharks are often targeted by some semi-industrial, artisanal and recreational fisheries and are a bycatch of industrial fisheries (pelagic longline tuna and swordfish fisheries and purse seine fishery). In other Oceans, due to its energetic displays and edibility, the shortfin mako is considered one of the great gamefish of the world.

There is little information on the fisheries prior to the early 1970's, and some countries continue not to collect shark data while others do collect it but do not report it to IOTC. It appears that significant catches of sharks have gone unrecorded in several countries. Furthermore, many catch records probably under-represent the actual catches of sharks because they do not account for discards (i.e. do not record catches of sharks for which only the fins are kept or of sharks usually discarded because of their size or condition) or they reflect dressed weights instead of live weights.

Catches of shortfin mako sharks in the IOTC region are not given in this summary because their representativeness is highly uncertain.

FAO also compiles landings data on elasmobranchs, but the statistics are limited by the lack of species-specific data and data from the major fleets.

Estimated abundance and by-catch mortality in the Indian Ocean pelagic fisheries [2, 3, 4, 5, 6, 23]

Gears	PS	LL		BB/TROL/HAND	GILL	UNCL
		SWO	TUNA			
Abundance	rare	common		rare-common	rare-common	unknown

- Finning practice: **often** [11, 12]
- By-catch/release injury rate: **unknown**.
- Area overlap with IOTC management area: **high** (Fig)

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is little information available on shortfin mako shark biology and no information is available on stock structure.

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for shortfin mako are highly uncertain as is their utility in terms of minimum catch estimates.
2. **Nominal CPUE Trends:** data not available. Historical research data shows overall decline in CPUE and mean weight of mako sharks [4].
3. **Average weight in the catch by fisheries:** data not available.
4. **Number of squares fished:** CE data not available.

STOCK ASSESSMENT

No quantitative stock assessment has been undertaken by the IOTC Working Party on Ecosystems and Bycatch.

MANAGEMENT ADVICE

There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. There is no quantitative stock assessment or basic fishery indicators currently available for shortfin mako shark in the Indian Ocean therefore the stock status is highly uncertain.

Shortfin mako sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (over 24 years), mature at 7-8 years, and have relativity few offspring (<30 pups every three years), the shortfin mako sharks is vulnerable to overfishing.

EXECUTIVE SUMMARY OF THE STATUS OF THE SCALLOPED HAMMERHEAD SHARK RESOURCE

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

Scalloped hammerhead shark. *Sphyrna lewini* (Griffith & Smith, 1834)

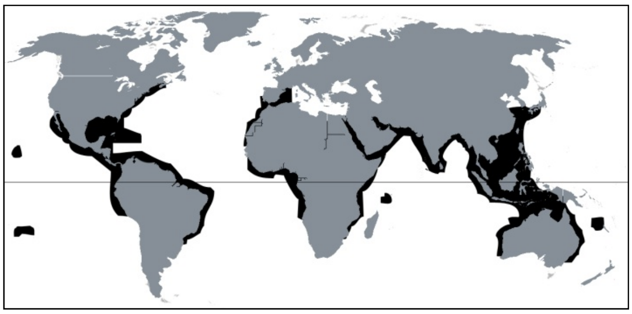
FAO code: **SPL**

Vulnerability and conservation status

Species	IUCN status [1]		
	Global status	WIO	EIO
Sphyrna lewini	NT/EN	-	LC

BIOLOGY

The scalloped hammerhead shark (*Sphyrna lewini*) is widely distributed and common in warm temperate and tropical waters down to 275 m. It is also found in estuarine and inshore waters.



The worldwide distribution of the scalloped hammerhead shark

In some areas, the scalloped hammerhead shark forms large resident populations. In other areas, large schools of small-sized sharks are known to migrate pole wards seasonally.

Scalloped hammerhead sharks feeds on pelagic fishes, other sharks and rays, squids, lobsters, shrimps and crabs.

The maximum age for Atlantic Ocean scalloped hammerheads is estimated to be over 30 years with the largest individuals reaching over 2.4 m.

Males in the Indian Ocean mature at around 1.4-1.65 m TL. Females mature at about 2.0 m TL. The scalloped hammerhead shark is viviparous with a yolk sac-placenta. The young are around 38-45 cm TL at birth, and litters consist of 15-31 pups. The reproductive cycle is annual and the gestation period is 9-10 months. The nursery areas are in shallow coastal waters.

- Fecundity: **medium** (<31 pups)
- Gestation Period: 9-10 months

Biological parameters in Indian Ocean

Parameters	Status	Area	References
Reproduction cycle	Unknown		
Size at first maturity	Partially known	east coast of southern Africa	[20]
Nursery ground	Unknown		
Growth	Unknown		
Migration pattern	Unknown		

FISHERIES

Scalloped hammerhead sharks are often targeted by some semi-industrial, artisanal and recreational fisheries and are a bycatch of industrial fisheries (pelagic longline tuna and swordfish fisheries and purse seine fishery).

There is little information on the fisheries prior to the early 1970's, and some countries continue not to collect shark data while others do collect it but do not report it to IOTC. It appears that significant catches of sharks have gone unrecorded in several countries. Furthermore, many catch records probably under-represent the actual catches of sharks because they do not account for discards (i.e. do not record catches of sharks for which only the fins are kept or of sharks usually discarded because of their size or condition) or they reflect dressed weights instead of live weights.

Catches of scalloped hammerhead sharks in the IOTC region are not given in this summary because their representativeness is highly uncertain.

FAO also compiles landings data on elasmobranchs, but the statistics are limited by the lack of species-specific data and data from the major fleets.

Estimated abundance and by-catch mortality in the Indian Ocean pelagic fisheries [2, 3, 4, 23]

Gears	PS	LL		BB/TROL/HAND	GILL	UNCL
		SWO	TUNA			
Abundance	rare-common[11]	common		absent	common	unknown

- Finning practice: **very often** [11, 12, 22]
- By-catch/release injury rate: **unknown**
- Area overlap with IOTC management area: **high** (map to be updated)

AVAILABILITY OF INFORMATION FOR STOCK ASSESSMENT

There is little information available on scalloped hammerhead shark biology and no information is available on stock structure.

Possible fishery indicators:

1. **Trends in catches**: The catch estimates for scalloped hammerhead are highly uncertain as is their utility in terms of minimum catch estimates.
2. **Nominal CPUE Trends:** data not available.
3. **Average weight in the catch by fisheries:** data not available.
4. **Number of squares fished:** CE data not available.

STOCK ASSESSMENT

No quantitative stock assessment has been undertaken by the IOTC Working Party on Ecosystems and Bycatch.

MANAGEMENT ADVICE

There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. There is no quantitative stock assessment or basic fishery indicators currently available for scalloped hammerhead shark in the Indian Ocean therefore the stock status is highly uncertain.

[11] Depends on tuna schools/associations type

Scalloped hammerhead sharks are commonly taken by a range of fisheries in the Indian Ocean. They are extremely vulnerable to gillnet fisheries. Furthermore, pups occupy shallow coastal nursery grounds, often heavily exploited by inshore fisheries. Because of their life history characteristics – they are relatively long lived (over 30 years), and have relativity few offspring (<31 pups each year), the scalloped hammerhead shark is vulnerable to overfishing.

REFERENCES

[1] IUCN Species Survival Commission's Shark Specialist Group. Review of Chondrichthyan Fishes. 15, 72 p. 2007. Information Press, Oxford, UK., IUCN–The World Conservation Union, the United Nations Environment Programme (UNEP) and the Secretariat of the Convention on the Conservation of Migratory Species of Wild Animals (CMS).IUCN and UNEP/ CMS Secretariat, Bonn, Germany. Technical Report Series.

[2] Romanov, E. V. 2002. Bycatch in the tuna purse-seine fisheries of the western Indian Ocean. Fishery Bulletin 100:90-105.

[3] Romanov, E. V. 2008. Bycatch and discards in the Soviet purse seine tuna fisheries on FAD-associated schools in the north equatorial area of the Western Indian Ocean. Western Indian Ocean Journal of Marine Science 7:163-174.

[4] Romanov, E., Bach, P., Romanova, N., 2008. Preliminary estimates of bycatches in the western equatorial Indian Ocean in the traditional multifilament longline gears (1961-1989) IOTC Working Party on Ecosystems and Bycatch (WPEB) Bangkok, Thailand. 20-22 October, 2008. 18 p.

[5] Petersen, S., Nel, D., Ryan, P., and Underhill, L., 2008. Understanding and mitigating vulnerable bycatch in southern African trawl and longline fisheries. 225 p. WWF South Africa Report Series.

[6] Ariz, J., A. Delgado de Molina, M. L. Ramos, and J. C. Santana., 2006. Check list and catch rate data by hook type and bait for bycatch species caught by Spanish experimental longline cruises in the south-western Indian Ocean during 2005. IOTC-2006-WPBy-04 2006.

[7] Campana, S. E., W. Joyce, and M. J. Manning. 2009. Bycatch and discard mortality in commercially caught blue sharks Prionace glauca assessed using archival satellite pop-up tags. Marine Ecology Progress Series 387:241-253.

[8] Poisson F., Gaertner J.C., Taquet M., Durbec J.P., Bigelow K.(submitted). Effects of the lunar cycle and operational factors on the catches of pelagic longlines in the Reunion Island swordfish fishery.

[9] Boggs, C. H. 1992. Depth, capture time and hooked longevityof longline-caught pelagic fish: timing bites of fish with chips. Fishery Bulletin 90:642-658.

[10] Diaz, G. A., and Serafy J. E., 2005. Longline-caught blue shark (*Prionace glauca*): factors affecting the numbers available for live release. Fish. Bull. 103:720-724.

[11] Clarke, S. 2008. Use of shark fin trade data to estimate historic total shark removals in the Atlantic Ocean. Aquat. Living Resour. 21:373-381.

[12] Clarke, S. C., M. K. McAllister, E. J. Milner-Gulland, G. P. Kirkwood, C. G. J. Michielsens, D. J. Agnew, E. K. Pikitch, H. Nakano, and M. S. Shivji. 2006. Global estimates of shark catches using trade records from commercial markets. Ecology Letters 9:1115-1126.

[13] Gubanov, E. P. and V. N. Gigor'yev. 1975. Observations on the Distribution and Biology of the Blue Shark Prionace glauca (Carcharhinidae) of the Indian Ocean // Raspredelenie i nekotorye cherty biologii goluboj akuly Prionace glauca L. (Carcharhinidae) Indijskogo okeana. Voprosy Ikhtiologii 15:43-50.

[14] Mejuto J., Garcia-Cortes B., 2006. Reproductive and reproduction parameters of the blue shark Prionace glauca, on the basis of on-board observations at sea in the Atlantic, Indian and Pacific Oceans. ICCAT Col. Vol. Sci. Pap. Vol. 58(3):951-973 (CD vers SCRS/2004/103).

[15] Anderson, R.C., Ahmed H. 1993. The shark fisheries in the Maldives. FAO, Rome, and Ministry of Fisheries, Male, Maldives.

[16] E.V. Romanov, 2009 pers. comm.

[17] Rabehagasoa N., Bach P., Campana S., Lorrain A., Morize E., Romanov E.V., Bruggemann H., 2009. Individual age and growth of the blue shark (Prionace glauca) in the South West Indian Ocean: Preliminary results. IOTC-2009-11. 16 p.

[18] Romanov E., Romanova, N. 2009. Size distribution and length-weight relationships for some large pelagic sharks in the Indian Ocean. IOTC-2009-WPEB-06. 12 p.

[19] Mejuto J., Garcia-Cortes B., Ramos-Cartelle, A., 2005. Tagging-recapture activities of large pelagicsharks carried out by Spain in collaboration with the tagging programs of other countries. SCRS/2004/104 Col. Vol. Sci. Pap. ICCAT, 58(3): 974-1000 (2005).

[20] Scomal, G.B. and L.J. Natanson. 2003. Age and growth of the blue shark (Prionace glauca) in the North Atlantic Ocean. Fishery Bulletin 101:627-639.

[20] Bass A.J., D' Aubrey J.D., Kistnasamy N., 1973. Sharks of the east coast of southern Africa. I. The genus Carcharhinus (Carcharhinidae). Oceanogr. Res. Inst. (Durban) Investig. Rep. 33: 168 pp.

[22] Holmes, B. H., D. Steinke, and R. D. Ward. 2009. Identification of shark and ray fins using DNA barcoding. Fisheries Research 95:280-288.

[23] Dudley, S. F. J. and C. A. Simpfendorfer. 2006. Population status of 14 shark species caught in the protective gillnes off KwaZulu-Natal beaches, South Africa. Marine and Freshwater Research 57:225-240.

[24] IOTC, 2007. Compilation of information on blue shark (Prionace glauca), silky shark (Carcharhinus falciformis), oceanic whitetip shark (Carcharhinus longimanus), scalloped hammerhead (Sphyrna lewini) and shortfin mako (Isurus oxyrinchus) in the Indian Ocean. IOTC-2007-WPEB-INF01. 18 p.

EXECUTIVE SUMMARY OF THE STATUS OF SEA TURTLES IN THE INDIAN OCEAN

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

OVERVIEW OF THE SEA TURTLE SPECIES

Six species of sea turtles[12] inhabit the Indian Ocean and likely interact with the fisheries for tuna and tuna-like species.

Green turtle

The green turtle (*Chelonia mydas*) is the largest of all the hard-shelled sea turtles, growing up to one meter long and weighing 130-160 kg. Adult green turtles are unique among sea turtles in that they are herbivorous, feeding on seagrasses and algae. Green turtles reach sexual maturity between 20 and 50 years. Females return to their natal beaches (i.e. the same beaches where they were born) every 2 to 4 years to nest, laying several clutches of about 125 eggs at roughly 14-day intervals several times in a season. However, very few hatchlings survive to reach maturity – perhaps fewer than one in 1,000.

The green turtle is globally distributed and generally found in tropical and subtropical waters along continental coasts and islands between 30°N and 30°S. Green turtles primarily use three types of habitat: oceanic beaches (for nesting), convergence zones in the open ocean, and benthic feeding grounds in coastal areas. Adults migrate from foraging areas to mainland or island nesting beaches and may travel hundreds or thousands of kilometers each way. After emerging from the nest, hatchlings swim offshore, where they are believed to caught up in major oceanic current systems and live for several years, feeding close to the surface on a variety of pelagic plants and animals. Once the juveniles reach a certain age/size range, they leave the pelagic habitat and travel to nearshore foraging grounds.

The Indian Ocean hosts some of the largest nesting populations of green turtles in the world, particularly on oceanic islands in the southwest and on islands in SE Asia. Many of these populations are now recovering after intense exploitation in the last century greatly reduced the populations; some populations are still declining. The green turtle is one of the most widely distributed and commonest of the marine turtle species in the Indian Ocean.

During the 19th and 20th centuries intense exploitation on green turtles provided onboard red meat for sustained cruises of sailing vessels before the time of refrigeration, as well as meat and calipee for an international market. Several nesting populations in the Indian Ocean were devastated as a result.

Hawksbill turtle

The hawksbill (*Eretmochelys imbricata*) turtle is small to medium-sized compared to other sea turtle species. In the Indian Ocean, adults weigh 45 to 70 kg, but can grow to as large as 90 kg. Female hawksbills return to their natal beaches every 2-3 years to nest. A female hawksbill may lay 3-5, or more, nests in a season, which contain an average of 130 eggs.

Hawksbill turtles use different habitats at different stages of their life cycle, but are most commonly associated with coral reefs. Post-hatchlings (oceanic stage juveniles) are believed to occupy the pelagic environment. After a few years in the pelagic zone, small juveniles recruit to coastal foraging grounds. This shift in habitat also involves a shift in feeding strategies, from feeding primarily at the surface to feeding below the surface primarily on animals

12 The following biological information on marine turtle species found around the Indian Ocean is derived largely from the NOAA Fisheries, Office of Protected Resources, website: (http://www.nmfs.noaa.gov/pr/species/turtles/), supplemented by other sources (such as a website of the Australian Government, Department of Environment, Water, Heritage and the Arts for information on the Flatback turtle)

associated with coral reef environments. Their narrow, pointed beaks allow them to prey selectively on soft-bodied animals like sponges and soft corals

Hawksbill turtles are circumtropical, typically occurring from 30°N to 30°S latitude. Adult hawksbill turtles are capable of migrating long distances between nesting beaches and foraging areas, which are generally shorter to migrations of green and loggerhead turtles.

In modern times hawksbills are solitary nesters (although some scientists postulate that before their populations were devastated they may have nested on some beaches in concentrations) and thus, determining population trends or estimates on nesting beaches is difficult. Decades long protection programs in some places, particularly at several beaches in the Indian Ocean, have resulted in population recovery. Hawksbills – although generally not found in large concentrations, are widely distributed in the Indian Ocean. The largest nesting populations of hawksbills in or around the Indian Ocean (which are among the largest in the world) occur in the Seychelles, Indonesia and Australia.

The keratinous (horn-like) scutes of the hawksbill are known as "tortoise shell," and they were sought after for manufacture of diverse articles in both the Orient and Europe. From before the time of Christ tortoise shell was one of the most important trade commodities in a well developed trade network in the Indian Ocean.

Leatherback turtle

The leatherback (*Dermochelys coriacea*) is the largest turtle and the largest living reptile in the world. Mature males and females can grow to 2 m and weigh almost 900 kg. Females lay clutches of approximately 100 eggs on sandy, tropical beaches. They nest several times during a nesting season.

The leatherback is the only sea turtle that lacks a hard shell: there are no large external keratinous scutes and the underlying bony shell is composed of a mosaic of hundreds of tiny bones. Adults are capable of tolerating water temperatures well below tropical and subtropical conditions, and special physiological adaptations allow them to maintain body temperature above cool water temperatures. They specialise on soft bodied invertebrates found in the water column, particularly jelly fish and other sorts of "jellies." The leatherback is the most wide ranging marine turtle species, and regularly migrates enormous distances, e.g. between the Indian and south Atlantic Oceans. They are commonly found in pelagic areas, but they also forage in coastal waters in certain areas. The distribution and developmental habitats of juvenile leatherbacks are poorly understood. While the leatherback is not as common in the Indian Ocean as other species, important nesting populations are found in and around the Indian Ocean, including in Indonesia, South Africa, Sri Lanka and India's Andaman and Nicobar Islands.

Loggerhead turtle

The loggerhead turtle (*Caretta caretta*) may grow to over one meter long and weigh around 110 kg or more. It reaches sexual maturity at around 35 years of age. Loggerheads are circumglobal, occurring throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans.

Loggerheads nest in relatively few countries in the Indian Ocean and the number of nesting females is generally small, except on Masirah Island (Sultanate of Oman) which supports one of only two loggerhead nesting beaches in the world that have greater than 10,000 females nesting per year. The hatchlings and juveniles are pelagic, living in the open ocean, while the adults forage in coastal areas. Studies in the Atlantic and Pacific Oceans show that loggerheads can spend decades living on the high seas, crossing from one side of an ocean basin to another before taking up residence on benthic coastal waters. Their enormous heads and powerful jaws enable them to crush large marine molluscs, on which they specialise.

Olive ridley

The olive ridley (*Lepidochelys olivacea*) turtle is considered the most abundant sea turtle in the world, with an estimated 800,000 nesting females annually. Adults are relatively small, weighing on average around 45 kg. As with other species of sea turtles, their size and morphology varies from region to region.

The olive ridley is globally distributed in the tropical regions of the South Atlantic, Pacific, and Indian Oceans. It is mainly a pelagic species, but it has been known to inhabit coastal areas, including bays and estuaries. Olive ridleys often migrate great distances between feeding and breeding grounds. They mostly breed annually and have an annual migration from pelagic foraging, to coastal breeding and nesting grounds, back to pelagic foraging. They can dive to depths of about 150 m to forage. Olive ridleys reach sexual maturity in around 15 years, a young age compared to some other sea turtle species. Many females nest every year, once or twice a season, laying clutches of approximately 100 eggs.

The olive ridley has one of the most extraordinary nesting habits in the natural world. Large groups of turtles gather off shore of nesting beaches. Then, all at once, vast numbers of turtles come ashore and nest in what is known as an "arribada". During these arribadas, hundreds to thousands of females come ashore to lay their eggs. In the northern Indian Ocean, arribadas occur on three different beaches along the coast of Orissa, India. Gahirmatha used to be one of the largest arribada nesting sites in the world. However, arribada nesting events have been less frequent there in recent years and the average size of nesting females has been smaller, indicative of a declining population. Declines in solitary nesting of olive ridleys have been recorded in Bangladesh, Myanmar, Malaysia, and Pakistan. In particular, the number of nests in Terengganu, Malaysia has declined from thousands of nests to just a few dozen per year. Solitary nesting also occurs extensively throughout this species' range. Despite the enormous numbers of olive ridleys that nest in Orissa, this species is not generally common throughout much of the Indian Ocean.

Flatback turtle

The flatback turtle (*Natator depressus*) nests exclusively along the northern coast of Australia. It gets its name from its relatively flat, smooth shell, unlike other marine turtles which have a high domed shell. The flatback is a medium-sized marine turtle, growing to up to one meter long and weighing up to 90 kg. It is carnivorous, feeding mostly on soft-bodied prey such as sea cucumbers, soft corals, jellyfish, molluscs and prawns.

Flatback turtles are found in northern coastal areas, from Western Australia's Kimberley region to the Torres Strait extending as far south as the Tropic of Capricorn. Feeding grounds also extend to the Indonesian Archipelago and the Papua New Guinea Coast. Although flatback turtles do occur in open seas, they are common in inshore waters and bays where they feed on the soft-bottomed seabed.

Flatbacks have the smallest migratory range of any sea turtle species, though they do make long reproductive migrations of up to 1300 km. This restricted range means that the flatback is vulnerable to habitat loss, especially breeding sites

AVAILABILITY OF INFORMATION ON THE INTERACTIONS BETWEEN SEA TURTLES AND FISHERIES FOR TUNA AND TUNA-LIKE SPECIES

IOTC and the Indian Ocean -- South-East Asian Marine Turtle Memorandum of Understanding, an agreement under the Convention on Migratory Species (IOSEA) are actively collecting a range of information on fisheries and sea turtle interactions. The IOSEA database covers information from a wider range of fisheries and gears than IOTC does.

The IOSEA Online Reporting Facility[13] compiles information through IOSEA National Reports on potential sea turtle fisheries interactions, as well as various mitigation measures put in place by its Signatory States and collaborating organisations. For example, members provide information on fishing effort and perceived impacts of fisheries that may interact with sea turtles, including longlines, purse seines, FADs, and gillnets.

While the information is incomplete for some countries and is generally descriptive rather than quantitative, it has begun to provide a general overview of potential fisheries interactions as well as their extent. No information is available for China, Taiwan,China , Japan, Republic of Korea (among others) which are not yet signatories to IOSEA. Information is also provided on such mitigation measures as appropriate handling techniques, gear modifications, spatial/temporal closures etc.

IOSEA is collecting all of the above information with a view to providing a regional assessment of member States' compliance with the FAO Guidelines on reducing fisheries interactions with marine turtles.

---

[13] (www.ioseaturtles.org/report.php) and Dr Jack Frazier (Smithsonian Institution)

The IOTC has implemented data collection measures using onboard observers to better understand the nature and extent of the interactions between fisheries for tuna and tuna-like species in the Indian Ocean and sea turtles.

IOTC members have implemented a number of national observer programmes that are providing information on the levels of sea turtle bycatch. While there have been the recent improvements in the observer data from purse seine operations, coverage of longline and artisanal fleets remains low.

Purse seine

EC observers (covering on average 5 % of the operations annually) reported 74 sea turtles were caught by French and Spanish purse seiners over the period 2003 to 2007[14]. The most common bycatch species reported are olive ridley, green and hawksbill, and these were mostly caught on log sets and returned to the sea alive (although there is no systematic information on survivorship after release). Furthermore, mortality levels of marine turtles due to entanglement in the drifting FADs set by the fishery are unknown but could, most probably, be largely decreased with the developpement of ecological FADs.

Long line

While information on most of the major longline fleets in the IOTC is currently not available, in the South African longline fisheries the sea turtle bycatch mainly comprises leatherback turtles, with lesser amounts of loggerheads, hawksbills and greens[15]. Estimated average catch rates of sea turtles ranged from 0.005 to 0.3 turtles per 1000 hooks and varied by location, season and year. The highest catch rate reported in one trip was 1.7 turtles per 1000 hooks in oceanic waters.

The Soviet Indian Ocean Tuna Longline Research Programme undertaken in the western Indian Ocean from 1964 to 1988 reported catching 2 sea turtles from a total of 1346 sets (around 660,00 hooks)[16]. However, it is not known if there was systematic recording of sea turtle captures.

Over the period 1997 to 2000, the Programme Palangre Réunionnais[17] examined sea turtle bycatch on 5,885 longline sets in the vicinity of Reunion Island (19-25° S, 48-54° E). The fishery caught 47 leatherbacks, 30 hawksbills, 16 green turtles and 25 unidentified sea turtles. This equated to an average catch rate of less than 0.02 sea turtles per 1000 hooks over the 4 years.

Nonetheless, information on longline interactions with sea turtles in the Indian Ocean is at a very preliminary stage, and it is not known if this fishing activity represents a serious threat to sea turtles, as is the case in most other fisheries regions of the world.

"Gillnets"

Overall, the incidental captures of sea turtles by longlines and purse seine fishing is considered to be relatively minor compared to that of gillnets. While the IOTC currently has virtually no information on sea turtle-"gillnet" interactions, the IOSEA database indicates that the coastal mesh net fisheries occur in about 90% of IOSEA Signatory States in the Indian Ocean, and the fishery is considered to have moderate to relatively high impact on sea turtles in about half of these IOSEA member States. Given the widespread abundance of mesh net fisheries in the Indian Ocean, there is clearly an urgent need for careful, systematic information on this fishery and its impacts on sea turtles.

IOTC'S APPROACH TO ENHANCE THE CONSERVATION OF SEA TURTLES

The IOTC collaborates with IOSEA. With 30 Signatory States bordering the Indian Ocean and contiguous waters, the IOSEA MoU is the world's largest intergovernmental agreement focusing on the conservation of marine turtles and their habitats.

---

[14] IOTC-2008-WPEB-08
[15] IOTC-2006-WPBy-15
[16] IOTC-2008-WPEB-10
[17] Poisson F. and Taquet M. (2001) L'espadon: de la recherche à l'exploitation durable. Programme palangre réunionnais, rapport final, 248 p. available in the website www.ifremer.fr/drvreunion

In accordance with the FAO Technical Guidelines to Reduce Sea Turtle Mortality in Fishing Operations, IOTC took in 2009 a Resolution to mitigate the impact of fishing operations on sea turtles:

A. In general

i) CPCs shall implement as appropriate the FAO Guidelines.

ii) CPCs shall collect all data on their vessels' interaction s with with marine turtles in fisheries targeting the species covered by the IOTC Agreement

iii) CPC shall also furnish available information to the Scientific Committee on successful mitigation measures and other impacts on marine turtles in the IOTC Area, such as the deterioration of nesting sites and swallowing of marine debris.

iv) CPCs shall require fishermen on vessels targeting species covered by the IOTC Agreement to bring aboard, if practicable, any captured hard shelled turtle that is comatose or inactive as soon as possible and foster its recovery, including aiding in its resuscitation, before safely returning it to the water. CPCs shall ensure that fishermen are aware of and use proper mitigation and handling techniques and keep on board all necessary equipment for the release of turtles, in accordance with guidelines to be adopted by the IOTC.

v) CPCs shall undertake research trials of circle hooks, use of whole finfish for bait, alternative FAD designs, alternative handling techniques, gillnet design and fishing practices and other mitigation methods which may improve the mitigation of adverse effects on turtles, and report the results of these trials to the Scientific Committee (SC), at least (60 days) in advance of the annual meetings of the SC

B. For purse seine fisheries

(a) Ensure that operators of such vessels, while fishing in the IOTC Area:

(i) To the extent practicable, avoid encirclement of marine turtles, and if a marine turtle is encircled or entangled, take practicable measures to safely release the turtle.

(ii) To the extent practicable, release all marine turtles observed entangled in fish aggregating devices (FADs) or other fishing gear.

(iii) If a marine turtle is entangled in the net, stop net roll as soon as the turtle comes out of the water; disentangle the turtle without injuring it before resuming the net roll; and to the extent practicable, assist the recovery of the turtle before returning it to the water.

(iv) Carry and employ dip nets, when appropriate, to handle turtles.

(b) Encourage such vessel to adopt FAD designs which reduce the incidence of entanglement of turtles;

(c) Require that operators of such vessels record all incidents involving marine turtles during fishing operations in their logbooks18 and report such incidents to the appropriate authorities of the CPC;

(d) Provide the results of the reporting under paragraph 7(c) to the Commission as part of the reporting requirement of paragraph 2.

C. For longline fisheries

(a) Ensure that the operators of all longline vessels carry line cutters and de-hookers in order to facilitate the appropriate handling and prompt release of marine turtles caught or entangled, and that they do so in accordance with IOTC Guidelines to be developed. CPCs shall also ensure that operators of such vessels are required to carry and use, where appropriate, dip-nets, in accordance with guidelines to be adopted by the IOTC;

(b) Encourage the use of whole finfish bait where appropriate;

(c) Require that operators of such vessels record all incidents involving marine turtles during fishing operations in their logbooks19 and report such incidents to the appropriate authorities of the CPC;

[18] This information should include, where possible, details on species, location of capture, conditions, actions taken on board and location of release

[19] This information should include, where possible, details on species, location of capture, conditions, actions taken on board and location of release

(d) Provide the results of the reporting under paragraph 6(c) to the Commission as part of the reporting requirement of paragraph 2.

D. For gilnet fisheries

(a) Require that operators of such vessels record all incidents involving marine turtles during fishing operations in their logbooks20 and report such incidents to the appropriate authorities of the CPC;

(b) Provide the results of the reporting under paragraph 5(a) to the Commission as part of the reporting requirement of paragraph 2

In an effort to better understand the situation regarding marine turtle interactions, the IOTC has implemented data collection measures to improve the collection of scientific data regarding all sources of mortality for sea turtle populations, including but not limited to, data from fisheries within the IOTC Area to enhance the proper conservation of sea turtles

IOSEA has also been collecting information on progress made towards the completion of national plans of action for sea turtles. According to information available as at November 2008, six Indian Ocean IOSEA Signatory States (Australia, Comoros, Myanmar, Saudi Arabia, Seychelles, United Kingdom) already have national action plans in place while another ten (Bangladesh, Eritrea, Indonesia, Kenya, Madagascar, Pakistan, South Africa, Sri Lanka, Thailand, United Republic of Tanzania) are working towards this end.

MANAGEMENT CONCERNS

The IOTC notes that the International Union for Conservation of Nature (IUCN) has classified the olive ridley turtle as vulnerable, the green turtle and loggerhead turtle as endangered and the hawksbill turtle and leatherback turtle as critically endangered. It is important to point out that a number of international global environmental accords (e.g., CMS, CBD), as well as numerous fisheries agreements obligate States to provide protection for these species.

While the status of sea turtles is affected by a range of factors such as degradation of nesting beaches and targeted harvesting of eggs and turtles, the level of mortality of sea turtles due to capture by gillnets and to a lesser extent purse seine fishing and longline is not known. Notwithstanding this, it is acknowledged that the impact on sea turtle populations from fishing for tuna and tuna-like species may increase if fishing pressure increases, or if the status of the sea turtle populations worsens due to other factors such as an increase in fishing pressure from other fisheries or anthropological or climatic impacts.

[20] This information should include, where possible, details on species, location of capture, conditions, actions taken on board and location of release

EXECUTIVE SUMMARY OF THE STATUS OF SEA BIRDS

(AS ADOPTED BY THE IOTC SCIENTIFIC COMMITTEE IN DECEMBER 2009)

OVERVIEW OF SEABIRD SPECIES IN THE IOTC KNOWN OR LIKELY TO BE VULNERABLE TO MORTALITY FROM FISHING OPERATIONS

Seabirds are species that derive their sustenance primarily from the ocean and which spend the bulk of their time (when not on land at breeding sites) at sea. Seabirds are characterised as being late to mature and slow to reproduce; some do not start to breed before they are ten years old. Most lay a single egg each year, with some albatross species only breeding every second year. To compensate for this, seabirds are long-lived, with natural adult mortality typically very low. These traits make any increase in human-induced adult mortality potentially damaging for population viability, as even small increases in mortality can result in population decreases.

Eight seabird families occur within the convention area of the Indian Ocean Tuna Commission, either regularly or as breeding species. They are typically referred to as penguins, albatrosses and petrels, tropicbirds, gannets and boobies, cormorants, frigatebirds, and skuas, gulls and terns. Of these, the procellariiformes (albatrosses and petrels) are the species most susceptible to being caught as bycatch in longline fisheries (Wooller *et al.* 1992, Brothers *et al.* 1999), and therefore are most susceptible to direct interactions with IOTC fisheries.

Worldwide, 18 of the 22 species of albatross are listed by the IUCN as globally threatened, with bycatch in fisheries identified as the key threat to the majority of these species (Robertson & Gales 1998). Impacts of longline fisheries on seabird populations have been demonstrated (e.g. Weimerskirch & Jouventin 1987, Weimerskirch *et al.* 1997, Croxall *et al.* 1990, Tuck *et al.* 2001, Nel *et al.* 2003). In general, other IOTC gear types (including purse seine, bait boats, troll lines, and gillnets) are considered to have low incidental catch of seabirds, however data remain limited.

The southern Indian Ocean is of global importance in relation to albatross distribution: seven of the 18 species of southern hemisphere albatrosses have breeding colonies on Indian Ocean islands[21]. In addition, all but one[22] of the 18 southern hemisphere albatrosses forage in the Indian Ocean at some stage in their life cycle. The Indian Ocean is particularly important for **Amsterdam Albatross** (Critically Endangered) and **Indian Yellow-nosed Albatross** (Endangered), which are endemic to the southern Indian Ocean, as well as **Shy Albatross** (endemic to Tasmania, and which forages in the area of overlap between IOTC and WCPFC), **Wandering Albatross** (74% global breeding pairs), **Sooty Albatross** (39% global breeding pairs), **Light-mantled sooty Albatross** (32% global breeding pairs), **Grey-headed Albatross** (20% global breeding pairs) and **Northern and Southern Giant-petrel** (26% and 30% global breeding pairs, respectively).

AVAILABILITY OF INFORMATION ON THE INTERACTIONS BETWEEN SEABIRDS AND FISHERIES FOR TUNA AND TUNA-LIKE SPECIES

Data on seabird bycatch in IOTC longline fisheries have been reported to the IOTC WPEB by South Africa, Spain, Chinese Taipei and Australia. A list of the seabird species recorded as caught in IOTC longline fisheries is shown in Table 1. However, not all reports identify birds to a species level and, overall, information on seabird bycatch in the IOTC area remains very limited (Gauffier 2007).

[21] Amsterdam, Black-browed, Grey-headed, Indian yellow-nosed, Light-mantled, Sooty and Wandering albatrosses

[22] Atlantic Yellow-nosed Albatross (*Thalassarche chlororhynchos)*

Table 1. List of seabird species recorded as caught in longline fisheries within IOTC convention area

Species	Latin name	IUCN threat status
Black-browed albatross	*Thalassarche melanophrys*	Endangered
Shy albatross	*Thalassarche cauta*	Near Threatened
Sooty albatross	*Phoebetria fusca*	Endangered
Indian yellow-nosed albatross	*Thalassarche carteri*	Endangered
Wandering albatross	*Diomedia exulans*	Vulnerable
White-capped albatross	*Thalassarche steadi*	Near Threatened
Northern giant-petrel	*Macronectes halli*	Least Concern
White-chinned petrel	*Procellaria aequinoctialis*	Vulnerable
Grey petrel	*Procellaria cinerea*	Near Threatened
Flesh-footed shearwater	***Puffinus carneipes***	Least Concern
Cape gannet	***Morus capensis***	Vulnerable

In the absence of data from observer programs recording seabird bycatch, risk of bycatch has been identified through analysis of the overlap between albatross and petrel distribution and IOTC longline fishing effort, based on data from the Global Procellariiform Tracking Database (ACAP 2007). The overlap between seabird distribution and IOTC longline fishing effort is shown in Table 2. A summary map indicating distribution is shown in Figure 1. The 2007 analysis of tracking data indicated that albatrosses breeding on Southern Indian Ocean islands spent 70-100% of their foraging time within areas overlapping with IOTC longline fishing effort. The analysis identified the proximity of the Critically Endangered Amsterdam Albatross and Endangered Indian Yellow-nosed Albatross to high levels of pelagic longline effort. Wandering, Shy, Grey-headed and Sooty albatrosses and White-chinned Petrels showed a high overlap with IOTC longline effort. Data on distribution during the non-breeding season was lacking for many species, including Black-browed Albatrosses and White-capped Albatrosses (known from bycatch data to be some of the most frequently caught species).

In 2009, new tracking data were presented to the WPEB which filled a number of gaps from the 2007 analysis, particularly for Sooty Albatross, and for distributions of juveniles of Wandering Albatross, Sooty Albatross, White-chinned Petrel, Northern Giant-petrel (Delord & Weimerskirch 2009). This analysis indicated substantial overlap with IOTC longline fisheries.

Due to remaining gaps in tracking and observer data, it is likely that there are other species at risk of bycatch which are not identified in Tables 1 and 2.

Table 2. Overlap between the distribution of (a) breeding and (b) non-breeding albatrosses, petrels and shearwaters and IOTC fishing effort. Distributions were derived from tracking data held in the Global Procellariiform Tracking Database. Fishing data are based on the average annual number of hooks set per 5° grid square from 2002 to 2005. Overlap is expressed as the percentage of time spent in grid squares with longline effort, and is given for each breeding site as well the species' global population where sufficient data exists. Shaded squares represent species/colonies for which no tracking data were available.

Species/Population **(a) Breeding**	**Global Population (%)**	**Overlap (%)**
Amsterdam Albatross (Amsterdam)	100	100
Antipodean (Gibson's) Albatross		
Auckland Islands	59	1
Black-browed Albatross		1
Iles Kerguelen	1	88
Macquarie Island	<1	1
Heard & MacDonald	<1	
Iles Crozet	<1	
Buller's Albatross		2
Solander Islands	15	1
Snares Islands	27	2
Grey-headed Albatross		7
Prince Edward Islands	7	70
Iles Crozet	6	
Iles Kerguelen	7	
Indian Yellow-nosed Albatross		
Ile Amsterdam	70	100
Ile St. Paul	<1	
Iles Crozet	12	
Iles Kerguelen	<1	

Prince Edward Island	17	
Light-mantled albatross	39	
Shy Albatross		
Tasmania	100	67
Sooty Albatross		
Iles Crozet	17	87
Ile Amsterdam	3	
Ile St. Paul	<1	
Iles Kerguelen	<1	
Prince Edward Island	21	
Wandering Albatross		75
Iles Crozet	26	93
Iles Kerguelen	14	96
Prince Edward Islands	34	95
Northern Giant Petrel	26	
Southern Giant Petrel	9	
White-chinned Petrel		
Iles Crozet	?	60
Iles Kerguelen	?	
Prince Edward Island	?	
Short-tailed Shearwater		
Australia	?	3

Species/Population (b) Non-breeding	**Global Population (%)**	**Overlap (%)**
Amsterdam Albatross (Amsterdam)	100	98
Antipodean (Gibson's) Albatross		9
Antipodes Islands	41	3
Auckland Islands	59	13
Black-browed Albatross		
South Georgia (GLS data)	16	3
Heard & MacDonald Islands	<1	
Iles Crozet	<1	
Iles Kerguelen	1	
Buller's Albatross		13
Solander Islands	15	9
Snares Islands	27	15
Grey-headed Albatross		
South Georgia (GLS data)	58	16
Iles Crozet	6	
Iles Kerguelen	7	
Prince Edward Island	7	
Indian Yellow-nosed Albatross		
Light-mantled albatross		
Northern Royal Albatross		3
Chatham Islands	99	3
Taiaroa Head	1	1
Shy Albatross		
Tasmania	100	72
Sooty Albatross		
Southern Royal Albatross		
Wandering Albatross		59
White-Capped Albatross		
Northern Giant Petrel		
Southern Giant Petrel		
White-chinned Petrel		
Westland Petrel		
Short-tailed Shearwater		

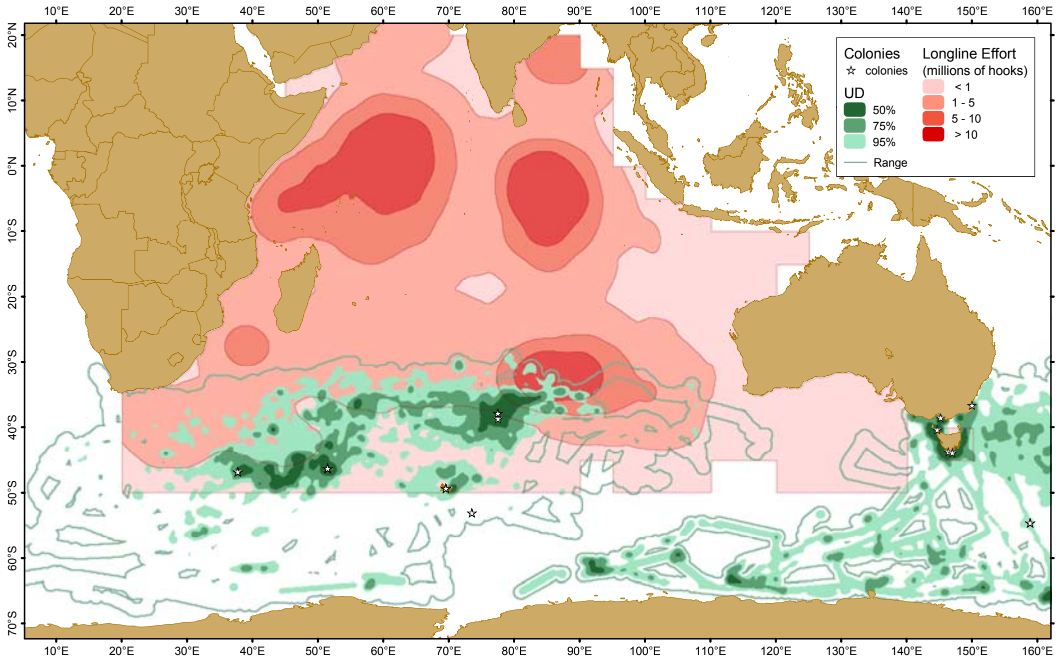


Figure 4. Distribution of breeding albatrosses, petrels and shearwaters in the Indian Ocean (see Table 2 for list of species included), and overlap with IOTC longline fishing effort for all gear types and fleets (average annual number of hooks set per 5° grid square from 2002 to 2005).

MANAGEMENT CONCERNS

Several solutions have been developed that can reduce seabird bycatch in longline fisheries. Evidence from areas where seabird bycatch was formerly high but has been reduced (e.g. Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) and South Africa) has shown that it is important to employ, simultaneously, a suite of mitigation measures. In addition, experience from CCAMLR and elsewhere has indicated a number of additional factors to contribute to successful reduction of seabird bycatch (Waugh et al. 2008; FAO 2008). These include research to optimise the effectiveness of mitigation measures and their ease of implementation, the use of onboard observer programs to collect seabird bycatch data, training of both fishermen and observers in relation to the problem and its solutions, and ongoing review of the effectiveness of these activities. Mitigation measures recommended by ACAP (Agreement on the Conservation of Albatrosses and Petrels) as effective include night setting, appropriate deployment of well designed tori (bird streamer) lines, and weighted branch lines that ensure that baits sink below the reach of diving seabirds quickly.

Reduction of seabird bycatch may even bring benefits to fishing operations for example by reducing the loss of bait to seabirds. Recent research in Brazil showed a reduction of 60% of the capture of seabirds with a single tori line. Moreover, when tori lines were deployed, higher catch rates (20-30%) were recorded for target species (Mancini et al. 2009). However, more detailed economic assessments across a diversity of regions, fishing gears and seasons are required to get a fuller picture of economic benefits.

IOTC'S APPROACH TO ENHANCE THE CONSERVATION OF SEABIRDS

Since 2005, IOTC has adopted three measures to address seabird bycatch. The current measure (Resolution 08/03) requires that all longline vessels fishing south of 30°S use at least two seabird bycatch mitigation measures selected from a table, including at least one measure from Column A (Table 3). In addition, CPCs are required to provide to the Commission all available information on interactions with seabirds. The effectiveness of this resolution and its impact on reducing seabird bycatch is due to be evaluated no later than the 2011 Commission meeting.

Table 3. Seabird bycatch mitigation measures in IOTC Resolution 08/03

Column A	**Column B**
Night setting with minimum deck lighting	Night setting with minimum deck lighting
Bird-scaring lines (Tori Lines)	Bird-scaring lines (Tori Lines)
Weighted branch lines	Weighted branch lines
	Blue-dyed squid bait
	Offal discharge control
	Line shooting device

IOTC Resolution 09/04 set out procedures to establish a regional observer programme within the convention area, with a required level of coverage of at least 5% of operations/sets observed. This programme will increase data available to IOTC on bycatch, including bycatch of seabirds.

GAPS IN OUR KNOWLEDGE OF FISHERY IMPACTS ON SEABIRDS

While Table 1 indicates several species known to have been caught in IOTC longline fisheries and analysis of tracking data has highlighted species likely to be at risk (Table 2), many data gaps remain.

Bycatch data from onboard observer programs

Data on seabird bycatch within IOTC fisheries is generally very sparse. Reports on observer data on seabird bycatch have been submitted to WPEB by South Africa, Spain, Chinese Taipei and Australia. Globally it is recognized that onboard observer programs are vital for collecting data on catches of non-target species, particularly those species which are discarded at sea. More specifically, observers need to monitor hooks during the hauling process to adequately assess seabird bycatch. Levels of observer coverage in excess of 5% are likely to be needed if IOTC is to be able to monitor seabird bycatch levels in its fisheries.

Bycatch data from longline fisheries in tropical areas

Observer data from longline fisheries occurring north of 20˚S is very sparse (Gauffier 2007). While seabird bycatch rates in tropical areas are generally assumed to be low, a number of threatened seabirds forage in these northern waters. Due to their small population sizes, bycatch at significant levels could be occurring but almost never observed.

Impacts of fishing gears other than longline

The impact of purse-seine fishing on tropical seabird species, including larids and sulids, is generally considered to be low, but data remain sparse and there are anecdotal observations which suggest that these interactions might merit closer investigation. However, no observation of incidental catch of seabird in the purse-seine fishery has been made in the Indian Ocean since the beginning of the fishery 25 years ago. The scale and impacts of gillnet fishing impacts on seabirds in the IOTC convention area is unknown. Outside the convention area, gillnet fishing has been recorded as catching high numbers of diving seabird species, including shearwaters and cormorants (e.g. Berkenbusch and Abraham 2007). The large coastal gillnet fisheries in the northern part of the IOTC clearly merit closer investigation, and should be considered a priority, as should the impact of lost or discarded gillnets (ghost fishing) on seabirds.

Indirect impacts of fisheries on seabirds

Many tropical seabird species forage in association with tunas, which drive prey to the surface and thereby bring them within reach of the seabirds. The depletion of tuna stocks could therefore have impacts on these dependent species. More widely, the potential ‘cascade’ effects of reduced shark and tuna abundances on the ecosystem is largely unknown. Although these kinds of impacts are difficult to predict, there are some examples that suggest meso-predator release has occurred in the Convention area (*e.g.* Romanov and Levesque 2009)

REFERENCES

ACAP 2007. Analysis of albatross and petrel distribution and overlap with longline fishing effort within the IOTC area: results from the Global Procellariiform Tracking Database. Paper submitted to the Third Session of the IOTC Working Party on Ecosystems and Bycatch, Victoria, Seychelles, 11-13 July 2007.

Baker, G.B., Double, M.C., Gales, R., Tuck, G.N., Abbott, C.L., Ryan, P.G., Petersen, S.L., Robertson, C.J.R., Alderman, R., 2007. A global assessment of the impact of fisheries-related mortality on shy and white-capped albatrosses: conservation implications. Biological Conservation 137, 319-333.

Berkenbusch, K., Abraham, E., 2007. The incidental capture of seabirds and marine mammals in non-commercial fisheries: a literature review, p. 34. Unpublished report to the New Zealand Ministry of Fisheries, Dragonfly, Wellington, NZ.

Brothers, N. P., Cooper, J., Løkkeborg, S. 1999. The incidental catch of seabirds by longline fisheries: worldwide review and technical guidelines for mitigation. *FAO Fisheries Circular* No. 937, Rome.

Croxall, J. P., Rothery, P., Pickering, S. P. C. & Prince, P. A. (1990). Reproductive performance, recruitment and survival of Wandering Albatrosses Diomedea exulans at Bird island, SouthGeorgia. J. Anim. Ecol. 59: 775–796.

Delord, K., Weimerskirch, H. New information on the distribution of southern seabirds and their overlap with the IOTC zone. Paper presented to the fifth meeting of the IOTC WPEB, Mombasa, Kenya 12 - 14 October 2009. IOTC-2009-WPEB-13

FAO, 2008. Report of the expert consultation on best practice technical guidelines for IPOA/NPOA-Seabirds. Bergen, Norway, 2-5 September 2008. FAO Fisheries and Aquaculture Report No. 880.

Gauffier, P. 2007. A review of the information on Bycatch in the Indian Ocean IOTC Secretariat. Paper submitted to the third meeting of the IOTC Working Party on Ecosystems and Bycatch, 11-13 July 2007, Victoria. IOTC-2007-WPEB-11

Mancini, P.L., Neves, T., Nascimento, L.A. Update of seabird bycatch and the effect of light toriline on seabird bycatch and fish catch rates in the pelagic longline fishery off southern Brazil. Paper presented to the SC-ECO intersessional meeting of the International Commission for the Conservation of Atlantic Tunas. Recife, Brazil, 9-12 June 2009, SCRS-09-060.

Nel, D. C., Taylor, F., Ryan, P. G. & Cooper, J. (2003). Population dynamics of wandering albatrosses Diomedea exulans at sub- Antarctic Marion Island: long-line fishing and environmental influences. Afr. J. Mar. Sci. 25: 503–517.

Robertson, G., Gales, R. 1998. *Albatross Biology and Conservation*. Surrey Beatty and Sons, NSW, Australia.

Romanov, E.V, Levesque, J.C. 2009. Crocodile shark (*Pseudocarcharias kamoharai)* distribution and abundance trends in pelagic longline fisheries. Paper presented to the fifth meeting of the IOTC WPEB, Mombasa, Kenya 12 - 14 October 2009. IOTC-2009-WPEB-Inf01.

Tuck, G.N., Polacheck, T., Croxall, J. P.,Weimerskirch, H. 2001. Modelling the impact of fishery by-catches on albatross populations. Journal of Applied Ecology 38, 1182-1196.

Waugh, S.M., Baker, G.B., Gales, R., Croxall, J.P., 2008. CCAMLR process of risk assessment to minimise the effects of longline fishing mortality on seabirds. Marine Policy 32, 442-454.

Weimerskirch, H. & Jouventin, P. (1987). Population dynamics of the wandering albatross, Diomedea exulans of the Crozet Islands: causes and consequences of the population decline. Oikos 49: 315–322.

Weimerskirch, H., N. Brothers, and P. Jouventin, Population dynamics of Wandering albatross Diomedea exulans and Amsterdam albatross D. amsterdamensis in the Indian Ocean and their relationships with long-line fisheries: conservation implications. Biological Conservation, 1997. 79: p. 257-270.Wooller, R.D., Bradley, J.S., Croxall, J.P. 1992. Long-term population studies of seabirds. *Trends in Ecology and Evolution* 7: 111-114.

APPENDIX VII
STATEMENT OF MAURITIUS AND UK WITH REGARDS TO CONSULTATION ON WHETHER TO ESTABLISH A MARINE PROTECTED AREA IN THE CHAGOS ARCHIPELAGO (BRITISH INDIAN OCEAN TERRITORY)

Statement of Mauritius

With regards to consultation on whether to establish a Marine Protected Area in the Chagos Archipelago, Mauritius states the following

a. Mauritius does not recognize the so-called British Indian Ocean Territory. The Chagos Archipelago was illegally excised from the territory of Mauritius prior to its independence in violation of UN General Assembly resolutions 1514 (XV) of 14 December 1960 and 2066 (XX) of 16 December 1965.

b. Under both Mauritian law and International law, the Chagos Archipelago is under the sovereignty of Mauritius. The creation of any Marine Protected Area in the Chagos Archipelago would therefore require the consent of Mauritius.

c. Since there is an ongoing bilateral Mauritius-UK mechanism for talks and consultations on issues relating to Chagos Archipelago and a third round of talks is envisaged early next year, it is inappropriate for the British Government to embark on consultation globally on the proposed Marine Protected Area outside the bilateral framework. This position was brought to the attention of the British Government by way of Note Verbale dated 23 November 2009 issued by the Ministry of Foreign Affairs, Regional Integration and International Trade to the UK Foreign and Commonwealth Office.

d. The establishment of a Marine Protected Area in the Chagos Archipelago should not be incompatible with the sovereignty of Mauritius over the Chagos Archipelago. A Marine Protected Area project in the Chagos Archipelago should address the issues of resettlement (Chagossians), access to the resources and the economic development of the islands in a manner which would not prejudice the effective exercise by Mauritius of its sovereignty over the Archipelago. A total ban on fisheries exploitation and omission of those issues from any Marine Protected Area project would not be compatible with the resolution of the sovereignty issue and progress in the ongoing talks.

e. The existing framework for bilateral talks between Mauritius and the United Kingdom and the related environmental issues should not be overtaken or bypassed by the process of consultation unilaterally launched by the British Government on the proposed Marine Protected Area.

Statement of the United Kingdom

The British Government maintains that the British Indian Ocean Territory is British and has been since 1814. It does not recognise the sovereignty claim of the Mauritian Government.

However, the British Government has recognised Mauritius as the only State which has a right to assert a claim of sovereignty when the United Kingdom relinquishes its own sovereignty.

Successive British Governments have given undertakings to the Government of Mauritius that the Territory will be ceded when no longer required for defence purposes.

The British Government remains open to discussions regarding the arrangements governing the British Indian Ocean Territory or the future of the Territory. The British Government has stated that when the time comes for the Territory to be ceded it will liase closely with the Government of Mauritius.

The British Government values its close and constructive cooperation with the Government of Mauritius on a wide range of issues and looks forward to it continuing.

APPENDIX VIII
PROPOSAL FOR A REVISED LIST OF SHARKS SPECIES IN RESOLUTION 08/04

UNDER RESOLUTION 08/04	UNDER NEW PROPOSAL		IUCN status		
Species/Genus	**Species/Genus (for logbook)**	**Detailed species list (for observers)**	**Global**	**WIO**	**EIO**
Blue Shark	Blue shark, *Prionace glauca*	Blue shark, *Prionace glauca*	NT	-	-
Mako Shark	Mako Sharks, *Isurus* spp.	Shortfin mako shark, *Isurus oxyrinchus*	NT	-	-
		Longfin mako shark, *Isurus paucus*	VU	-	-
Porbeagle	***TO BE REMOVED***	***TO BE REMOVED***[23]	VU	-	-
	Great White Shark, *Carcharodon carcharias*	Great white shark, *Carcharodon carcharias*	VU	-	-
	Crocodile Shark, *Pseudocarcharias kamoharai*	Crocodile shark, *Pseudocarcharias kamoharai*	NT	-	-
	Thresher Sharks, *Alopias* spp.	Pelagic thresher shark, *Alopias pelagicus*	DD/VU	-	-
		Bigeye thresher shark, *Alopias superciliosus*	DD/VU	-	VU
		Common thresher shark, *Alopias vulpinus*	DD/VU	-	VU
	Tiger Shark, *Galeocerdo cuvier*	Tiger shark, *Galeocerdo cuvier*	NT	-	-
	Requiem Sharks, *Carcharhinus* spp.	Silvertip shark, *Carcharhinus albimarginatus*	DD/NT	-	LC
		Silky shark, *Carcharhinus falciformis*	LC/NT	NT	NT
		Oceanic whitetip shark, *Carcharhinus longimanus*	VU	-	-
		Sandbar shark, *Carcharhinus plumbeus*	NT/VU	DD	NT
		Requiem shark nei.[24], *Carcharhinus* spp.			
	Hammerhead Sharks, *Sphyrna* spp.	Winghead shark, *Eusphyra blochii*	NT	-	-
		Scalopped shark, *Sphyrna lewini*	NT/EN	-	LC
		Great hammerhead, *Sphyrna mokarran*	EN	EN	DD
		Smooth hammerhead, *Sphyrna zygaena*	NT	-	LC
Other Sharks	Other Sharks				
	Pelagic Stingray, *Pteroplatytrygon violacea*	Pelagic stingray, *Pteroplatytrygon violacea*	LC	-	-

[23] Little overlap with IOTC fisheries. For info see IOTC-2009-WPEB-05

[24] More than another 10 species occurs in the LL catches but their occurrence is rare and identification usually very difficult.

APPENDIX IX
PROPOSAL FOR A VOLUNTARY DEPREDATION FORM FOR ARTISANAL FISHERIES

Confidential data
For statistical purposes only
None of the fields are obligatory

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

Tuna Statistics in the Indian Ocean
IOTC Form 99:
Voluntary reporting form for depredation and other non-target species for small-scale fisheries

Page ___ of ___

Vessel name	
Vessel length, m	
Fishing area	
Landing site	
Country/flag	

Observation type	
Single operation	☐
Several operations	☐
No of operations	

Position/area	
Lat	**Long**
DD°MM' S/N	DDD°MM' E

Type of Gear			**Effort**				
Longline	**Pelagic drifting**	☐		**Hooks**			
	Pelagic statinary	☐		**Hooks**			
	Bottom	☐		**Hooks**			
Gillnet	**Pelagic drifting**	☐		**Sections of**		**m length**	
	Pelagic statinary	☐		**Sections**		**m length**	
	Bottom	☐		**Sections**		**m length**	
Purse seine		☐		**Sets**	**Length/height**	/	
Ring net		☐		**Sets**	**Length/height**	/	

Operation details			
Fishing type		**Bait**	
Night fishing	☐	**Fish whole**	☐
Day fishing	☐	**Fish parts**	☐
Soaking time, h		**Squid**	☐
Target species		**Attractant used**	
Tuna	☐		
Swordfish	☐	**Lightsteaks**	☐
Sharks	☐	**Fish/fish blood**	☐

Catch details		
Catch, no	**Non-damaged**	**Damaged**
Total		
Tuna		
Swordfish		
Other billfish		
Sharks		
Other fish		

Damage details				**Sightings**								**Catch/bycatch species involved in depredation**			
Damage done by	**Damage of**			Along the gear				Along the vessel				Numbers			
				Numbers				Numbers							
	Catch	Bait	Gear	n/a	1-5	5-50	>50	n/a	1-5	5-50	>50	n/a	1-5	5-50	>50
Cetaceans	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Big sharks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Cookiecutter shark	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Squid	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Seabirds	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Seaturtles	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Crustaceans	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐