Report of the Eighth Session of the IOTC Working Party on Ecosystems and Bycatch

Cape Town, South Africa, 17–19 September, 2012

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ACRONYMS

ACAP	Agreement on the Conservation of Albatrosses and Petrels
AIC	Akaike Information Criterion
BSH	Blue shark
CMM	Conservation and Management Measure (of the IOTC; Resolutions and Recommendations)
CPCs	Contracting parties and cooperating non-contracting parties
CPUE	Catch per unit of effort
current	Current period/time, i.e. $F_{current}$ means fishing mortality for the current assessment year.
EEZ	Exclusive Economic Zone
ERA	Ecological Risk Assessment
EU	European Union
F	Fishing mortality; F_{2010} is the fishing mortality estimated in the year 2010
FAD	Fish Aggregation Device
FAO	Food and Agriculture Organization of the United Nations
F_{MSY}	Fishing mortality at MSY
GLM	Generalised liner model
HBF	Hooks between floats
IO	Indian Ocean
IOTC	Indian Ocean Tuna Commission
IOSEA	Indian Ocean - South-East Asian Marine Turtle Memorandum
IPOA	International Plan of Action
LL	Longline
MoU	Memorandum of Understanding
MSY	Maximum sustainable yield
n.a.	Not applicable
NPOA	National Plan of Action
PSA	Productivity Susceptibility Analysis
ROP	Regional Observer Programme
SC	Scientific Committee of the IOTC
SB	Spawning biomass (sometimes expressed as SSB)
SB_{MSY}	Spawning stock biomass which produces MSY
SWIOFP	South West Indian Ocean Fisheries Project
Taiwan,China	Taiwan, Province of China
UN	United Nations
WPEB	Working Party on Ecosystems and Bycatch

DEFINITIONS

Bycatch	All species, other than the 16 species listed in Annex B of the IOTC Agreement, caught or interacted with by fisheries for tuna and tuna-like species in the IOTC area of competence.
Discards	Any species, whether an IOTC species or bycatch species, which is not retained onboard for sale or consumption.
Large-scale driftnets	Gillnets or other nets or a combination of nets that are more than 2.5 kilometers in length whose purpose is to enmesh, entrap, or entangle fish by drifting on the surface of, or in, the water column.

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EXECUTIVE SUMMARY

The Eighth Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Ecosystems and Bycatch (WPEB) was held in Cape Town, South Africa, from 17 to 19 September 2012. A total of 48 participants attended the Session, including one invited expert, Dr. Robert Olsen from the Inter-American Tropical Tuna Commission.

The following are a subset of the complete recommendations from the WPEB08 to the Scientific Committee, which are provided at Appendix IV.

Sharks

Data and reporting requirements

NOTING that despite the mandatory reporting requirements, detailed in Resolutions 05/05, 10/02, 10/06, 12/03, 12/04 and 12/06, bycatch data remain largely unreported by CPCs, and the WPEB **RECOMMENDED** that the SC address these concerns to the Compliance Committee and the Commission in order for them to take steps to develop mechanisms which would ensure that CPCs fulfill their bycatch reporting obligations. (para.41)

Ecological Risk Assessment: review of current knowledge and potential management implications

The WPEB **RECOMMENDED** that the SC note the list of the 10 most vulnerable shark species to longline gear, as determined by the productivity susceptibility analysis, and compare it to the list of shark species/groups required to be recorded for longline gear, contained in Resolution 12/03 o*n the recording of catch and effort by fishing vessels in the IOTC area of competence*, provided at Table 5. (para.112)

Development of technical advice on the status of the shark stocks

The WPEB **RECOMMENDED** that the SC note the management advice developed for a subset of shark species commonly caught in IOTC fisheries for tuna and tuna-like species: (para.118)

- Blue sharks (*Prionace glauca*) – Appendix X
- Oceanic whitetip sharks (*Carcharhinus longimanus*) – Appendix XI
- Scalloped hammerhead sharks (*Sphyrna lewini*) – Appendix XII
- Shortfin mako sharks (*Isurus oxyrinchus*) – Appendix XIII
- Silky sharks (*Carcharhinus falciformis*) – Appendix XIV
- Bigeye thresher sharks (*Alopias superciliosus*) – Appendix XV
- Pelagic thresher sharks (*Alopias pelagicus*) – Appendix XVI

NOTING that Resolution 10/02 *mandatory statistical requirements for IOTC members and Cooperating Non-Contracting Parties (CPC's)*, makes provision for data to be reported to the IOTC on "*the most commonly caught shark species and, where possible, to the less common shark species*", without giving any list defining the most common and less common species, and recognising the general lack of shark data being recorded and reported to the IOTC Secretariat, the WPEB **RECOMMENDED** that Resolution 10/02 is revised in order to include the list of most commonly caught elasmobranch species (Table 6) for which nominal catch data shall be reported as part of the statistical requirement for IOTC CPCs. (para.124)

Marine turtles

Data and reporting requirements

The WPEB **RECOMMENDED** that the current IOTC Resolution 12/04 *on the conservation of marine turtles* is strengthened to ensure that CPCs report annually on the level of incidental catches of marine turtles by species, as provided at Table 8. (para.128)

The WPEB **RECOMMENDED** that marine turtles, as a group, be added to Resolution 12/03 *on the recording of catch and effort by fishing vessels in the IOTC area of competence*, in Annex II (Record once per set/shot/operation) paragraph 2.3 (SPECIES) for longline gear. (para.130)

Development of management advice for marine turtles

The WPEB **RECOMMENDED** that the SC note the management advice developed for marine turtles, as provided in the draft resource stock status summary (Appendix XVII). (para.145)

Seabirds

Development of technical advice on the status of seabirds

The WPEB **RECOMMENDED** that the SC note the management advice developed for seabirds, as provided in the draft resource stock status summary (Appendix XVIII). (para.168)

Other matters

Employment of a Fisheries Officer

Noting the rapidly increasing workload at the IOTC Secretariat, including a wide range of additional duties assigned to it by the SC and the Commission, the WPEB **RECOMMENDED** that the Commission increase the staff of the IOTC Secretariat to incorporate a new Fisheries Officer post to work on a range of matters in support of the scientific process. (para.184)

Recommendations

The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB08, provided at Appendix IV. (para. 194)

A summary of the stock status for some of the most commonly caught shark species caught in association with IOTC fisheries for tuna and tuna-like species is provided in Table 1.

TABLE 1. Status summary for shark species caught in association with IOTC fisheries for tuna and tuna-like species.

Stock	Indicators	Prev[1]	2010	2011	Advice to Commission
Sharks: Although they are not part of the 16 species directly under the IOTC mandate, sharks are frequently caught in association with other species as bycatch, and for some fleets are often as much a target as tuna. As such, IOTC Members and Cooperating non-Contracting Parties are required to report information at the same level of detail as for the 16 IOTC species. The following are the main species caught in tuna fisheries, but the list is not exhaustive.					
Blue shark *Prionace glauca*	Unknown Unknown				There is a paucity of information available for these species and this situation is not expected to improve in the short to medium term. There is no quantitative stock assessment and limited basic fishery indicators currently available. Therefore the stock status is highly uncertain. The available evidence indicates considerable risk to the stock status at current effort levels. The primary source of data that drive the assessment (total catches) is highly uncertain and should be investigated further as a priority.
Silky shark *Carcharhinus falciformis*	Unknown Unknown				
Oceanic whitetip shark *Carcharhinus longimanus*	Unknown Unknown				
Scalloped hammerhead shark *Sphyrna lewini*	Unknown Unknown				
Shortfin mako *Isurus oxyrinchus*	Unknown Unknown				
Bigeye thresher shark *Alopias superciliosus*	Unknown Unknown				
Pelagic thresher shark *Alopias pelagicus*	Unknown Unknown				

Colour key	Stock overfished($SB_{year}/SB_{MSY} < 1$)	Stock not overfished ($SB_{year}/SB_{MSY} \geq 1$)
Stock subject to overfishing($F_{year}/F_{MSY} > 1$)		
Stock not subject to overfishing ($F_{year}/F_{MSY} \leq 1$)		
Not assessed/Uncertain		

1. OPENING OF THE MEETING

1. The Eighth Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Ecosystems and Bycatch (WPEB) was held in Cape Town, South Africa, from 17 to 19 September 2012. A total of 48 participants attended the Session. The list of participants is provided at Appendix I.

2. The meeting was opened by the Chair, Dr. Charles Anderson, who subsequently welcomed participants to Cape Town. The participants were also welcomed by Dr. Johann Augustyn, Chief Director, Fisheries Research and Development, from the Department of Agriculture, Forestry and Fisheries of South Africa.

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

3. The WPEB **ADOPTED** the Agenda provided at Appendix II. The documents presented to the WPEB are listed in Appendix III.

4. **NOTING** that several key working papers were provided either immediately prior to, or on the morning of the meeting, thereby making it difficult or impossible for all participants to thoroughly review and therefore be able to comment and contribute to discussions during the meeting, the WPEB **URGED** all authors to ensure that they comply with the recommendation from the Scientific Committee (SC) that all working party papers need to be submitted to the IOTC Secretariat no later than 15 days prior to the relevant meeting.

3. OUTCOMES OF THE FOURTEENTH SESSION OF THE SCIENTIFIC COMMITTEE

5. The WPEB **NOTED** paper IOTC–2012–WPEB08–03 which outlined the main outcomes of the Fourteen Session of the Scientific Committee, specifically related to the work of the WPEB.

6. The WPEB **NOTED** that as part of the Executive Summaries adopted for shark species, the SC also adopted a table summarising the status of the shark species most frequently impacted by IOTC fisheries. The WPEB **AGREED** to include a draft of this table at the front of the WPEB report for the SC's consideration.

7. The WPEB **NOTED** the recommendations of the Fourteenth Session of the SC and agreed to consider how to progress these issues at the present meeting.

4. OUTCOMES OF SESSIONS OF THE COMMISSION

4.1 Outcomes of the Sixteenth Session of the Commission

8. The WPEB **NOTED** paper IOTC–2012–WPEB08–04 which outlined the main outcomes of the Sixteenth Session of the Commission, specifically related to the work of the WPEB.

9. The WPEB **NOTED** the 15 Conservation and Management Measures (CMMs) adopted at the 16th Session of the Commission (consisting of 13 Resolutions and 2 Recommendations), and in particular the following Resolutions which have a direct impact on the work of the WPEB:
   - Resolution 12/01 *On the Implementation of the Precautionary Approach*
   - Resolution 12/03 *On Catch and Effort Recordings by Fishing Vessels in the IOTC Area of Competence*
   - Resolution 12/04 *On the Conservation of Marine Turtles*
   - Resolution 12/05 *On establishing a programme for transhipment by large-scale fishing vessels*
   - Resolution 12/06 *On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries*
   - Resolution 12/08 *On a Fish Aggregating Devices (FADs) Management Plan*
   - Resolution 12/09 *On the Conservation of Thresher Sharks (Family Alopiidae) Caught in Association with Fisheries in the IOTC Area of Competence*
   - Resolution 12/12 *To prohibit the use of large-scale driftnets on the high seas in the IOTC area*

10. The WPEB **NOTED** the outcomes of the Sixteenth Session of the Commission, and **AGREED** to consider how best to provide the SC with the information it needs, in order to satisfy the Commission's requests, throughout the course of the meeting.

4.2 Review of Conservation and Management Measures relating to Ecosystems and Bycatch

11. The WPEB **NOTED** paper IOTC–2012–WPEB08–05 which aimed to encourage the WPEB to review the existing CMMs relating to ecosystems and bycatch, and as necessary to 1) provide recommendations to the SC on whether modifications may be required; and 2) recommend whether other CMMs may be required.

12. The WPEB **AGREED** that it would consider proposing modifications for improvement to the existing CMMs following discussions held throughout the current WPEB meeting.

5. PROGRESS ON THE RECOMMENDATIONS OF WPEB07

13. The WPEB **NOTED** paper IOTC–2012–WPEB08–06 which provided an update on the progress made in implementing the recommendations from previous WPEB meetings, and also provided alternative recommendations for the consideration and potential endorsement by participants.

14. The WPEB **AGREED** to a set of revised recommendations that are provided throughout this report and in the consolidated list of recommendations (Appendix IV), for the consideration of the SC.

6. REVIEW OF NATIONAL PLANS OF ACTION (SHARKS AND SEABIRDS)

15. The WPEB **NOTED** paper IOTC–2012–WPEB08–07 which provided an update on the development and implementation of National Plans of Action for seabirds and sharks by IOTC CPCs, including the following abstract provided by the authors:

> "*At the 14th Session of the SC, the SC NOTED the current status of development and implementation of Nation Plans of Action for sharks and RECOMMENDED that all CPCs without an NPOA-Sharks expedite the development and implementation of their NPOA-Sharks, and to report progress to the WPEB in 2012, recalling that NPOA-Sharks are a framework that should facilitate estimation of shark catches, and development and implementation of appropriate management measures, which should also enhance the collection of bycatch data and compliance with IOTC Resolutions. In July 2012, the Secretariat circulated the table adopted by the Scientific Committee for further comment and updating by each of the 33 CPCs (31 Members and 2 Cooperating Non-Contracting Parties). Comments and updates were received from 6 CPCs, which have been incorporated into the table provided at Attachment A, for the consideration of the WPEB. Text in RED and CPCs highlighted in YELLOW had not provided an update as of 30 August, 2012, and thus, the text is from the 2011 SC report.*"

16. The WPEB **NOTED** the current status of development and implementation of National Plans of Action (NPOA's) for sharks and seabirds, by each CPC, recalling that the IPOA-Seabirds and IPOA-Sharks were adopted by the FAO in 1999 and 2000, respectively, and required the development of NPOAs. Despite the time that has elapsed since then, very few CPCs have developed NPOA's, or even carried out assessments to ascertain if the development of a Plan is warranted. Currently only nine of the 32 IOTC CPCs have an NPOA-Sharks, with seven others in development, while only three CPCs have an NPOA-Seabirds, with two others in development.

17. **NOTING** that the FAO prepared best practice guidelines to reduce the incidental catch of seabirds in capture fisheries in 2009 to support implementation of the IPOA-Seabirds, the WPEB **REQUESTED** that CPCs use these guidelines to immediately review bycatch in longline, trawl and gillnet fisheries within their jurisdiction and develop, if appropriate, NPOA-Seabirds for fisheries where seabird bycatch is problematic.

18. The WPEB **REQUESTS** that the IOTC Secretariat should revise annually the table summarising progress towards the development of NPOA-Sharks and NPOA-Seabirds by CPCs for the consideration at each WPEB and the SC meeting.

7. REGIONAL OBSERVER SCHEME – UPDATE

19. The WPEB **NOTED** paper IOTC–2012–WPEB08–08 which provided an update on the Regional Observer Scheme (ROS), including the following abstract provided by the authors:

> "*At its 13th Session, the Commission adopted Resolution 09/04* on a Regional Observer Scheme, *which was superseded in 2010, and again in 2011 by Resolution 11/04* on a Regional Observer Scheme. *This resolution makes provision for national observer scheme to be implemented in all CPCs in order to cover at least 5 % of the number of operations/sets for each gear type by the*

fleet of each CPC while fishing in the IOTC Area of competence of 24 meters overall length and over, and under 24 meters if they fish outside their EEZs. In 2010, the Scientific Committee endorsed an Observer Manual, a set of observer forms and an Observer Trip Report Template that included minimum data requirements developed by a workshop that took place in May 2010, as well as the recommendation from the workshop that CPCs shall send to the Secretariat a list of their accredited observers participating into the ROS. However, the Scientific Committee noted concerns of some CPCs and requested that these concerns be addressed at the next Session of the WPDCS in 2012…" – (see paper for full abstract).

20. **NOTING** the update of the implementation of the Regional Observer Scheme (Appendix V), the WPEB **EXPRESSED** its disappointment on the very low level of reporting to the IOTC Secretariat of both the observer trip reports and the list of accredited observers since the start of the ROS in July 2010, which undermined any progress on the work requested by the Commission.

21. The WPEB **AGREED** that such a low level of implementation and reporting is detrimental to its work, in particular regarding the estimation of incidental catches of non-targeted species, as requested by the Commission.

22. The WPEB **NOTED** that piracy in the western Indian Ocean has resulted in a sharp reduction of the EU observer program in that area since July 2008. However, the EU is presently communicating observer reports to the IOTC when available and is currently developing an electronic monitoring program for potential implementation in coming years, as it is unlikely that observers will be permitted on EU purse seine vessels until the piracy problem has been resolved.

23. The WPEB **NOTED** that at the Sixteenth Session of the Commission, the Commission made the following statement regarding the regional observer program:

"*The Commission URGED all IOTC CPCs to urgently implement the requirements of Resolution 11/04 on a Regional Observer Scheme, which states that: "The observer shall, within 30 days of completion of each trip, provide a report to the CPCs of the vessel. The CPCs shall send within 150 days at the latest each report, as far as continuous flow of report from observer placed on the longline fleet is ensured, which is recommended to be provided with 1°x1° format to the Executive Secretary, who shall make the report available to the Scientific Committee upon request. In a case where the vessel is fishing in the EEZ of a coastal state, the report shall equally be submitted to that Coastal State." (para. 11), NOTING that the timely submission of observer trip reports to the Secretariat is necessary for the SC to carry out the tasks assigned to it by the Commission, including the analysis of accurate and high resolution data, in particular for bycatch, which would allow the scientists to better assess the impacts of fisheries for tuna and tuna-like species on bycatch species. (para. 40 of the S16 report).*"

24. The WPEB **RECOMMENDED** that the SC consider requesting that the Commission considers how to address the lack of implementation of observer programmes by CPCs for their fleets and the lack of reporting to the IOTC Secretariat, as per the provisions of Resolution 11/04 *on a Regional Observer Scheme*.

25. The WPEB **NOTED** the request by the participant from the I.R. Iran to reduce the required level of observer coverage as follows:
    1. *Countries with less than 500 vessels the coverage will be 5%*
    2. *Countries with 500 to 1000 vessels the coverage will be 3%*
    3. *Countries with more than 1000 vessels the coverage will be 1%*

26. The WPEB **NOTED** that some developing and coastal CPCs with large fleets are experiencing difficulties in developing their national observer programme, as part of the ROS as specified in Resolution 11/04 *on a Regional Observer Scheme*, due to a number of factors including financial and human resource constraints. It was suggested by one participant that the level of coverage set out by Resolution 11/04 could be adapted according to a CPC's number of active vessels (as noted in para. 25). However, the WPEB did not support any decrease of the 5% observer coverage set out in Resolution 11/04 without a clear scientific basis to do so, and recalled its previous agreement from 2011 that 5% coverage levels are already very low in order to be able to estimate reliable levels of bycatch.

27. The WPEB **RECOMMENDED** that the SC consider requesting that the Commission allocate additional funds in 2013 to print further sets of the shark, seabird and marine turtle identification cards

developed by the IOTC Secretariat, noting that expected costs are in the vicinity of US$6,000 per 1000 sets of cards.

28. The WPEB **REQUESTED** that IOTC CPCs translate, print and disseminate the identification cards to their observers and field samplers (Resolution 11/04), and as feasible, to their fishing fleets targeting tuna, tuna-like and shark species. This would allow accurate observer, sampling and logbook data on sharks, seabirds and marine turtles to be recorded and reported to the IOTC Secretariat as per IOTC requirements.

29. The WPEB **ENCOURAGED** all CPCs to implement training sessions on shark, seabird and marine turtle identification to improve the quality of data collected in the field for their observers.

30. The WPEB **REQUESTED** that, in addition to the implementation of the ROS, the collection of scientific data by all other means available including auto-sampling (collection of data by trained crew) and electronic monitoring (sensors and video cameras) be encouraged and developed, and for CPCs to report on progress at the next WPEB meeting.

31. The WPEB **NOTED** paper IOTC–2012–WPEB08–INF22 which outlined an ISSF funded meeting of technical experts from tuna purse-seine fisheries observer programs, which aimed to harmonise data collection systems and variable definitions to improve research on bycatch mitigation, stock assessment and other topics.

8. SHARKS

8.1 Review of data available at the secretariat for sharks

32. The WPEB **NOTED** paper IOTC–2012–WPEB08–09 which summarised the standing of a range of data and statistics received by the IOTC Secretariat for sharks, in accordance with IOTC Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*, for the period 1950–2010 (Appendix VI). Statistics for 2011 were not covered in the paper as preliminary catches for the previous year are usually reported later during the following year (June–October). It covers availability of nominal catches, catch-and-effort, and size-frequency data. A summary of the supporting information for the WPEB is provided in Appendix VII.

Data and reporting requirements

33. The WPEB **NOTED** each of the IOTC Resolutions relevant to shark species (notably Resolutions 05/05, 10/02 and 12/09, including the data and reporting requirements (Table 2). Contracting and non-Contracting Cooperating Parties (CPCs) are required to collect and report the same information as is collected and reported for tuna and tuna-like species (catch, effort and size frequency).

TABLE 2. IOTC data collection and reporting requirements for shark species.

Resolution	Paragraph
Sharks	
IOTC Resolution 05/05: *Concerning the conservation of sharks caught in association with fisheries managed by IOTC*	Paragraph 1: CPCs shall annually report data for catches of sharks, in accordance with IOTC data reporting procedures, including available historical data.
IOTC Resolution 10/02: *Mandatory statistical requirements for IOTC Members and Cooperating Non-Contracting Parties (CPC's)*	Paragraph 3: The provisions, applicable to tuna and tuna-like species, shall also be applicable to the most commonly caught shark species and, where possible, to the less common shark species.
IOTC Resolution 12/09: *On the conservation of thresher sharks (family Alopiidae) caught in association with fisheries in the IOTC area of competence*	Paragraph 1: This measure shall apply to all fishing vessels on the IOTC record of authorised vessels. Paragraph 4: CPCs shall encourage their fishers to record and report incidental catches as well as live releases. These data will be then kept at the IOTC Secretariat. Paragraph 8: The Contracting Parties, Co-operating non-Contracting Parties, especially those directing fishing activities for sharks, shall submit data for sharks, as required by IOTC data reporting procedures.

34. The WPEB **NOTED** each of the IOTC Resolutions relevant to all bycatch species (notably Resolutions 10/02, 11/04 and 12/03, including the data and reporting requirements (Table 3).

TABLE 3. IOTC data collection and reporting requirements for all bycatch species (NOTE: this applies to all species other than the 16 IOTC species listed in the IOTC Agreement).

Resolution	Paragraph
IOTC Resolution 10/02: Mandatory statistical requirements for IOTC Members and Cooperating Non-Contracting Parties (CPC's)	Paragraph 3(end): These provisions, applicable to tuna and tuna-like species, shall also be applicable to the most commonly caught shark species and, where possible, to the less common shark species. CPC's are also encouraged to record and provide data on species other than sharks and tunas taken as bycatch.
IOTC Resolution 11/04: On a Regional Observer Scheme	Paragraph 2: In order to improve the collection of scientific data, at least 5 % of the number of operations/sets for each gear type by the fleet of each CPC while fishing in the IOTC Area of competence of 24 meters overall length and over, and under 24 meters if they fish outside their EEZs shall be covered by this observer scheme. For vessels under 24 meters if they fish outside their EEZ, the above mentioned coverage should be achieved progressively by January 2013. Paragraph 4: The number of the artisanal fishing vessels 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 (i.e. total number of vessel trips or total number of vessels active). Paragraph 11: The observer shall, within 30 days of completion of each trip, provide a report to the CPCs of the vessel. The CPCs shall send within 150 days at the latest each report, as far as continuous flow of report from observer placed on the longline fleet is ensured, which is recommended to be provided with 1°x1° format to the Executive Secretary, who shall make the report available to the Scientific Committee upon request. In a case where the vessel is fishing in the EEZ of a coastal State, the report shall equally be submitted to that coastal State.
IOTC Resolution 12/03: On The recording of Catch and Effort by fishing vessels in the IOTC Area of Competence	Paragraph 1: Each flag CPC shall ensure that all purse seine, longline, gillnet, pole and line, handline, and trolling fishing vessels flying its flag and authorized to fish species managed by IOTC be subject to a data recording system. Paragraph 8 (start): The flag State and the States which receive this information shall provide all the data for any given year to the IOTC Secretariat by June 30th of the following year on an aggregated basis.

35. The WPEB **NOTED** that although some CPCs have reported more detailed data on sharks in recent years, including time-area catches and effort, and length frequency data for the main commercial shark species, the WPEB expressed strong **CONCERN** that the information on retained and discarded catches of sharks available in the IOTC database remains very incomplete, and makes very difficult any attempt to estimate the total catches of sharks aggregated and/or per species, in the Indian Ocean.

36. The WPEB **NOTED** the main shark data issues that are considered to negatively affect the quality of the statistics available at the IOTC Secretariat, by type of dataset and fishery, which are provided in Appendix VIII, and **RECOMMENDED** that the CPCs listed in the Appendix, make efforts to remedy the data issues identified and to report back to the WPEB at its next meeting, noting the status and type of datasets that need to be provided for sharks, and other bycatch species provided at Appendix IX.

37. The WPEB **NOTED** that records of discards of sharks and catches by shark species are not available from most fleets and periods. Also for all fleets, historical data series are missing or highly incomplete. Size frequency data have been reported only for some fisheries in recent years, however, small sample sizes for most species, and biological data, such as fin-body ratio by species, are still largely missing.

38. Noting that the information on retained catches and discards of sharks contained in the IOTC database remains very incomplete for most fleets despite their mandatory reporting status, and that catch-and-effort as well as size data are essential to assess the status of shark stocks, the WPEB **RECOMMENDED** that all CPCs collect and report catches of sharks (including historical data),

catch-and-effort and biological data on sharks, as per IOTC Resolutions, so that more detailed analysis can be undertaken for the next WPEB meeting.

39. Noting that there is extensive literature available on pelagic shark fisheries and interactions with fisheries targeting tuna and tuna-like species, in countries having fisheries for sharks, and in the databases of governmental or non-governmental organisations, the WPEB **AGREED** on the need for a major data mining exercise in order to compile data from as many sources as possible and attempt to rebuild historical catch series of the most commonly caught shark species. In this regard, the WPEB **RECOMMENDED** that the SC considers proposing that the Commission allocates funds for this activity, in the 2013 IOTC budget.

40. The WPEB **NOTED** that to date, many CPCs have not reported bycatch data and urged all CPCs to make the necessary arrangements for bycatch data to be collected and reported to the IOTC as soon as possible. The WPEB **RECALLED** the value of reporting to the IOTC Secretariat all information on bycatch, caught in fisheries targeting tuna and tuna-like species, or collected during national monitoring programs, and encouraged CPCs to initiate such programs. Summarised bycatch estimates are valuable, but original data as per IOTC standards are required. The WPEB particularly emphasised the necessity of improvements to both the quantity and quality of data on sharks to be collected and reported over the coming years.

41. **NOTING** that despite the mandatory reporting requirements, detailed in Resolutions 05/05, 10/02, 10/06, 12/03, 12/04 and 12/06, bycatch data remain largely unreported by CPCs, and the WPEB **RECOMMENDED** that the SC address these concerns to the Compliance Committee and the Commission in order for them to take steps to develop mechanisms which would ensure that CPCs fulfill their bycatch reporting obligations.

8.2 New information on the biology, stock structure, bycatch mitigation measures, fisheries and associated environmental data

Sri Lankan shark fisheries resources

42. The WPEB **NOTED** paper IOTC–2012–WPEB08–15 Rev_1 which provided a review on shark fishery resources in Sri Lanka, including the following abstract provided by the authors:

"This study reviews the past and present status of the shark fishery in Sri Lanka. The large pelagic fishery database (PELAGOS) of the National Aquatic Resources Research and Development Agency (NARA) in Sri Lanka and the published database for sharks of the Indian Ocean Tuna Commission (IOTC) were incorporated for this review. There is an increasing trend of shark landings since 1950's with the peak of 34,842 Mt reported in 1999. Thereafter, annual shark production has shown a considerable decline up to 3,601 Mt, reported in 2005. Although, sharks were dominant in the historical large pelagic fish landings, their production at present is at a low level and the catches mostly come as a by- catch. During the period from 1950 to 1974, sharks accounted for more than 45% of the total large pelagic fish production. However, at present, the contribution of sharks to the total large pelagic fish production is less than 4%. Currently, the highest percentage of total shark landings is reported from the Southwest coast followed by the South and West coasts and a large quantity of sharks are being caught as a by-catch of the longline-gillnet gear combination…" – (see paper for full abstract).

Sri Lankan shark fisheries management

43. The WPEB **NOTED** paper IOTC–2012–WPEB08–10 Rev_1 which provided an overview of the management of shark fisheries in Sri Lanka, including the following abstract provided by the authors:

"The fisheries sector is one of the most important sectors in the economy of Sri Lanka by providing direct and indirect employment to the country. The sector also contributes nearly 3% to the GDP and provides 65-70 % of the animal protein consumed by the population. Fisheries management arrangements within the EEZ were implemented under the provisions of Fisheries and Aquatic Resources Act No.2 of 1996. The objectives of the Act are management, conservation, regulation, and development of the fisheries and aquatic resources of Sri Lanka. During the past two decades the fishing activities have been expanded from its continental shelf and beyond 200 mile EEZ. Sharks have been exploited for 4-5 decades using various fishing methods during last decades. However presently deep water shark fisheries are operating in very insignificant levels. Majority of the catch come as by-catch from tuna long line and gill net fishery. It has been observed that Shark catches have been decreased rapidly during last decades as a result of the management arrangements…" – (see paper for full abstract).

44. The WPEB **NOTED** that shark species identification at Sri Lankan landing ports has been improved substantially and **URGED** other coastal states to make similar improvements in species identification.

45. The WPEB **REQUESTED** that Sri Lanka works with the IOTC Secretariat to ensure that data collection programs and reporting meets IOTC standards.

Mozambique fisheries

46. The WPEB **NOTED** paper IOTC–2012–WPEB08–11 which provided an overview of the sharks caught in Mozambican waters, including the following abstract provided by the authors:

"Mozambique has no national fleet for tuna and tuna like species so tuna (Thunnus albacares, Thunnus obesus and T. alalunga) are caught by foreign fleet. However since 2011 a national flagged longliner started fishing in Mozambican coast. Catch composition showed that sixty percent of the catch was made up shark and the main species caught were Prionace glauca, Isurus oxyrinchus, Carcharhinus sorrah, Squalus asper and Carcharhinus leucas. The best catches and catch rates were obtained in July and September."

47. The WPEB **QUESTIONED** the calculation of the potential harvest of 5,000 to 18,000 t of sharks in the Mozambique EEZ, as indicated in the fisheries management plan of Mozambique, as this is unusually high and apparently not based on any clear, scientifically sound calculation. Any harvesting plan of sharks of this magnitude must be based on sound scientific advice and justified accordingly.

48. The WPEB **NOTED** the absence of information on shark catches from artisanal fisheries in Mozambique and **RECOMMENDED** that information on bycatch from artisanal fisheries is collected for this fishery and reported in due course.

Madagascar fisheries

49. The WPEB **NOTED** paper IOTC–2012–WPEB08–12 Rev_1 which provided a summary of catch and effort by longliners of Madagascar, including the following abstract provided by the authors:

"In 2010 and 2011, 8 malagasy longliners evolved in the eastern part of Madagascar water and targeted tuna and swordfish. Except these target species, some billfish species and sharks were taken as Bycatch by this new fishery according to the data declared by ship-owners. Note that these results were obtained by the declarative system of fishing companies. The first analysis highlighted that the data series used are too inconsistent and incompletes because of misreporting and species misidentification. However, they are broken down by species and month. Estimates in terms of fishing effort were implemented in order to produce such an article while being aware of bias induced by the method adopted. Thus, this study revealed that the CPUE of sharks all species is [165; 92] Kg/1000 hooks in 2010 against [86; 48]/1000 hooks in 2011."

50. The WPEB **NOTED** that sharks are being caught in large quantities by the new and rapidly expanding longline fleet of Madagascar which is based primarily off the eastern coast and is as yet poorly monitored.

51. **NOTING** that the longline fishery in Madagascar is a new and developing fishery, the WPEB **REQUESTED** that Madagascar ensure that it develops and implements a data collection system, including sampling, logbooks and observers, which would adequately cover the entire fishery.

Pakistan gillnet fisheries

52. The WPEB **NOTED** papers IOTC–2012–WPEB08–13 and IOTC–2012–WPEB08–INF08, which provided a description of bycatch in tuna gillnet operations in Pakistan, including the following abstract provided by the authors:

"Shark fisheries is one of the oldest fisheries of Pakistan. Sharks are being caught by target demersal fisheries as well as a bycatch of tuna gillnet fisheries. Gill-net are used for catching tuna by using large boats (size ranging from 24 m and above) . These are operated in coastal waters as well as in high seas. The time-series data from 1980 onward shows tuna landings from EEZ, Sindh and Balochistan provinces are increasing. Landings of sharks including that of by catch from 1999-2011 indicates a decline of more than 80%. Presently shark bycatch of tuna fisheries is about 3 to 4 % of the tuna landings., With the continues harvest of the apex predators their population has declined since 1999 – 2007 and as a result a recorded increase of Indian mackeral was noticed which indicates that ecosystem imbalance because of removal of the predators. Further studies are required to verify the same."

53. The WPEB **NOTED** that gillnet fisheries are expanding rapidly in Pakistan waters with high levels of bycatch being reported. Gillnets used in Pakistan are often more than 2.5 km reaching 25 km or more in some cases. Catches of sharks are already showing signs of declines in average sizes which is a cause for concern.

54. The WPEB **AGREED** that although the switch from inshore to offshore fishing would have a substantial impact on the time series of catches shown, the overall trend of a rapid and large increase in shark catches is a serious concern and should be monitored carefully. Similarly, the large increase in the number of gillnet vessels may lead to over exploitation of fishery resources, both inshore and offshore.

55. **NOTING** that shark identification remains problematic, the WPEB **URGED** Pakistan to continue to improve species identification. The data presented in the study may suggest that the smallest size class of silky sharks may be incorrectly identified.

56. The WPEB **REMINDED** participants that Resolution 12/12 *to prohibit the use of large-scale driftnets on the high seas in the IOTC area*, paragraph 1, states that: *The use of large-scale driftnets on the high seas within the IOTC area of competence shall be prohibited* and **RECALLED** that this Resolution is binding. Where "Large-scale driftnets" are defined as gillnets or other nets or a combination of nets that are more than 2.5 kilometers in length whose purpose is to enmesh, entrap, or entangle fish by drifting on the surface of, or in, the water column.

Research survey by Thailand

57. The WPEB **NOTED** paper IOTC–2012–WPEB08–14 Rev_1 which provided the results of research cruises examining bycatch in the pelagic longline fishery along Ninety East Ridge, Thailand, including the following abstract provided by the authors:

> "*Sharks are present as an important role in the ocean ecosystem. The fishing operation was reduced their population. This study was carried out the data by the pelagic longline. Two research vessels, M.V. SEAFDEC and F.R.V. CHULABHORN were operated along the Ninety East Ridge, Eastern Indian Ocean during 2011-2012. The composition by number of sharks was 5.60% with the CPUE 1.09 fish/1,000 hooks. The C-hook No.14 captured 53.85% of sharks, followed by the C-hook No.18 (38.46%), while the J-hook captured only 7.69% of sharks. Almost of sharks were male with the 1st and 2nd maturity stage, and their stomach were empty.*"

58. The WPEB **ENCOURAGED** Thailand to develop a long term independent research fishery survey with the aim of being able to gather shark biological data as well as catch rates independent from the fisheries for comparison over time. The IOTC Secretariat should offer advice and other assistance if requested by Thailand.

Shark fin to body weight ratio

59. The WPEB **NOTED** paper IOTC–2012–WPEB08–18 which provided the results of a study on the fin to carcass weight ratios for the silky shark *Carcharhinus falciformis*, including the following abstract provided by the authors:

> "*In the frame of the MADE program (Mitigating adverse ecological impacts of open ocean fisheries), the different fin to carcass weight ratios were calculated on 42 dead specimens collected from French purse-seiners in the western Indian Ocean. The fins were dried to constant weight thank to the use, for the first time, of a food dehydrator. The weights were accurately measured with precision scales in laboratory. No difference was found between males and females. The 1st fin set wet weight to total body weight was 2.02% in average (minimum 1.6% - maximum 2.46%) that is much less than the 5% used in many regulations on finning. The results were compared to other values found in the scientific literature. The observed differences are due to variations in methods (primary set or full set with or without the upper caudal lobe) and the way of cutting the fins (straight-cut, moon-cut or crude cut).*"

60. The WPEB **NOTED** that the fin to body weight ratio is highly variable depending on species, type of cut and degree of drying of the fin, and therefore not a sound means of determining the relationship between fins and sharks onboard a vessel.

61. The WPEB **NOTED** that the 5% ratio measure currently used is not entirely satisfactory for all purposes, in particular as this measure does not specify whether it refers to dressed or round body

weight, shark species and type of fins retained and type of cut used, and discussions at the WPEB showed that there were different understandings on what was required.

Length and length weight relationships

62. The WPEB **NOTED** paper IOTC–2012–WPEB08–19 which provided length and length/weight relationships for silky shark (*Carcharhinus falciformis*), in the western Indian Ocean, including the following abstract provided by the authors:

"Meristic relationships between total length, fork length and pre-caudal length as well as between total length and whole weight are described for silky sharks Carcharhinus falciformis from the western Indian Ocean."

63. The WPEB **NOTED** that the various length relationships described in the paper appear to generally match those derived in the western and central Pacific Ocean and those from the western Atlantic, and that they should be added to the IOTC executive summary for silky shark.

Post-release survival of silky sharks – EU purse seine fishery

64. The WPEB **NOTED** paper IOTC–2012–WPEB08–20 which provided an update on the post-release survival of silky sharks incidentally captured by tuna purse seine vessels in the Indian Ocean, including the following abstract provided by the authors:

"Silky sharks captured onboard the tropical tuna purse seine vessel Torre Giulia were tagged with miniPATs (Wildlife computers) to study their post release survival. A total of 86 sharks were captured. Twelve of these were in good enough condition to be tagged to estimate survival. Five of the 12 died due to the capture operation. An overall mortality rate of between 82% and 91% was obtained during this cruise."

65. The WPEB **AGREED** that more research needs to be conducted on other mitigation methods that could be applied prior to the sharks being brailed and brought onboard a purse seine vessel, as well as on post-release mortality of sharks.

66. The WPEB **NOTED** the protocol of 'best practices' for shark handling and release onboard purse seiners (IOTC–2012–WPEB08–INF07) has been developed by the MADE project in collaboration with Orthongel to increase shark survival opportunities and minimize the risk of injury of vessel crew and **ENCOURAGED** that these guidelines are utilised by all purse seine fleets.

Methods to reduce mortality of silky sharks – EU purse seine fishery

67. The WPEB **NOTED** paper IOTC–2012–WPEB08–21 which provided a summary of results on the development of methods to reduce the mortality of silky sharks by purse seiners, including the following abstract provided by the authors:

"*A review of the research conducted under the ISSF Bycatch project and the EU funded MADE project for the development of methods to reduce the FAD purse seine fishery-induced mortality of silky sharks is presented. The review comprises non entangling FADs, behavior of silky sharks, attraction of sharks away from FADs, double FAD experiments, attraction of sharks outside the net, and survival of sharks released alive.*"

68. The WPEB **NOTED** that research is being planned to examine the level of shark mortality due to entanglement in nets underneath FADs. It was **AGREED** that the results of such a study should be presented at the next WPEB.

69. **NOTING** the apparent separation of silky sharks and tuna in purse seine nets at certain times of the haul, the WPEB **REQUESTED** that further research be carried out to determine if this behavioural response is not only consistent spatially and temporally, but whether means to release or entice silky sharks from the nets could be identified. The results of these studies should be presented at the next WPEB meeting.

Size distribution and length-weight relationships

70. The WPEB **NOTED** paper IOTC–2012–WPEB08–22 which provided size distribution and length-weight relationships for some large pelagic sharks in the Indian Ocean, including the following abstract provided by the authors:

"Size frequencies and L-W relationships for bigeye thresher shark (Alopias superciliosus), tiger shark (Galeocerdo cuvier), silvertip shark (Carcharhinus albimarginatus), sandbar shark (Carcharhinus plumbeus), great hammerhead shark (Sphyrna mokarran) and scalloped

hammerhead shark (Sphyrna lewini) caught during Soviet Indian Ocean Tuna Longline Research Programme (SIOTLLRP) in 1961-1989 are presented."

71. The WPEB **AGREED** that basic biological information for sharks, including size frequencies and length-weight relationships were previously unknown or unreliable for some shark species caught in IOTC fisheries, and that the results presented in this paper should be used to update the shark species executive summaries, for use in future assessments as appropriate.

Vertical and horizontal behaviour of silky, oceanic whitetip and blue sharks in the western Indian Ocean

72. The WPEB **NOTED** paper IOTC–2012–WPEB08–23 which provided the results of a study examining the vertical and horizontal behaviour of silky, oceanic whitetip and blue sharks in the western Indian Ocean, including the following abstract provided by the authors:

"The vertical and horizontal behaviour of silky, oceanic whitetip and blue sharks in the western Indian Ocean was investigated through the use of pop-up archival tags (PATs) and smaller miniPATs. Tags were deployed from 2009 to 2012 under the MADE (www.made-project.eu), ISSF bycatch research projects (www.iss-foundation.org) and the project Contrat Avenir from the French fleet organization ORTHONGEL. Strong differences were found between the vertical behaviour of juvenile silky sharks tagged around drifting FADs and larger individuals caught on pelagic longlines. Oceanic whitetips displayed similar vertical behaviour to large silky sharks while blue sharks spent far more time at greater depths than the other two species. All three species displayed large horizontal movements."

73. The WPEB **NOTED** the large differences observed between the vertical distribution of small (<155 cm TL) and large silky sharks (>154 cm TL), which may be a behavioural response of juveniles to associate with drifting objects whereas larger individuals and adults occur far less frequently in such aggregations.

74. The WPEB **NOTED** that the vertical distribution may reflect physiological or dietary shifts, which occur later in the species ontogeny. Nevertheless, irrespective of the causes behind the differences, the results presented in the study highlight the vulnerability of these two size classes to both purse seine and longline gears.

75. The WPEB **NOTED** that similar to silky sharks, the depth range occupied by oceanic whitetip sharks overlaps directly with both purse seine and longline gears. Oceanic whitetip sharks mainly occupy the first 150 m of the water column, while blue sharks appear to spend far more of its time at greater depths.

76. The WPEB **NOTED** that the horizontal movements observed for all three species clearly show extended movements which would need to be taken into consideration as part of any future stock assessment for these species.

Biological observations on oceanic whitetip sharks – EU, Spain longline fishery

77. The WPEB **NOTED** paper IOTC–2012–WPEB08–25 Rev_1 which provided biological observations of oceanic whitetip shark (*Carcharhinus longimanus*) on Spanish surface longline fishery targeting swordfish in the Indian Ocean, including the following abstract provided by the authors:

"A total of 7107 oceanic whitetip sharks (3440 females, 3444 males and 223 unidentified) were observed in the Indian Ocean between 4ºN-34ºS and 34º-109ºE during the period 1993-2011. The observed prevalence –all data combined- of the oceanic whitetip shark totaled 1.4% or 5.0% depending on whether we take into consideration the catch of all species combined or the catch of sharks only, respectively. However, great differences can be seen among the different areas, affecting the overall prevalence when data are geographically stratified. Standard length (FL) ranged from 50 to 250 cm and 50-260 cm for females and males, respectively. Individuals with the smallest lengths were mostly observed to the East of 75ºE and North of 20ºS. The nominal CPUE by length groups also confirms this segregation. The female overall sex-ratio was 50.0%. A total of 11.2% of the females specifically analyzed showed external or internal signs of fertilization (92.3% of them had embryos in their uteri)…" – (see paper for full abstract).

78. The WPEB **SUGGESTED** that distribution maps be developed for oceanic whitetip sharks based on the catch and effort data presented in this study, and requested that this information be presented to the next WPEB meeting.

Whale shark interactions – EU purse seine fishery

79. The WPEB **NOTED** paper IOTC–2012–WPEB08–32 which provided results of a study on the interactions between whale sharks and the European tropical tuna purse seine fishery in the Indian and Atlantic oceans, including the following abstract provided by the authors:

"The world's largest living chondrichtyan, the whale shark, Rhyncodon typus, is found in both oceanic and coastal tropical water. The tuna fishing industry holds an important place in the Indian and Atlantic Oceans and this large marine organism is indeed observed during fishing activities and is sometimes encircled with the net when fishing tuna schools. We studied the relationship between fishing fleets and whale shark considering two complementary data sets: a 31 years data set derived from logbooks systematically filled by captains of the French and Spanish tuna purse seine fleets (1980-2011) and a 16 years data set compiling observations from various scientific observers programs (1995-2011) with partial and variable coverage. The purpose of this study is to analyze the spatio-temporal distribution (season and year) of co-occurrence frequency between fishing activities and this large marine organism, and the potential impact on their mortality. Distribution maps of fishing activities and whale shark, supported by multivariate data analysis (PCA), were performed…" – (see paper for full abstract).

80. The WPEB **AGREED** that the definition of survival used in this paper is not appropriate as the survivorship of the sharks was not monitored after release, but rather the use of the term 'survival' in the present study means 'released alive'.

81. The WPEB **AGREED** that post-release survival rate should be determined by undertaking tagging studies of released whale sharks. It was **NOTED** that ISSF will be undertaking such a study in the near future, and the results will be presented at the next WPEB meeting.

82. The WPEB **NOTED** that during the period 1980 to 1999, a total of 1,073 whale sharks were sighted while 59,940 fishing sets were made during the same period by the EU,France fleet. During the following decade (2000 to 2011) a total of 706 whale sharks were sighted while a total of 120,924 fishing sets were made by the combine EU,France and EU,Spain fleets.

83. The WPEB **REQUESTED** that the data available on whale sharks be further examined to determine the cause(s) of the decline in sightings, interactions and effort, for presentation at the next WPEB meeting.

Sharks caught in the La Réunion longline fishery

84. The WPEB **NOTED** paper IOTC–2012–WPEB08–INF24 which provided preliminary results of bycatch ratios, catch rates, and species distribution of sharks in the pelagic longline fishery based in Reunion Island, including the following abstract provided by the authors:

"Bycatch level and species composition of sharks in the pelagic longline fishery based in Reunion Island were analysed for the period 2009 – 2011. Two sources of data were pooled, data collected by observers on board the largest boats of the fleet (20 m < LOA < 24 m) and self-reporting data transmitted by a group of cooperating fishermen in exchange for the use of temperature depth recorders (TDRs) deployed on the mainline to monitor the maximum fishing depth of the gear. A total of 318 sets in the South West Indian Ocean (SWIO) representing 356825 hooks deployed are considered in this analysis. Data were spatially stratified and 5 geographical areas were considered: Mozambique Channel, South of Madagascar, East of Madagascar, Reunion and Mauritius area and 'far east' region of the South West Indian Ocean. Eight shark species our group of species were considered (blue shark, thresher sharks, oceanic white tip, hammerhead sharks, mako sharks, tiger shark, requiem sharks and crocodile shark). For each stratum, shark bycatch ratio in respect to the target species (swordfish) and the major commercial species (swordfish and tuna species) were calculated as well as the nominal catch per unit effort (CPUE) and the species (or group of species frequency CPUEs distribution…" – (see paper for full abstract).

Other information papers and recommendations

85. The WPEB **NOTED** the range of other information papers on sharks, as presented in IOTC–2012–WPEB08–02 and thanked the contributors for the information.

86. The WPEB **AGREED** that any study presented to the WPEB must clearly define the type of measurements used, with a preference being expressed by the group that where possible, fork length

(FL) should be used to facilitate comparison among studies. If FL is not obtained then authors should provide an appropriate conversion factor.

87. Noting the continued confusion in the terminology of various hook types being used in IOTC fisheries, (e.g. tuna hook vs. J-hook; definition of a circle hook), the WPEB reiterated its **RECOMMENDATION** that the IOTC Secretariat develop an identification guide for hooks and pelagic gears used in IOTC fisheries, as staffing and financial resources permit, and to distribute the guide to all CPCs once completed. The WPEB also **AGREED** that circle hooks are defined by hooks having their point turned at least 90° from their shank.

8.3 Stock status indicators for sharks

8.3.1 Indicators (CPUE analysis)

88. The WPEB **REMINDED** all authors of the CPUE papers presented at the WPEB08 meeting, that they should prepare and present the methods and results of the paper following the guidelines for the presentation of stock assessment results, adopted by the SC in 2012, which includes guidelines for CPUE analysis. In addition, CPUE and stock assessment papers must be provided as stand along papers for the consideration of the WPEB, rather than referring to previous papers containing crucial background information to the analysis.

Japanese fleets – Catch-per-unit-of-effort (CPUE) for oceanic whitetip sharks

89. The WPEB **NOTED** paper IOTC–2012–WPEB08–26 which provided standardised CPUE of oceanic whitetip sharks caught by the Japanese longline fishery in the Indian Ocean, including the following abstract provided by the authors:

> *"The standardized CPUE of oceanic whitetip shark caught by Japanese longliners in the Indian Ocean was updated to 2011 with modified data filtering method. The trend of the updated standardized CPUE shows the fact that the level of CPUE does not change largely in the period between 2003 and 2011, and modified data filtering method produced rather similar and somewhat flatten trend in comparison with the one provided to WPEB07. Smoother trend of the standardized CPUE in the period of 2003 and after than the one in the previous study suggests the fact that the newly developed data filtering method increased the reliability of the estimated abundance index.*"

90. The WPEB **NOTED** that the updated results are in line with those presented to the WPEB07, although there are some differences on the initial years of the data series, which were due to an improvement on the filtering process. However, the WPEB **NOTED** that the analysis is based on a relatively short period and may not be reflecting the abundance trend of the stock as the fishery started operating well before. Discarding data in an arbitrary manner was not desirable, and using more comprehensive statistical techniques for examining outliers should be presented, if data are not included in an analysis.

EU,Spain fleets– Catch-per-unit-of-effort (CPUE) for oceanic whitetip shark

91. The WPEB **NOTED** paper IOTC–2012–WPEB08–27 which provided standardised CPUE of oceanic whitetip shark caught by the Spanish longline fishery in the Indian Ocean, including the following abstract provided by the authors:

> *"The standardized catch per unit of effort for the oceanic whitetip shark (Carcharhinus longimanus) was obtained by means of a General Linear Mixed Model (GLMM) based on 2806 set records for the 1998-2011 period. Since the number of zero catch observations was considerably high, catch rates were modeled with a delta-lognormal approach using year, quarter, zone and gear as the main explanatory variables. The best models were chosen based on the Akaike information (AIC) and the Bayesian information criteria (BIC). Diagnostics for both models indicated relatively good model fits. The obtained results, together with the full analysis of the managed data, suggest that the standardized index shows a statistically satisfactory fitting level, allowing to identify some significant values which could partially explain the variability of the observed CPUE. However, the high variability of the standardized catch rates between consecutive years and the limited availability of specimens in some years-areas suggest that this index could show the availability rates of this low-prevalence species during a particular period instead of being a representative and plausible indicator of the stock abundance at large. This paper discusses the difficulty to obtain biologically plausible abundance indexes for this kind of species with a low occurrence-prevalence in these fisheries."*

92. The WPEB **NOTED** some concerns related to the areas used in the study and considering other criteria's such as examining Areas 1 and 2 only may give a more appropriate CPUE signal. The WPEB further **SUGGESTED** considering the use of other stratifications related to the biological distribution of the species or to the Longhurst ecological provinces in the Indian Ocean.

93. The WPEB **NOTED** that the reason for the increase after 2007 was not entirely clear, whether it is the result/effect of targeting of a particular species or some other reason.

Japan – Catch-per-unit-of-effort (CPUE) for blue shark

94. The WPEB **NOTED** paper IOTC–2012–WPEB08–28 which provided standardised CPUE of blue shark caught by the Japanese longline fishery in the Indian Ocean, including the following abstract provided by the authors:

> *"In the present study, the standardized CPUE of blue shark caught by Japanese longliners is re-estimated and updated with modified method from the previous study by Hiraoka and Yokawa (2011). The re-estimated standardized CPUE shows rather stable trend in the first period of 1971 – 1993, and general increasing trend in the second period of 1994 – 2011. Though some unnatural fluctuation are observed in the second period, the estimated standardized CPUE believed to be reflecting general trend of the blue shark stocks in the period of analysis. This study also estimated the total annual catch number in the period analyzed, which could be directly used for the estimation of total annual catch weight using information about seasonal and areal average weight. Same method would also be applied for the estimate of total annual catch of other longline fleet with no historical catch data but effort data of blue shark. Thus the results of this study could offer the basic information for some simple stock analysis like surplus production model on blue shark stocks. The observed fluctuation of the standardized CPUE in the second period supposed not to reflect the actual fluctuation of the stock but to be caused by the somewhat simpler method of data selection or the model structure of GLM. The improvement of data selection and analysis method would enable us to estimate less fluctuating trend of the standardized CPUE.*"

95. The WPEB **NOTED** the method of producing blue shark catch prior to 1994, when all sharks were combined, was not scientifically defensible. Based on the paper, all catches were considered to be blue shark for those trips in which 80% or more operations reported shark catch. The WPEB **NOTED** that this method seemed arbitrary, and until more work was done defending its validity to not use data prior to 1994, as species-specific data is available since then.

96. The WPEB **SUGGESTED** that an analysis on blue shark should be conducted in a similar manner as the delta lognormal model, in future years. Comparisons should be made with other standardised CPUEs.

EU,Portugal fleet – Catch-per-unit-of-effort (CPUE) for blue sharks and shortfin mako sharks

97. The WPEB **NOTED** paper IOTC–2012–WPEB08–29 which provided standardised CPUE for blue sharks and shortfin mako sharks caught by the EU,Portugal longline fishery in the Indian Ocean, including the following abstract provided by the authors:

> *"Portuguese longliners targeting swordfish and operating in the Indian Ocean regularly capture elasmobranch fishes as bycatch. Of those, the blue shark (Prionace glauca) and the shortfin mako (Isurus oxyrinchus) constitute the two main shark species captured. A recent effort by IPMA (Portuguese Sea and Atmospheric Institute) has been recovering historical catch data on elasmobranchs captured since the late 1990's to the present date in that fishery. Nominal CPUEs for these two major sharks were calculated as Kg /1000 hooks and standardized with Generalized Linear Models (GLMs). Several different modelling techniques were tested and compared, chosen depending on the specific proportion of zeros in the catch data for each species. The models tested included the delta method, tweedie, gamma and lognormal models. Model validation was carried out with residual analysis, and relative indexes of abundance for the two species were calculated. The results presented in this paper update a previous analysis on the trends of elasmobranch catch rates available from the Portuguese longline fishery operating in the Indian Ocean."*

98. The WPEB **NOTED** a stable trend on the series for blue shark and shortfin mako shark, although the analysis is based on a relatively short period.

99. **NOTING** the improvements made in terms of the models used for the standardisation process, the WPEB **SUGGESTED** that further analysis could explore area and targeting factors (other than species ratios).

CPUE discussion summary

100. The WPEB **REQUESTED** that any future CPUE analysis papers include model comparisons and residual diagnostics, as per the '*Guidelines for the presentation of stock assessment models'* adopted by the SC in 2010. Comparison of catch to derived CPUE should be examined and detailed in the meeting paper.

101. The WPEB **NOTED** that the CPUE analyses for oceanic whitetip sharks and blue sharks were improved in 2012, with the addition of an analysis for shortfin mako sharks caught by the EU,Portugal longline fleet. However, due to the lack of a reliable data series for each species, fully quantitative stock assessments using population dynamic models was not possible, although further work towards undertaking stock assessments in 2013 should be continued depending on availability of suitable data.

102. The WPEB **NOTED** that CPUE time series covering only recent years (such as those presented at the WPEB08 meeting) cannot by themselves give a complete picture of stock status, and need to be interpreted in conjunction with additional information from earlier years in the fishery.

103. The WPEB **NOTED** that the following matters shall be taken into account when undertaking CPUE standardisation analysis in 2013:

Changes in targeting

- Changes in species targeting is the most important issue to address in CPUE standardisations, and that the following points should be taken into consideration, when assessing bycatch data that is a function of differential targeting rates on other species:
  i. While hooks between floats (HBF) provides some indication of setting depth, it is generally considered not to be a sufficient indicator of species targeting. HBF is just one aspect of the setting technique, which can vary by species, area, set-time, and other factors.
  ii. Highly aggregated (e.g. 5x5 degrees) data can make it difficult to observe the factors driving CPUE in a fishery, in particular the targeting effects. Operational data provides additional information that may allow effort to be classified according to fishing strategy (e.g. using cluster analyses or regression trees to estimate species targeting as a function of spatial areas, bait type, catch species composition, set-time, vessel-identity, skipper, etc.). Operational data also permits vessel effects to be included in analyses.

Spatial structure

- Appropriate spatial structure needs to be considered carefully as fish density (and targeting practices) can be highly variable on a fine spatial scale, and it can be misleading to assume that large areas are homogenous when there are large shifts in the spatial distribution of effort. In the course of the discussion, the following points to be taken into consideration were discussed:
  i. Addition of finer scale (e.g. 1x1 degrees) fixed spatial effects in the model can help to account for heterogeneity within sub-regions.
  ii. Efforts should be made to identify spatial units that are relatively homogeneous in terms of the population and fishery to the extent possible (e.g. uniform catch size composition and targeting practices).
  iii. There may be advantages in conducting separate analyses for different sub-regions. The error distribution may differ by sub-region and the proportion of zero sets may vary substantially by region, and there may be very different interactions among explanatory variables.
  iv. There may be advantages in analyzing data of shorter temporal resolution with higher fishery specific covariates to assess if the longer term time-series is indicating the same temporal patterns such as that presented for blue sharks (Japan).
  v. The possibility of defining a representative 'space-time' window: if this leads to the identification of a fishery with homogeneous targeting practices, it is probably worthwhile. However, it may not be possible to identify an appropriate window, or the window may be so small that it is not representative of the larger population (or has a high variance).

Zero observations

104. The WPEB **NOTED** that if there are many observations with positive effort and zero catch, it is worth considering models which explicitly model the processes that lead to the zero observations (e.g. negative binomial, Poisson, zero-inflated or delta-lognormal models). Adding a small constant to the lognormal model may be fine if there are few zero's, but may not be appropriate for areas with many zero catches (e.g. north of 10°S).

Environmental variables

105. The WPEB **NOTED** that the appropriate inclusion of environmental variables in CPUE standardisation is an ongoing research topic, and should possibly be examined in standardisation process used by the WPEB. Other IOTC working parties have examined the inclusion of these variables with some success; using these as covariates may explain the abundance peaks and troughs that are observed in some of the CPUE standardisation datasets. However, such an approach would require the use of operational data and not highly aggregated data. The WPEB further **SUGGESTED** that such data should be made available to scientists conducting CPUE standardisations.

Model building

106. The WPEB **NOTED** that it is difficult to prescribe analyses in advance, and model building should be undertaken as an iterative process to investigate the processes in the fishery that affect the relationship between CPUE and abundance. Specifically:
    i. Model building should proceed with a stepwise introduction of explanatory terms (or starting with a full model and removing one variable at a time), in which the net effect of each level of complexity is presented. Parameter estimates should be presented and examined to see if the mechanism makes sense and the contribution has a practical influence.
    ii. Simulations have shown that model selection using Akaike Information Criterion (AIC) tends to recommend over-parameterized models, and often parsimonious models perform just as well.

Selection of CPUE series

107. The WPEB **NOTED** different trends between the standardised oceanic whitetip shark CPUE for Japan and EU,Spain, and the standardised blue shark CPUE for Japan (since 1994) and EU,Portugal. The WPEB **AGREED** to provide the standardised CPUE data for blue sharks (Fig. 1) and standardised CPUE data for oceanic whitetip sharks (Fig. 2) as stock status indicators.

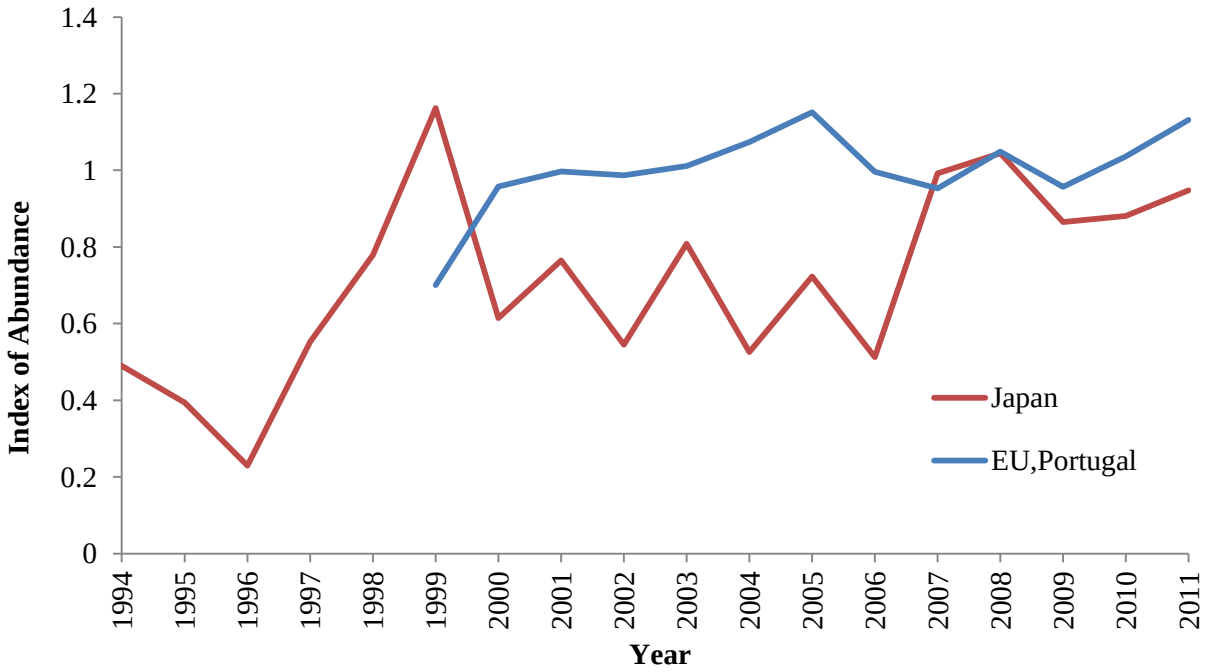

Fig. 1. Blue shark: Comparison of the blue shark standardised CPUE series for the longline fleets of Japan and EU,Portugal.

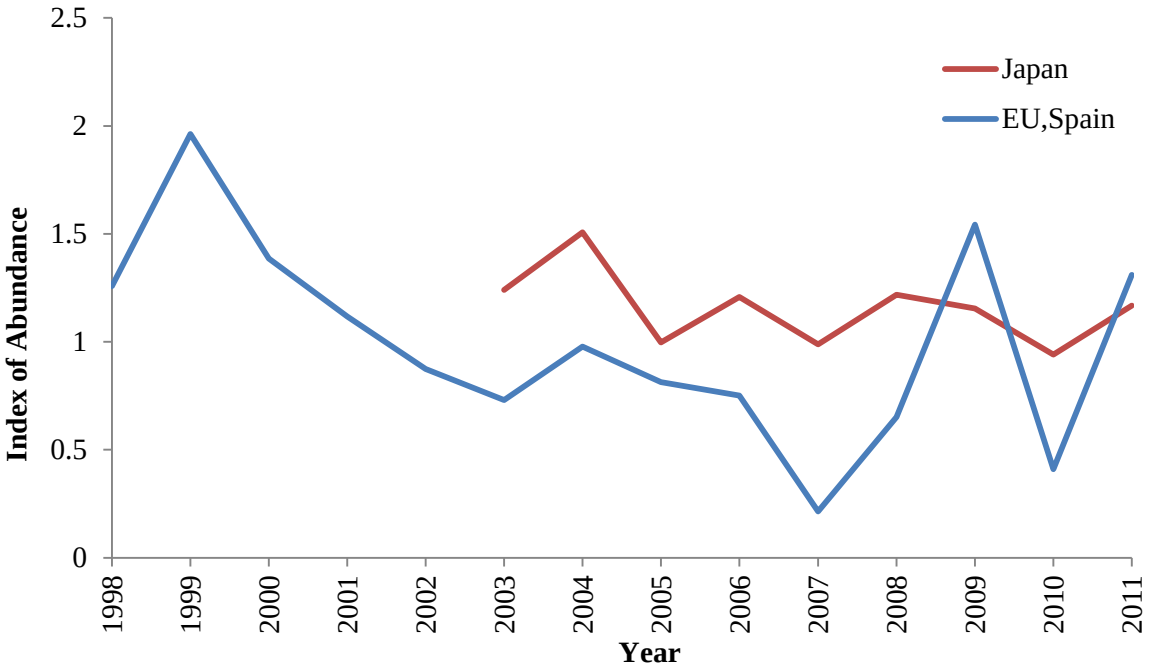

Fig. 2. Oceanic whitetip shark: Comparison of the oceanic whitetip shark standardised CPUE series for the longline fleets of Japan and EU,Spain.

Parameters for future analyses: CPUE standardisation and stock assessments

108. The WPEB **NOTED** that in order to obtain comparable CPUE standardisations, the set of parameters detailed in Table 4, if available, could be used for the standardisation of CPUE analysis in 2013, which could then be used as indices of abundance for the stock assessments for blue shark and oceanic whitetip shark (and other species if available).

TABLE 4. A selection of the possible parameters for the standardisation of shark CPUE series.

CPUE standardisation parameters/approach	Value for 2013 CPUE standardisation
Model	*Delta-Log Normal/Poisson/Log-Normal/Tweedie*
Area	*To be defined (possibly use the North, South and Coastal Areas corresponding to Longhurst ecological provinces for the Indian Ocean).* Explore core area(s) as an alternative TBD
CE Resolution	Operational data
GLM Factors	Year, Quarter, Area, HBF, environmental, species ratios + interactions

8.3.2 Ecological Risk Assessment: review of current knowledge and potential management implications

109. The WPEB **NOTED** the following request from the Commission in 2012:
"*Commission reiterated its previous REQUESTS that an Ecological Risk Assessment (ERA) approach be applied to the various shark species considered at risk by fishing activities in the Indian Ocean, and for the Working Party on Ecosystems and Bycatch to undertake appropriate analyses under the guidance of relevant experts in 2012.*"

110. The WPEB **NOTED** that as part of its request, the Commission approved a short term consultancy to provide the following scientific services for sharks and present the results in a document at the WPEB:

- To gather available data from the IOTC Secretariat and from other sources needed for an Ecological Risk Assessment.
- To lead the production of an updated Level 2 Ecological Risk Assessment for shark species caught in fisheries under the IOTC mandate, working closely with other scientists involved in

this process. This should include the completion of a Productivity-Sensitivity Analysis (PSA) and other appropriate analyses as part of the ERA.

- To identify particular areas of concern, to the extent possible, including but not limited to i) prioritization of most vulnerable species by fishing gear, ii) identification of major sources of mortality, iii) identification of critical areas and seasons.
- To identify major sources of uncertainty in the updated ERA and detail the data required (by gear/fleet) to undertake more quantitative methods of assessment.

111. The WPEB **NOTED** paper IOTC–2012–WPEB08–31 Rev_2, which provided a preliminary Ecological Risk Assessment (ERA) for shark species caught in longline fisheries managed by the Indian Ocean Tuna Commission (IOTC), including the following abstract provided by the author:
"*Ecological risk assessment (ERA), and specifically Productivity-Susceptibility Analysis (PSA), is a useful methodology for assisting the management of fisheries from an ecosystem perspective in a data poor situation. Indian Ocean tuna and tuna-like fisheries, managed by the Indian Ocean Tuna Commission (IOTC), are economically important both at local and international scales and interact with several non-target or bycatch species. In spite of these interactions, to the authors best knowledge, no comprehensive ERA has been conducted for sharks caught by IOTC fisheries. A PSA for shark caught in various longline fleets operating in the Indian Ocean was carried out. Specifically, the analysis for the effects of fishing on sharks was carried for the Soviet Union research longline, Portuguese longline, Japanese longline, Korean longline, La Reunion Island longline, and Chinese longline fleets combined; for which observer or research data were available.*"

112. The WPEB **RECOMMENDED** that the SC note the list of the 10 most vulnerable shark species to longline gear, as determined by the productivity susceptibility analysis, and compare it to the list of shark species/groups required to be recorded for longline gear, contained in Resolution 12/03 o*n the recording of catch and effort by fishing vessels in the IOTC area of competence*, provided at Table 5.

113. The WPEB **NOTED** that Resolution 12/09 *on the conservation of thresher sharks (family alopiidae) caught in association with fisheries in the IOTC area of competence*, does not contain a mandatory requirement for fishers to record interactions with thresher sharks, although it does state that "*CPCs shall encourage their fishers to record and report incidental catches as well as live releases. These data will be then kept at the IOTC Secretariat*."

TABLE. 5. List of the 10 most vulnerable shark species to longline gear compared to the list of shark species/groups required to be recorded in logbooks, as listed in Resolution 12/03 *on the recording of catch and effort by fishing vessels in the IOTC area of competence*.

PSA vulnerability ranking	Most susceptible shark species to longline gear	FAO Code	Shark species currently listed in IOTC Resolution 12/03 for longline gear	FAO Code
1	Shortfin mako (*Isurus oxyrinchus*)	SMA	Blue shark (*Prionace glauca*)	BSH
2	Bigeye thresher (*Alopias superciliosus*)	BTH	Mako sharks (*Isurus* spp.)	MAK
3	Pelagic thresher (*Alopias pelagicus*)	PTH	Porbeagle shark (*Lamna nasus*)	POR
4	Silky shark (*Carcharhinus falciformis*)	FAL	Hammerhead sharks (*Sphyrna* spp.)	SPN
5	Oceanic whitetip shark (*Carcharhinus longimanus*)	OCS		
6	Smooth hammerhead (*Sphyrna zygaena*)	SPZ		
7	Porbeagle (*Lamna nasus*)	POR		
8	Longfin mako (*Isurus paucus*)	LMA		
9	Great hammerhead (*Sphyrna mokarran*)	SPM		
10	Blue shark (*Prionace glauca*)	BSH		

114. The WPEB **AGREED** that as the remainder of the consultancy work was not yet available, specifically to undertake a PSA on the other gears used in IOTC fisheries (e.g. purse seine and gillnet), identification of major sources of mortality, and the identification of critical areas and seasons, that the consultant provide these elements in the final report to the SC for its consideration, noting that data is limited for some of these assigned tasks.

115. The WPEB **NOTED** paper IOTC–2012–WPEB08–30 which provided an Ecological Risk Assessment (ERA) for marine mammals, marine turtles and Elasmobranchs caught on coastal areas, based on interviews conducted in the SWIO (south western Indian Ocean) region, including the following abstract provided by the authors:

> *"This study addressed the magnitude of bycatch of elasmobranchs, sea [marine] turtles and marine mammals in southwest Indian Ocean artisanal fisheries using interview survey data (~1,000 interviews). At least 59 species were identified as bycatch or byproduct species, including 5 species of sea [marine] turtles, 8 species of marine mammals and 46 species of elasmobranchs. A Productivity-Susceptibility Analysis (ERA-Level 2) emphasized at least 17 species were particularly at risk, including 5 species of sea [marine] turtles, 4 species of marine mammals and 8 species of elasmobranchs, especially in drift gillnet fisheries.*"

116. The WPEB **NOTED** that misidentification of some species due to the data collection methodology used could be an issue, and **SUGGESTED** considering the use of higher level taxonomic groups to account for this issue and improve the analysis.

117. The WPEB **NOTED** that there is an overlap between species caught in the coastal artisanal fisheries of the SWIO and those taken incidentally in the offshore tuna fisheries. Monitoring of coastal fisheries which do not necessarily target tunas may therefore be of relevance to IOTC.

8.4 Development of technical advice on the status of the shark stocks

118. The WPEB **RECOMMENDED** that the SC note the management advice developed for a subset of shark species commonly caught in IOTC fisheries for tuna and tuna-like species:
    - Blue sharks (*Prionace glauca*) – Appendix X
    - Oceanic whitetip sharks (*Carcharhinus longimanus*) – Appendix XI
    - Scalloped hammerhead sharks (*Sphyrna lewini*) – Appendix XII
    - Shortfin mako sharks (*Isurus oxyrinchus*) – Appendix XIII
    - Silky sharks (*Carcharhinus falciformis*) – Appendix XIV
    - Bigeye thresher sharks (*Alopias superciliosus*) – Appendix XV
    - Pelagic thresher sharks (*Alopias pelagicus*) – Appendix XVI

8.5 Update of shark species Executive Summaries for the consideration of the Scientific Committee

119. The WPEB **RECOMMENDED** that the IOTC Secretariat update the draft shark Executive Summaries with the latest 2011 catch data, and for these to be provided to the SC for its consideration.

8.6 Review of data needs and way forward for the evaluation of shark stocks

120. The WPEB **RECOMMENDED** that the SC notes that gillnet fisheries are expanding rapidly in the Indian Ocean, with gillnets often being longer than 2.5 km in contravention with UN and IOTC resolutions, and that their use is considered to have a substantial impact on marine ecosystems. **NOTING** that in 2012 the Commission adopted Resolution 12/01 *on the implementation of the precautionary approach*, the majority of the WPEB **URGED** the SC to consider recommending that the Commission freeze catch and effort by gillnet fisheries in the Indian Ocean in the near future, until sufficient information has been gathered to determine the impact of gillnet fleets on IOTC stocks and bycatch species caught by gillnet fisheries targeting tuna and tuna-like species, noting that the implementation of any such measure would be difficult.

121. The WPEB **RECOMMENDED** that the SC considers making a request to the Commission to allocate funds to carry out training for CPCs having gillnet fleets on species identification, bycatch mitigation and data collection methods and identifies other potential sources of assistance to carry out such activities.

122. The WPEB **RECOMMENDED** research and development of mitigation measures to minimize bycatch of the oceanic whitetip shark and its unharmed release for all types of fishing gears, and that CPCs with data on oceanic whitetip sharks (i.e. total annual catches, CPUE time series and size data) make these available to the next WPEB meeting.

123. The WPEB **AGREED** that blue shark undergo revised CPUE analysis in 2013, following the advice listed above (in section 8.3.1), and for a stock assessment to be undertaken to the extent possible.

124. **NOTING** that Resolution 10/02 *mandatory statistical requirements for IOTC members and Cooperating Non-Contracting Parties (CPC's)*, makes provision for data to be reported to the IOTC on "*the most commonly caught shark species and, where possible, to the less common shark species*",

without giving any list defining the most common and less common species, and recognising the general lack of shark data being recorded and reported to the IOTC Secretariat, the WPEB **RECOMMENDED** that Resolution 10/02 is revised in order to include the list of most commonly caught elasmobranch species (Table 6) for which nominal catch data shall be reported as part of the statistical requirement for IOTC CPCs.

TABLE 6. List of the most commonly elasmobranch species caught.

Common name	Species	Code
Manta and devil rays	Mobulidae	MAN
Whale shark	*Rhincodon typus*	RHN
Thresher sharks	*Alopias spp.*	THR
Mako sharks	*Isurus spp.*	MAK
Silky shark	*Carcharhinus falciformis*	FAL
Oceanic whitetip shark	*Carcharhinus longimanus*	OCS
Blue shark	*Prionace glauca*	BSH
Hammerhead shark	Sphyrnidae	SPY
Other Sharks and rays	–	SKH

9. MARINE TURTLES

9.1 Review of data available at the secretariat for marine turtles

125. The WPEB **NOTED** paper IOTC–2012–WPEB08–09 which summarised the standing of a range of data and statistics received by the IOTC Secretariat for marine turtles, in accordance with IOTC Resolution 10/02 *mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*, for the period 1950–2010. A summary of the supporting information for the WPEB is provided in Appendix VII.

126. The WPEB **NOTED** that there is very limited information on interactions with marine turtles available in the IOTC Secretariat's databases for most longline and purse seine fleets, and for all gillnet fleets that operate in the Indian Ocean.

Data and reporting requirements

127. The WPEB **NOTED** the IOTC Resolutions relevant to marine turtle species (notably Resolutions 10/02, 12/03 and 12/04, including the data and recording, and reporting requirements (Table 7) by which Contracting and non-Contracting Cooperating Parties (CPCs) are required to collect and report all marine turtle interaction data.

TABLE 7. IOTC data collection and reporting requirements for marine turtles.

Resolution	Paragraph
IOTC Resolution 12/04: *On Marine Turtles*	Paragraph 3: CPCs shall collect (including through logbooks and observer programs) and provide to the IOTC Secretariat no later than 30 June of the following year in accordance with Resolution 10/02 (or any subsequent revision), all data on their vessels' interactions with marine turtles. The data shall include the level of logbook or observer coverage and an estimation of total mortality of marine turtles incidentally caught in their fisheries.

128. The WPEB **RECOMMENDED** that the current IOTC Resolution 12/04 *on the conservation of marine turtles* is strengthened to ensure that CPCs report annually on the level of incidental catches of marine turtles by species, as provided at Table 8.

TABLE 8. Marine turtle species reported as caught in fisheries within the IOTC area of competence.

Common name	Scientific name
Flatback turtle	*Natator depressus*
Green turtle	*Chelonia mydas*
Hawksbill turtle	*Eretmochelys imbricata*
Leatherback turtle	*Dermochelys coriacea*
Loggerhead turtle	*Caretta caretta*
Olive ridley turtle	*Lepidochelys olivacea*

129. The WPEB **RECOMMENDED** that the SC note that the lack of data from CPCs on interactions and mortalities of marine turtles in the Indian Ocean is a substantial concern, resulting in an inability of the WPEB to estimate levels of marine turtle bycatch. There is an urgent need to quantify the effects of fisheries for tuna and tuna-like species in the Indian Ocean on marine turtle species, and it is clear that little progress on obtaining and reporting data on interactions with marine turtles has been made. This data is necessary to allow the IOTC to respond and manage the adverse effects on marine turtles, and other bycatch species.

130. The WPEB **RECOMMENDED** that marine turtles, as a group, be added to Resolution 12/03 *on the recording of catch and effort by fishing vessels in the IOTC area of competence*, in Annex II (Record once per set/shot/operation) paragraph 2.3 (SPECIES) for longline gear.

131. **NOTING** that Resolution 10/02 does not make provisions for data to be reported to the IOTC on marine turtles, the WPEB **RECOMMENDED** that Resolution 10/02 is revised in order to make the reporting requirements coherent with those stated in Resolution 12/04 on the conservation of marine turtles.

9.2 New information on the biology, stock structure, bycatch mitigation measures, fisheries and associated environmental data

132. The WPEB **NOTED** that, in accordance with Resolution 12/04, paragraph 6, CPCs are obliged to ensure that fishers are aware of and use proper mitigation, identification, handling and de-hooking techniques. Furthermore, it is mandatory that vessels keep onboard all necessary equipment for the release of marine turtles, in accordance with handling guidelines in the *IOTC Marine Turtle Identification Cards*. The WPEB **NOTED** that appropriate equipment for longliners includes line cutters, dehooking devices and dipnets for safely bringing marine turtles onboard.

Hook and bait type – marine turtle bycatch

133. The WPEB **NOTED** paper IOTC–2012–WPEB08–33 which provided results of a study on the effect of hook style and bait type on the incidental bycatch of marine turtles on the Portuguese pelagic longline fishery: lessons from the Atlantic Ocean, including the following abstract provided by the authors:

> *"This scientific document briefly reports some of the major results of the SELECT-PAL Project, which aimed to evaluate the effect of hook style and bait type on the catches of major target and bycatch species of the Portuguese pelagic longline fishery on different areas of the Atlantic Ocean (NE tropical, Equatorial and Southern temperate). A total of 733 longline sets were carried out, namely 202 in the NE Tropical, 221 in the Equatorial and 310 in the Southern Atlantic. Three different hook types were tested, traditional J hook (9/0) and two 17/0 circle hooks (a non-offset and a 10º offset), but only one bait type was used in each set (Scomber spp. or Illex spp.). Overall, a total of 1,006,272 hooks were set (335,424 of each hook style). The highest mean sea [marine] turtle BCPUE (J hook baited with squid) was observed on the Equatorial area (1.83/1000hooks), followed by the Southern and North-eastern tropical areas, respectively. The highest mean BPUE values for sea [marine] turtle species combined and for the individual species occurred with the J style hook…"* – (see paper for full abstract).

134. The WPEB **NOTED** that the use of circle hooks in combination with fish bait (rather than squid bait) may reduce the incidental catch and/or post-capture mortality of marine turtles. The WPEB **ENCOURAGED** their use in all longline vessels targeting tuna and tuna-like species in the IOTC area of competence, in particular for shallow sets, and **ENCOURAGED** further studies on the socio-economic impact of the use of circle hooks in longline fisheries.

135. The WPEB **AGREED** that further research into the effectiveness of circle hooks adopt a multi-species approach, so as to avoid, as far as possible, promoting a mitigation measure for one bycatch taxon that might exacerbate bycatch problems for other taxa.

Satellite tagging – marine turtles

136. The WPEB **NOTED** paper IOTC–2012–WPEB08–INF02 which provided results of a study on the tracking of marine turtles using 130 satellite tracks deployed in the western Indian Ocean.

137. The WPEB **NOTED** that this study shed new light on the extent and overlap of regional management units of marine turtles and also areas of potential interactions with several fisheries in the western Indian Ocean.

Purse seine interactions with marine turtles

138. The WPEB **NOTED** paper IOTC–2012–WPEB08–35 which provided results of a study on the EU purse seine fishery interaction with marine turtles in the Atlantic and Indian Oceans: a 15 year analyses, including the following abstract provided by the authors:

> "*Bycatch of marine turtles, vulnerable or endangered species, is a growing issue of all fisheries, including Oceanic purse-seine fishery. The present paper seeks to assess marine turtle bycatch at a spatial and temporal level in the European purse seine fishery operating in the Atlantic and Indian Oceans. The study was based on data collected through French and Spanish observer programs from 1995 to 2011, a period where more than 230 000 fishing sets were realized by the UE fleets in both Oceans. A total of 15 913 fishing sets were observed, including 6 515 on drifting Fish Aggregate Devices (FAD) and 9 398 on Free Swimming Schools (FSC). Over the study period, 597 turtles were caught, 86% being released alive at sea. At the same time, from 2003 to 2011, 14 124 specific observations were carried out on floating objects whether they ended in a set or not. 354 marine turtles were observed upon which 80% were already free or entangled alive and therefore released alive...*" – *(see paper for full abstract)*

139. The WPEB **NOTED** that observer data showed a low level of interaction with marine turtles and even a lower mortality rate associated to sets or FAD.

140. The WPEB **NOTED** that observer data showed low levels of interaction with the EU purse seine fleets. However, the WPEB **AGREED** that there is a lack of information on cryptic mortality due to FADs and **ENCOURAGED** the EU to undertake research to estimate the real impact of FADs on marine turtles and sharks.

9.3 Stock status indicators for marine turtles

141. The WPEB **NOTED** that substantial effort with regards to marine turtles have been implemented across the IOTC area of competence, mostly through the implementation of coastal protection measures leading to the increase of some marine turtle populations. Examples of recovering populations include the green turtles (*Chelonia mydas*) of Aldabra, Grande Glorieuse and Europa Islands, hawksbill turtles (*Eretmochelys imbricata*) from Cousin and Aldabra islands, Seychelles, and loggerhead turtles from South Africa.

142. The WPEB **NOTED** that despite significant conservation efforts on marine turtles in the Indian Ocean, not all populations have shown the same response, with some populations remaining vulnerable either due to their small size or significant threats faced throughout the region. Populations of particular concern in the region include four of the five species of marine turtles occurring in the Bay of Bengal (olive ridley, loggerhead, leatherback and hawksbill turtles), western Indian Ocean olive ridley turtles, hawksbill turtles in the Arabian Gulf, flatback turtles and the small leatherback population of the South Western Indian Ocean.

Ecological Risk Assessment: review of current knowledge and potential management implications

143. The WPEB **NOTED** that in 2012 the Commission approved funds for a short term consultancy to provide the following Scientific Services for marine turtles:
    - To compile available data from the IOTC Secretariat, the IOSEA Secretariat and from other sources needed for an Ecological Risk Assessment.
    - To conduct a Level 1 and Level 2 Ecological Risk Assessment (ERA) for marine turtle species caught in fisheries under the IOTC mandate, working closely with other scientists involved in this process, and incorporating recommendations from the next WPEB meeting (to be held in September 2012). This should include the completion of a Productivity-Sensitivity Analysis (PSA) and other appropriate analyses as part of the ERA.
    - To compile all relevant and available information for each marine turtle species under the IOSEA mandate in order to give as clear an indication as possible of the current biological status and population trends. This will include, but is not limited to: catch and CPUE trends in IOTC fisheries for tuna and tuna-like species where available; nesting beach data and trends; comparisons with other oceans and tRMFOs; fishermen's knowledge and other anecdotal information.
    - To identify particular areas of concern, including but not limited to i) prioritization of most vulnerable species and populations, ii) identification of major sources of mortality, iii) identification of critical areas and seasons.

- To identify major sources of uncertainty in the ERA; to compile examples of data, data sources and data gathering methods; and detail the minimum/optimal data required (by gear/fleet) to undertake more quantitative methods of assessment.
- To review the state of implementation, by IOTC CPCs and other bodies fishing in the Indian Ocean, of IOTC Resolution 12/04 *on the conservation of marine turtles* citing, where possible, specific examples of measures taken by individual countries to implement its detailed provisions.
- To propose options for management, including but not limited to: potential mitigation measures; potential closure options (spatial and temporal); potential gear restrictions (e.g. fishing material and FADs).
- To prepare a brief progress report and outline for submission (in writing only) to the Working Party on Ecosystems in Bycatch to be held in South Africa from 17–19 September 2012, describing the state of advancement of the work, as well as any difficulties (including data deficiencies) encountered to date.
- To prepare a report on the methodology, implementation and results of the ERA which shall be submitted to the IOTC and IOSEA Secretariats.
- To present the methods and results of this study to the next meeting of the IOTC Scientific Committee, to be held in the Seychelles from 10–15 December 2012. The final report, bearing the IOTC and IOSEA logos, will also be made available to the Signatory States to the IOSEA Marine Turtle MoU, through its Secretariat.

144. The WPEB **REQUESTS** that all CPCs make available any data on marine turtle interactions with IOTC fisheries to the consultant hired by the Commission to undertake a marine turtle ERA in 2012.

9.4 Development of management advice for marine turtles

145. The WPEB **RECOMMENDED** that the SC note the management advice developed for marine turtles, as provided in the draft resource stock status summary (Appendix XVII).

146. The WPEB **DISCUSSED** the potential for time/area closures and **NOTED** that any such closures should be based on detailed analyses. It would be desirable for such analyses to be presented at the next WPEB meeting, with possible assistance from Iranian scientists working on marine turtles.

9.5 Update of marine turtle species Executive Summary for the consideration of the Scientific Committee

147. The WPEB **RECOMMENDED** that the IOTC Secretariat update the draft marine turtle Executive Summary with the latest 2011 interaction data, and for these to be provided to the SC for its consideration.

9.6 Research on marine turtles

Marine turtle lights for gillnets

148. The WPEB **NOTED** that WWF has provided funding for trials in the Gulf of Mexico for one of the 2011 Smart Gear winners, *Turtle Lights for Gillnets*. The concept, designed to reduce the bycatch of marine turtles in gillnets resulted in a 45% decrease in green turtle interactions, 55% decrease in scalloped hammerhead interactions, and an increase in the catch of target species, a species of sole. Additional trials in another Gulf location produced similar results in reduction of interactions with loggerhead turtles. Future trials in areas of leatherback turtles and gillnet interaction are being considered for 2013.

Fish Aggregating Devices

149. The WPEB **NOTED** the progress made regarding the design and deployment of ecological FADs[1]. Several designs of ecological FADs have been tested onboard the EU purse seine fleet and it seems that they considerably reduce the entanglement of sharks and marine turtles while yields do not appear to be altered by the changes of the FAD design. Consequently further refinements to the designs of ecological FADs will be tested by the EU,France fleet with the goal of zero entanglement.

[1] This terms means improved FAD designs to reduce the incidence of entanglement of bycatch species, using biodegradable material as much as possible.

National management plans/strategies for the reduction of marine turtle bycatch in tuna fisheries

150. The WPEB **NOTED** that no new information regarding the development and implementation of any national management plans for the reduction of marine turtle bycatch in tuna fisheries was presented and **URGED** CPCs to develop such a plan and that the scientists participating in the WPEB report on progress at the next WPEB meeting.

Requests contained in IOTC Conservation and Management Measures

151. The WPEB **NOTED** the three requests to the WPEB contained in paragraph 11 of Resolution 12/04 *on the conservation of marine turtles*. In developing its recommendations, the WPEB was instructed to examine and take into account the information provided by CPCs in accordance with paragraph 10 of Resolution 12/04, other research available on the effectiveness of various mitigation methods in the IOTC area, mitigation measures and guidelines adopted by other relevant organizations and, in particular, those of the Western and Central Pacific Fisheries Commission. The Resolution specifically asks the WPEB to consider the effects of circle hooks on target species catch rates, marine turtle mortalities and other bycatch species.

152. The WPEB **RECOMMENDED** that the SC note the following in regards to the requests to the WPEB outlined in paragraph 11 of Resolution 12/04:

a) *Develop recommendations on appropriate mitigation measures for gillnet, longline and purse seine fisheries in the IOTC area*

Gillnet: The absence of data for marine turtles on effort, spatial deployment and bycatch in the IOTC area of competence makes any recommendation regarding mitigation measures for this gear premature. Improvements in data collection and reporting of marine turtle interactions with gillnets, and research on the effect of gear types (i.e. net construction and colour, mesh size and soak times) are necessary.

Longline: Current information suggests inconsistent spatial catches (i.e. high catches in few sets) and by gear/fishery. The most important mitigation measures relevant for longline fisheries are to:

1. Encourage the use of circle hooks whilst developing further research into their effectiveness using a multiple species approach.
2. Release live animals after careful dehooking/disentangling/line cutting (See handling guidelines in the IOTC marine turtle identification cards).

Purse seine: see c) below

b) *Develop regional standards covering data collection, data exchange and training*

1. The development of standards using the IOTC guidelines for the implementation of the Regional Observer Scheme should be undertaken, as it is considered the best way to collect reliable data related to marine turtle bycatch in the IOTC area of competence.
2. The Chair of the WPDCS to work with the IOSEA MoU Secretariat, which has already developed regional standards for data collection, and revise the observer data collection forms and observer reporting template as appropriate, as well are current recording and reporting requirements through IOTC Resolutions, to ensure that the IOTC has the means to collect quantitative and qualitative data on marine turtle bycatch.
3. Encourage CPCs to use IOSEA expertise and facilities to train observers and crew to increase post-release survival rates of marine turtles.

c) *Develop improved FAD designs to reduce the incidence of entanglement of marine turtles, including the use of biodegradable materials*

All FAD-directed purse seine fisheries should rapidly change to only use FADs based on the following three basic principles:

1. The surface structure of the FAD should not be covered, or only covered with non-meshed material.
2. If a sub-surface component is used, it should not be made from netting but from non-meshed materials such as ropes or canvas sheets.
3. To reduce the amount of synthetic marine debris, and to promote the use of natural or biodegradable materials (such as Hessian canvas, hemp ropes, etc.) in FADs instead of nets.

10. OTHER BYCATCH, BYPRODUCT AND ECOSYSTEM ISSUES

10.1 Seabirds

153. The WPEB **NOTED** that for seabirds, there is very limited information on interactions available in the IOTC Secretariat's databases for most longline and gillnet fleets that operate in the Indian Ocean although some new information on seabirds was presented during the current meeting.

10.1.1 Data and reporting requirements

154. The WPEB **NOTED** each of the IOTC Resolutions relevant to seabirds (notably Resolutions 10/02 and 10/06 (to be superseded by 12/06 on 1 July, 2014), including the recording and reporting requirements (Table 9). Contracting and non-Contracting Cooperating Parties (CPCs) are required to collect and report incidental bycatch of seabirds.

TABLE 9. IOTC data collection and reporting requirements for seabirds.

Resolution	Paragraph
IOTC Resolution 10/06: *On reducing the incidental bycatch of seabirds in longline fisheries*	Paragraph 7: CPCs shall provide to the Commission, as part of their annual reports, all available information on interactions with seabirds, including bycatch by fishing vessels carrying their flag or authorised to fish by them. This is to include details of species where available to enable the Scientific Committee to annually estimate seabird mortality in all fisheries within the IOTC area of competence.
This Resolution shall enter into force on 1 July 2014 IOTC Resolution 12/06: *On reducing the incidental bycatch of seabirds in longline fisheries*	Paragraph 1 (start): CPCs shall record data on seabird incidental bycatch by species, notably through scientific observers in accordance with Resolution 11/04 and report these annually. Paragraph 2: CPCs that have not fully implemented the provisions of the IOTC Regional Observer Scheme outlined in paragraph 2 of Resolution 11/04 shall report seabird incidental bycatch through logbooks, including details of species, if possible.

10.1.2 Seabird identification sheets

155. The WPEB **NOTED** paper IOTC–2012–WPEB08–36 which provided results of a progress report on the development of seabird identification guide for use by tRFMOs, including the following abstract provided by the authors:

> "*At the Joint Technical By-catch Working Group (JTBWG) held prior to Kobe III the ACAP Secretariat offered to review the seabird identification guides currently used by the tuna RFMOs (tRFMO) with a view to collating the information that would best assist observers to accurately identify seabirds caught in fishing operations. Seabird identification guides have subsequently been obtained from two tRFMOs, as well as from some National Observer Programmes. An initial review of this and additional material has shown that a small number of species do not have sufficient distinguishing characteristics that would allow their certain identification across all relevant age classes. In these cases, an alternative method, such as DNA analysis, may be required for species-level identification.*"

156. The WPEB **NOTED** ACAP's draft seabird identification guides for use in observer programmes contained photos of seabird corpses for assisting the identification of dead seabirds caught at sea.

157. The WPEB **AGREED** that the identification of dead seabirds was not a simple task and that it is not realistic to expect that all fishing masters would possess the necessary skills to reliably identify seabirds caught on their vessels. Therefore reliable data would most likely only come from trained and experienced observers.

158. The WPEB **AGREED** that the ACAP identification guides would be a useful addition to the IOTC seabird identification guides, and that for future iterations of the identification guide, the IOTC Secretariat could liaise with ACAP in order to include the photos of dead seabirds in the IOTC identification guide.

10.1.3 Minimum data requirements for seabird bycatch

159. The WPEB **NOTED** paper IOTC–2012–WPEB08–37 which provided minimum data requirements for assessing and managing seabird bycatch, including the following abstract provided by the authors:

> "*The purpose of this paper is to assist the IOTC to identify data fields that are not currently included in its Regional Observer Scheme, the collection of which may assist its understanding of fishery impacts on seabirds and in assessing the efficacy of the mitigation measures currently being used.*"

160. The WPEB **NOTED** that ACAP has identified a number of additional data fields which, although not essential, would ideally be recorded by the IOTC ROS, as they would assist in improving the understanding of the factors influencing seabird bycatch. These additional data fields are:
    - Regular seabird abundance estimates;
    - The fate (dead/alive/injured) and number of birds (for each species) in each of these categories, and whether the bird was released alive, or discarded;

161. The WPEB **AGREED** that the collection of seabird abundance estimates would allow observed seabird bycatch rates to be related to the number of seabirds present during setting operations. Detailed observations of seabird interactions with fishing gear can assist in understanding the circumstances that result in bycatch, and can be useful to identify the most effective mitigation measures to be used.

162. The WPEB **AGREED** that while in Resolution 12/03 the catch of seabirds for vessels using longline and gillnet gear has been incorporated, it is assumed that it is only seabird mortality that is reported when a seabird is hauled on deck, and that this requirement does not include other interactions. The fate (dead/alive/injured) and number of seabirds (for each species) in each of these categories should be recorded for all observed seabird interactions. The WPEB **AGREED** that it is unclear why the requirement to collect seabird data (as stated in Resolution 12/06) is optional when the CPC fully implements the observer program. This data should continue to be collected through observer programs, in whatever form they take, and when an observer program is not available, by being recorded in logbooks.

10.1.4 Safe lead weights for pelagic longline fisheries

163. The WPEB **NOTED** paper IOTC–2012–WPEB08–38 which provided results of a study examining safer line weights for pelagic longline fisheries, including the following abstract provided by the authors:

> *"In many pelagic longline fisheries around the world there is reluctance to adopt a line weighting regime that will sink fishing gear rapidly to reduce seabird bycatch. In many cases this is due to safety concerns caused by traditional weighted swivels causing serious injuries, and even fatalities, when they recoil back at the crew in the event of line breakage (e.g., from shark bite offs) during line hauling. This paper presents the results of at-sea and on-shore trials to test the safety and operational effectiveness of an alternative line weight (the Safe Lead) which is designed to slide down, or off the line, in the event of a bite-off, virtually eliminating danger to the crew from line weights. At-sea trials in South Africa revealed that Safe Leads can reduce the incidence of dangerous fly-backs to very low levels. In at-sea trails, only 4.2 % of Safe Lead fly-backs reached the vessel (the remainder fell in the sea) whereas 73.3% of fly-backs by leaded swivels hit the vessel and one hit a crewmen in the head..."* – *(see paper for full abstract)*

164. The WPEB **NOTED** that mitigation measures should never compromise crew safety and commended BirdLife and collaborators for their innovative approach. The WPEB **ENCOURAGED** researchers to take this information to their national fleets. Information about Safe Leads is available at www.fishtekmarine.com.

165. The WPEB **NOTED** that a different system for safe line weighting, the Yamazaki Double-Weighting System (YDWS), had recently won the WWF Smart Gear competition. The WPEB **REQUESTED** that Japan present information about YDWS at the next WPEB meeting. The scientist from Japan indicated that they would present a video showing the use of the line weighting system at the next meeting.

10.1.5 Maldives seabird interactions

166. The WPEB **NOTED** paper IOTC–2012–WPEB08–39 which provided results of a study examining seabird bycatch in the Maldivian tuna fishery, including the following abstract provided by the authors:

"*Maldivian tuna fishermen have relied on seabirds to locate tuna schools for several hundred years. Even before binoculars were brought to Maldives fishermen observed the behaviour of seabirds associated with tuna schools to locate the fish. The study looks at the attitude of tuna fishermen towards seabirds associated with tuna schools and the amount of seabirds killed/caught during tuna fishing operations in the Maldives. The study was carried out by interviewing 102 fishermen throughout Maldives. The fishermen realise the usefulness of seabirds for their fishing operations and they are concerned with the decline in numbers of some seabirds species in Maldives. Less than 1% of fishermen said seabirds do get tangled on the fishing line or bite the hook during tuna fishing operation while using both pole-and-line and handlines. The main threats to seabirds population in Maldives are from expanding human population; destruction of seabirds resting and roosting sites for construction of resorts or picnic island;, disturbance caused by sand mining from sandbanks; and catching seabirds and collecting their eggs from roosting and nesting sites on the sand banks and islands to keep them as pets...*" – (see paper for full abstract)

167. The WPEB **COMMENDED** the authors for undertaking this research and **NOTED** that information indicating no interactions, is very valuable. The paper suggests no significant interactions between seabirds and fishing gear and supports the current understanding of the low risk of pole and line fishing to seabirds.

10.1.6 Development of technical advice on the status of seabirds

168. The WPEB **RECOMMENDED** that the SC note the management advice developed for seabirds, as provided in the draft resource stock status summary (Appendix XVIII).

10.1.7 Update of seabird Executive Summary for the consideration of the Scientific Committee

169. The WPEB **REQUESTED** that the IOTC Secretariat update the draft seabird Executive Summary with the latest 2011 interaction data, and for these to be provided to the SC for its consideration.

170. The WPEB **NOTED** the importance and difficulty of correct seabird identification, and recognized the importance of digital photographs to aid identification and welcomed the offer of support from Birdlife.

10.2 & 10.3 Marine mammals and depredation

171. The WPEB **NOTED** paper IOTC–2012–WPEB08–40 which provided a preliminary approach to defining hotspots for toothed cetaceans involved in pelagic longline fishery depredation in the western Indian Ocean, including the following abstract provided by the authors:

"*False killer whale (Pseudorca crassidens), short-finned pilot whale (Globicephala macrorhynchus) and Risso's dolphin (Grampus griseus) are the known cetacean species involved in pelagic longline depredation in the tropical and subtropical waters of the western Indian Ocean. In order to better understand interactions between these cetaceans and fisheries, it is crucial to investigate the spatial distribution, density and habitat preferences of these species. A review of the literature (published from 1973 to 2011) noted 500 presence sightings (P. crassidens 219, Globicephala macrorhynchus 108, Grampus griseus 173), resulting from ~1,991,112 kilometres of survey effort. Data were compiled for the western Indian Ocean region (IUCN region 12) using two approaches, those being the presence-only IUCN recommended α-hull and widely used density kernel. The study observed that although both methods utilised fundamentally different approaches there was observed a significant correlation between increasing mean regional density and the increasing mean-ranked occurrence of species presence within the region…*" – (see paper for full abstract)

172. The WPEB **NOTED** that for the first time, this preliminary study highlights the probable existence of density hotspots for false killer whales, short-finned pilot whales and Risso's dolphins in the western Indian Ocean. For all species, it appears that the Seychelles, the Mozambique Channel and, at a lesser extent, the Mascarene Islands constitute major areas for these species. These areas also constitute major pelagic longline fishing areas in the western Indian Ocean.

173. The WPEB **AGREED** that the results suggest a high level of spatial interactions between these cetacean species and pelagic longline fisheries. In order to better understand factors driving toothed cetacean density in those areas, research examining the physiographical and oceanographic features with toothed cetacean density needs to be carried out. Linking pelagic longline fishing effort and toothed cetacean habitat would also be important to better understand interactions between those fisheries and toothed cetaceans.

174. The WPEB **NOTED** paper IOTC–2012–WPEB08–41 which provided results of a study examining interactions between marine mammals and the European tropical tuna purse seine fishery in the Indian and Atlantic oceans, including the following abstract provided by the authors:

"*Marine mammals are ecologically important species and play an important role in trophic network of aquatic ecosystems. The tuna fishing industry holds an important place in the Indian and Atlantic Oceans and these large marine organisms are indeed observed during fishing activities and are sometimes encircled with the net when fishing tuna schools, before being released. We studied the relationship between fishing fleets and marine mammals considering two complementary data sets: a 31 years data set derived from logbooks systematically filled by captains of the French and Spanish tuna purse seine fleets (1980-2011) and a 16 years data set compiling observations from various scientific observers programs (1995-2011) with partial and variable coverage. We analyze the spatio-temporal distribution (season and year) of co-occurrence frequency between fishing activities and these large marine organisms, and the possible impact on their mortality. Marine mammals were divided into three groups: small toothed whales, big toothed whales and whales…*" – (see paper for full abstract)

175. The WPEB **AGREED** that the combination of logbook and observer data from the EU tuna purse seine fishery provide a useful basis for analysing the distribution of marine mammals in the western part of the Indian Ocean and indicate the low level of interactions associated with absence of mortality observed in this sample when encircled.

176. The WPEB **NOTED** that a seasonal, annual and spatial variability in the frequency of co-occurrence distribution between the tuna purse seine fishery and baleen whales was identified.

177. The WPEB **AGREED** that all CPCs should review their data holdings to determine the level of interactions with fishing gears and marine mammals and for this to be presented at the next WPEB meeting.

Marine mammals general discussion

178. The WPEB **NOTED** that when whales become entangled in nets but escape, not all escapees may survive; some may have pieces of netting attached and may succumb to the effects of entanglement at a later time.

10.4 Other taxa

Bycatch and discards – I.R. Iran gillnet fisheries

179. The WPEB **NOTED** paper IOTC–2012–WPEB08–42 which provided an estimation of bycatch and discard in Iranian fishing vessels (gillnets) in the IOTC area of competence during 2012, including the following abstract provided by the authors:

"*In order to assessment of bycatch and discard Iranian Tuna gill net fishing vessels in the IOTC competence of area, I.R. Iran developed and implemented a study during 2011. Base on the study results, around 87% of Iran gill nets catch belong to Tuna species while around 3.2%, 3.7%, 2.4% and 3.5% of the catch consequently belong to sharks, sailfish, dolphinfish and some other species. Iran also offered his request, to receive more technical and financial support, from IOTC to train fishermen and capacity building in the tuna fisheries field*."

180. The WPEB **RECOMMENDED** that the SC considers making a request to the Commission to allocate funds to support a regional review of the data available for gillnet fleets operating in the Indian Ocean. The scientists from all CPCs having gillnet fleets in the Indian Ocean should provide at the next session of the WPEB, a report summarising the known information on bycatch in their gillnet fisheries, including sharks, marine turtles and marine mammals, with estimates of their likely order of magnitude where more detailed data are not available.

181. The WPEB **REQUESTED** that CPCs explore means to undertake research cruises using driftnet vessels in the Indian Ocean aimed at documenting and quantifying the nature and extent of bycatch in these fisheries.

Bycatch and discard review

182. The WPEB **NOTED** paper IOTC–2012–WPEB08–INF20 which provided a review of bycatch and discard issues in Indian Ocean tuna fisheries, including the following abstract provided by the authors:

"Presents a review of bycatch and discard issues in Indian Ocean tuna fisheries. The review covered Maldivian pole-and-line, European purse seine and various longline fisheries. Despite

their major catches, data were not available for drift gillnet fisheries. The lowest bycatch rates were observed in the free-school (FS) purse seine fishery (1.7%) which has high yellowfin catches at large sizes and fairly small skipjack catches. This compares with floating object-associated schools (FO) with large skipjack catches and small yellowfin and bigeye tuna catches. Data from observer cruises raised to the total tuna catch estimated that the non-tuna catch amounted to 4,271t on average, 2.7% of the FO and 1.7% of the total tuna landings. All the fish caught (34%) came from "robust" stocks, but the bycatch included nearly 1,000t of sharks, including 79% of mainly small silky and 11% of whitetip sharks, both of which may be vulnerable species. Discarding occurs in small seiners, mainly from the French fleet, but most of the bycatch is landed and utilised…" – (see paper for full abstract)

10.5 Ecosystem issues

183. The WPEB **NOTED** the recent report "*Performance assessment of bycatch and discards governance of Regional Fisheries Management Organisations*". In that review, the IOTC scored the lowest of all five tuna RFMOs, in large part due to paucity of observer effort in the region. The WPEB **NOTED** that the threat of piracy had adversely affected the deployment of observers in the Indian Ocean. The WPEB **CALLED** upon the SC and the Commission to improve bycatch governance, for example developing systems to expand observer effort and improve bycatch mitigation and to ensure compliance with existing CMMs.

11. RESEARCH RECOMMENDATIONS AND PRIORITIES

11.1 Revision of the WPEB work plan

Employment of a Fisheries Officer

184. Noting the rapidly increasing workload at the IOTC Secretariat, including a wide range of additional duties assigned to it by the SC and the Commission, the WPEB **RECOMMENDED** that the Commission increase the staff of the IOTC Secretariat to incorporate a new Fisheries Officer post to work on a range of matters in support of the scientific process.

Core topics for research

185. The WPEB **RECOMMENDED** that the SC add the following core topic areas as priorities for research over the coming year, noting that the first step will be for the SC to establish priorities, taking into account data gaps, capacity among CPCs, and areas for implementation:

- ***Ecological Risk Assessment***
  i. Sharks – interpretation of consultant report
  ii. Marine turtles – interpretation of consultant report
- ***Shark stock status analyses (development of abundance indices)***
  i. Develop/improve accurate CPUE indices for analysis
  ii. Develop methods to estimate historical catch series by gear.
  iii. Develop life history and biological patterns for the species (namely migration patterns and distribution patterns).
- ***Depredation***
  i. Longline fishery depredation
- ***Bycatch mitigation***
  i. Sharks
  ii. Seabirds – line weighting
  iii. Marine turtles
  iv. Marine mammals
- ***Capacity building***
  i. Scientific assistance to CPCs and specific fleets considered to have the highest risk to bycatch species (e.g. gillnet fleets and longline fleets).

12. OTHER BUSINESS

12.1 Development of priorities for an Invited Expert/s at the next Working Party on Ecosystems and Bycatch meeting

186. The WPEB **NOTED** with thanks, the contributions of the Invited Expert for the meeting, Dr. Robert Olson, from the Inter-American Tropical Tuna Commission and encouraged him to maintain links with

IOTC scientists to aid in the improvement of approaches to assess ecosystem and bycatch issues in the IOTC area of competence.

187. The WPEB **NOTED** the following core areas of expertise and priority areas for contribution, that need to be enhanced for the next meeting of the WPEB at which shark analysis is a priority, by possibly refining the information base for species in addition to blue shark and oceanic whitetip sharks for stock assessment purposes.

12.2 Date and place of the Ninth Session of the Working Party on Ecosystems and Bycatch

188. The WPEB participants were unanimous in thanking South Africa for hosting the Eighth Session of the WPEB and commended South Africa on the warm welcome, the excellent facilities and assistance provided to the IOTC Secretariat in the organisation and running of the Session.

189. The WPEB **AGREED** that the three days allocated by the SC to the WPEB in 2012 was insufficient for the quantity and quality of information presented on sharks, which was set by the SC as a priority for the WPEB08 meeting. The WPEB **REQUESTED** that the next meeting be five days in duration.

190. Following a discussion on who would host the Ninth Session of the WPEB, and noting that the Working Party on Billfish has suggested holding their meeting in La Réunion in September 2013, the WPEB **RECOMMENDED** that the next session of the WPEB be held in conjunction with the Working Party on Billfish. Japan was offered as an alternative option if necessary. The exact dates and meeting location will be confirmed and communicated by the IOTC Secretariat to the SC for its consideration at its next session to be held in December 2012.

191. Following a discussion on who would host the Tenth Session of the WPEB in 2014, the WPEB **REQUESTED** that the IOTC Secretariat liaise with CPCs to determine a suitable host for the Tenth Session in September 2014, in conjunction with the Working Party on Billfish. The tentative dates and meeting location will be communicated by the IOTC Secretariat to the SC for its consideration.

192. The WPEB **NOTED** that as quantitative information on sharks becomes available, there should be the possibility for simple stock status analyses based on fisheries and biological indicators and development of stock status indicators for some species in the near future. Expertise in stock assessment from other IOTC working parties, e.g. the Working Party on Tropical Tunas or the Working Party on Billfish, would be of value for such analyses. Therefore, the WPEB **RECOMMENDED** that the SC consider the following options:
    - Possibility of a dedicated Working Party on Sharks (WPS), which could be held in alternate years to the WPEB so as not to increase the number of meetings held each year.
    - Retaining the WPEB in its current form, but to ensure that each five to six day meeting alternatives its focus between sharks versus all other ecosystem and bycatch issues.

12.3 Review of the draft, and adoption of the Report of the Eighth Session of the Working Party on Ecosystems and Bycatch

193. The WPEB **NOTED** the new Chairman's Award for best presentation by a coastal country scientist was introduced in 2012. This year's award had two joint winners: Ms. Nadeesha Hasarangi from Sri Lanka and Mr. Umair Shahid from Pakistan. Certificates were presented to the winners with warm congratulations from all participants.

194. The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB08, provided at Appendix IV.

195. The report of the Eighth Session of the Working Party on Ecosystems and Bycatch (IOTC–2012–WPEB08–R) was **ADOPTED** on the 19 September 2012.

APPENDIX I
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APPENDIX II
AGENDA FOR THE EIGHTH WORKING PARTY ON ECOSYSTEMS AND BYCATCH

Date: 17–19 September 2012
Location: 15 On Orange Hotel
15 Orange Street, Cape Town, South Africa
Time: 09:00 – 17:00 daily
Chair: Dr. Charles Anderson; **Vice-Chair**: Dr. Evgeny Romanov

1. **OPENING OF THE MEETING** (Chair)

2. **ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION** (Chair)

3. **OUTCOMES OF THE FOURTEENTH SESSION OF THE SCIENTIFIC COMMITTEE** (Secretariat)

4. **OUTCOMES OF SESSIONS OF THE COMMISSION**
   - Outcomes of the Sixteenth Session of the Commission (Secretariat)
   - Review of Conservation and Management Measures relating to Ecosystems and Bycatch (Secretariat)

5. **PROGRESS ON THE RECOMMENDATIONS OF WPEB07** (Chair)

6. **REVIEW OF NATIONAL PLANS OF ACTION (SHARKS AND SEABIRDS)** (Secretariat)

7. **REGIONAL OBSERVER SCHEME – Update** (Secretariat)

8. **SHARKS**
   - 8.1 Review of data available at the secretariat for sharks (Secretariat)
   - 8.2 New information on the biology, stock structure, bycatch mitigation measures, fisheries and associated environmental data (all)
   - 8.3 Stock status indicators for sharks (all)
     - Ecological Risk Analysis: review of current knowledge and potential management implications
     - Other indicators (e.g. CPUE analysis)
   - 8.4 Development of technical advice on the status of the shark stocks (all)
     - Update of shark species Executive Summaries for the consideration of the Scientific Committee (all)
   - 8.5 Review of data needs and way forward for the evaluation of shark stocks (all)

9. **MARINE TURTLES**
   - 9.1 Review of data available at the secretariat for marine turtles (Secretariat)
   - 9.2 New information on the biology, stock structure, bycatch mitigation measures, fisheries and associated environmental data (all)
   - 9.3 Stock status indicators for marine turtles (all)
     - Ecological Risk Analysis: review of current knowledge and potential management implications
     - Other indicators
   - 9.4 Development of management advice for marine turtles (all)
   - 9.5 Update of marine turtle species Executive Summary for the consideration of the Scientific Committee (all)

10. OTHER BYCATCH, BYPRODUCT AND ECOSYSTEM ISSUES

10.1 Seabirds (all)
10.2 Marine mammals (all)
10.3 Depredation (all)
10.4 Other taxa (all)
10.5 Ecosystem issues (all)

11. RESEARCH RECOMMENDATIONS AND PRIORITIES

11.1 Revision of the WPEB work plan (Chair)

12. OTHER BUSINESS

12.1 Development of priorities for an Invited Expert/s at the next Working Party on Ecosystems and Bycatch meeting (Chair)
12.2 Date and place of the Ninth Session of the Working Party on Ecosystems and Bycatch (Chair and Secretariat)
12.3 Review of the draft, and adoption of the Report of the Eighth Session of the Working Party on Ecosystems and Bycatch (Chair)

APPENDIX III
LIST OF DOCUMENTS

Document	Title	Availability
IOTC–2012–WPEB08–01a	Draft agenda of the Eighth Working Party on Ecosystems and Bycatch	✓(11 June 2012)
IOTC–2012–WPEB08–01b	Draft annotated agenda of the Eighth Working Party on Ecosystems and Bycatch	✓(7 September 2012)
IOTC–2012–WPEB08–02	Draft list of documents	✓(5 September 2012)
IOTC–2012–WPEB08–03	Outcomes of the Fourteenth Session of the Scientific Committee (Secretariat)	✓(17 July 2012)
IOTC–2012–WPEB08–04	Outcomes of the Sixteenth Session of the Commission (Secretariat)	✓(16 August 2012)
IOTC–2012–WPEB08–05	Review of current Conservation and Management Measures relating to ecosystems and bycatch (Secretariat)	✓(16 August 2012)
IOTC–2012–WPEB08–06	Progress made on the recommendations of WPEB07 (Chair)	✓(10 September 2012)
IOTC–2012–WPEB08–07	Status of development and implementation of National Plans for Action for Seabirds and Sharks (Secretariat)	✓(30 August 2012)
IOTC–2012–WPEB08–08 Rev_1	Update on the implementation of the IOTC Regional Observer Scheme (Secretariat)	✓(5 September 2012) ✓(17 September 2012)
IOTC–2012–WPEB08–09	Review of the statistical data available for bycatch species (Secretariat)	✓(13 July 2012)
Sharks		
IOTC–2012–WPEB08–10 Rev_1	Management of shark fishery in Sri Lanka (S. Herath)	✓(6 September 2012) ✓(15 September 2012)
IOTC–2012–WPEB08–11	Sharks caught in Mozambican waters (B. de Sousa)	✓(3 August 2012)
IOTC–2012–WPEB08–12 Rev_1	Catch per unit of effort of sharks caught by Malagasy longliners (D.M. Rahombanjanahary)	✓(28 August 2012) ✓(17 September 2012)
IOTC–2012–WPEB08–13	Status report on bycatch of tuna gillnet operations in Pakistan (M. Moazzam)	✓(2 September 2012)
IOTC–2012–WPEB08–14 Rev_1	Shark : Bycatch in the pelagic longline fishery along Ninety East Ridge taken by research vessel in 2011–2012 (P. Lerdwittayaprasit and P. Chaidee)	✓(13 August 2012) ✓(9 September 2012)
IOTC–2012–WPEB08–15 Rev_1	A review on shark fishery resources in Sri Lanka (D.G.N. Hasarangi, S.S.K. Haputhantri and R. Maldeniya)	✓(4 September 2012) ✓(14 September 2012)
IOTC–2012–WPEB08–16	Capture ratio and species abundance distribution of sharks in the pelagic longline fishery based in La Reunion (P. Bach)	Withdrawn
IOTC–2012–WPEB08–17	Results from the first conventional tagging pilot study on bycatch species from purse seiners (J. Filmalter)	Withdrawn
IOTC–2012–WPEB08–18	Fin to carcass weight ratios for the silky shark *Carcharhinus falciformis* in the western Indian Ocean (B. Séret, A. Blaison, L. Dagorn and J.D. Filmater)	✓(2 September 2012)
IOTC–2012–WPEB08–19	Length and length / weight relationships for the silky shark *Carcharhinus falciformis*, in the western Indian Ocean (J. Filmalter, B. Seret and L. Dagorn)	✓(7 September 2012)
IOTC–2012–WPEB08–20	An update on the post-release survival of silky sharks incidentally captured by tuna purse seine vessels in the Indian Ocean (J. Filmalter, F. Forget, F. Poisson, A.-L. Vernet and L. Dagorn)	✓(5 September 2012)
IOTC–2012–WPEB08–21	Summary of results on the development of methods to reduce the mortality of silky sharks by purse seiners (L. Dagorn, J. Filmalter and F. Forget)	✓(5 September 2012)

Document	Title	Availability
IOTC–2012–WPEB08–22	Size distribution and length-weight relationships for some large pelagic sharks in the Indian Ocean. Communication 2. Bigeye thresher shark, tiger shark, silvertip shark, sandbar shark, great hammerhead shark, and scalloped hammerhead shark (E.V. Romanov and N.V. Romanova)	✓(5 September 2012)
IOTC–2012–WPEB08–23	Vertical and horizontal behaviour of silky, oceanic whitetip and blue sharks in the western Indian Ocean (J. Filmalter, F. Forget, F. Poisson, A.-L. Vernet, P. Bach and L. Dagorn)	✓(6 September 2012)
IOTC–2012–WPEB08–24	Historical trends of abundance of silky and oceanic white tip sharks in the Western Indian Ocean from the purse seine fishery (M. Tolotti)	Withdrawn
IOTC–2012–WPEB08–25 Rev_1	Biological observations of oceanic whitetip shark (*Carcharhinus longimanus*) on Spanish surface longline fishery targeting swordfish in the Indian Ocean over the period 1993–2011 (B. García-Cortés, A. Ramos-Cartelle, I. González-González and J. Mejuto)	✓(3 September, 2012) ✓(10 September 2012)
IOTC–2012–WPEB08–26	Update of the standardized CPUE of oceanic whitetip shark (*Carcharhinus longimanus*) caught by Japanese longline fishery in the Indian Ocean (K. Yokawa and Y. Senba)	✓(13 September 2012)
IOTC–2012–WPEB08–27	Standardized catch rates of the oceanic whitetip shark (*Carcharhinus longimanus)* from observations of the Spanish longline fishery targeting swordfish in the Indian Ocean during the 1998–2011 period (A. Ramos-Cartelle, B. García-Cortés, J. Ortíz de Urbina, J. Fernández-Costa, I. González-González and J. Mejuto)	✓(3 September 2012)
IOTC–2012–WPEB08–28	Update of CPUE of blue shark caught by Japanese longliner and estimation of annual catch series in the Indian Ocean (Y. Hiraoka and K. Yokawa)	✓(12 September 2012)
IOTC–2012–WPEB08–29	Update of the standardized CPUE series for major shark species caught by the Portuguese pelagic longline fishery in the Indian Ocean (R. Coelho, M.N. Santos and P.G. Lino)	✓(3 September 2012)
IOTC–2012–WPEB08–30	An ecological risk assessment (ERA) for marine mammals, sea [marine] turtles and elasmobranchs captured in artisanal fisheries of the SW Indian Ocean based on interview survey data (J. Kiszka)	✓(2 September 2012)
IOTC–2012–WPEB08–31 Rev_2	Preliminary Ecological Risk Assessment (ERA) for shark species caught in fisheries managed by the Indian Ocean Tuna Commission (IOTC) (H. Murua, R. Coelho, M.N. Santos, H. Arrizabalaga, K. Yokawa, E. Romanov, J.F. Zhu, Z.G. Kim, P. Bach, P. Chavance, A. Delgado de Molina and J. Ruiz)	✓(7 September 2012) ✓(17 September 2012) ✓(18 September 2012)
IOTC–2012–WPEB08–32	Interactions between whale sharks and the European tropical tuna purse seine fishery in the Indian and Atlantic oceans (A. Capietto, R. Pianet, A. Delgado de Molina, H. Murua, L. Floch, A. Damiano, P. Chavance and B. Merigot)	✓(8 September 2012)
Marine Turtles		
IOTC–2012–WPEB08–33	Effect of hook style and bait type on the incidental bycatch of sea turtles on the Portuguese pelagic longline fishery: lessons from the Atlantic Ocean (M.N. Santos, R. Coelho, S. Amorim and J. Fernandez-Carvalho)	✓(5 September 2012)
IOTC–2012–WPEB08–34	Tracking all life stages: 130 satellite tracks deployed in the Indian Ocean unravelled invaluable spatial knowledge and highlight new challenges for sea turtle biology and conservation (J. Bourjea and M. Dalleau)	Withdrawn

Document	Title	Availability
IOTC–2012–WPEB08–35 Rev_1	EU purse seine fishery interaction with marine turtles in the Atlantic and Indian oceans: a 15 years analyses (S. Clermont, P. Chavance, A. Delgado, H. Murua, J. Ruiz, S. Ciccione and J. Bourjea)	✓(7 September 2012) ✓(18 September 2012)
Seabirds		
IOTC–2012–WPEB08–36	Progress report on development of a seabird identification guide for use by tRFMOs (N. Beck, Y, Inoue and W. Papworth)	✓(2 September 2012)
IOTC–2012–WPEB08–37	Minimum Data Requirements for Assessing and Managing Seabird Bycatch (J. Turner)	✓(2 September 2012)
IOTC–2012–WPEB08–38	Safe Leads for safe heads: safer line weights for pelagic longline fisheries (B.J. Sullivana, P. Kibelb, G. Robertsonc, B. Kibelb, M. Gorend, S.G. Candyc and B. Wieneckec)	✓(31 August 2012)
IOTC–2012–WPEB08–39	Significance of seabirds to the Maldivian tuna fishery (A.R. Jauharee and M.S. Adam)	✓(5 September 2012)
Marine Mammals and Depredation		
IOTC–2012–WPEB08–40	Defining hotspots for toothed cetaceans involved in pelagic longline fishery depredation in the western Indian Ocean: a preliminary approach (M. Tetley, J. Kiszka and E Hoyt)	✓(28 August 2012)
IOTC–2012–WPEB08–41	Interactions between marine mammals and the European tropical tuna purse seine fishery in the Indian and Atlantic Oceans (A. Capietto, R. Pianet, A. Delgado de Molina, H. Murua, L. Floch, A. Damiano, P. Chavance and B. Merigot)	✓(16 September 2012)
Bycatch and discards		
IOTC–2012–WPEB08–42	Estimation of bycatch and discard in Iranian fishing vessels (gillnets) in the IOTC area of competence during 2012 (R. Shahifar)	✓(5 September 2012)
INFORMATION PAPERS		
IOTC–2012–WPEB08–INF01	Targeting bigger schools can reduce ecosystem impacts of fisheries (L. Dagorn, J.D. Filmalter, F. Forget, M.J. Amandè, M.A. Hall, P. Williams, H. Murua, J. Ariz, P. Chavance, and N. Bez)	✓(31 August 2012)
IOTC–2012–WPEB08–INF02	Tracking all life stages: 130 satellite tracks deployed in the Indian ocean unraveled invaluable spatial knowledge and highlight new challenges for sea turtle biology and conservation (J. Bourjea and M. Dalleau)	✓(17 August 2012)
IOTC–2012–WPEB08–INF03	Identifying shark fins: Oceanic whitetip, porbeagle and hammerheads (PEW and SoMAS)	✓(2 September 2012)
IOTC–2012–WPEB08–INF04	Analysis of permanent magnets as elasmobranch bycatch reduction devices in hook-and-line and longline trials (C.P. O'Connell, D.C. Abel, E.M. Stroud and P.H. Rice)	✓(2 September 2012)
IOTC–2012–WPEB08–INF05	Pelagic predator associations: tuna and dolphins in the eastern tropical Pacific Ocean (M.D. Scott, S.J. Chivers, R.J. Olson, P.C. Fiedler and K. Holland)	✓(2 September 2012)
IOTC–2012–WPEB08–INF06	Preliminary ecological risk assessment for the purse-seine fishery in the eastern Pacific Ocean (R.J. Olson)	✓(26 June 2012)
IOTC–2012–WPEB08–INF07	Good practices to reduce the mortality of sharks and rays caught incidentally by the tropical tuna purse seiners (F. Poisson, A.L. Vernet, B. Seret and L Dagorn)	✓(26 June 2012)
IOTC–2012–WPEB08–INF08	An overview of shark fishing in Pakistan: Interaction with tuna fisheries (U. Shahid)	✓(3 September 2012)

Document	Title	Availability
IOTC–2012–WPEB08–INF09	Spatial Dynamics and Expanded Vertical Niche of Blue Sharks in Oceanographic Fronts Reveal Habitat Targets for Conservation (N. Queiroz, N.E. Humphries, L.R. Noble, A.M. Santos and D.W. Sims)	✓(6 September 2012)
IOTC–2012–WPEB08–INF10	Marine Turtle Conservation: Review report (BOBLME, 2011)	✓(6 September 2012)
IOTC–2012–WPEB08–INF11	Physical and psychological deterrence strategies to mitigate odontocete by-catch and depredation in pelagic longline fisheries: progress report (D.J. Hamer and S.J. Childerhouse)	✓(6 September 2012)
IOTC–2012–WPEB08–INF12	Is it good or bad to fish with FADs? What are the real impacts of the use of drifting FADs on pelagic marine ecosystems? (L. Dagorn, K.N. Holland, V. Restrepo and G. Moreno)	✓(6 September 2012)
IOTC–2012–WPEB08–INF13	Ecological metrics of biomass removed by three methods of purse-seine fishing for tunas in the eastern tropical Pacific Ocean (T. Gerrodette, R. Olson, S. Reilly, G. Watters and W. Perrin)	✓(6 September 2012)
IOTC–2012–WPEB08–INF14	Pathways between primary production and fisheries yields of large marine ecosystems (K.D. Friedland, C. Stock, K.F. Drinkwater, J.S. Link, R.T. Leaf, B.V. Shank, J.M. Rose, C.H. Pilskaln and M.J. Fogarty)	✓(6 September 2012)
IOTC–2012–WPEB08–INF15	Identification of factors influencing shark catch and mortality in the Marshall Islands tuna longline fishery and management implications (D. Bromhead, S. Clarke, S. Hoyle, B. Muller, P. Sharples and S. Harley)	✓(8 September 2012)
IOTC–2012–WPEB08–INF16	Postrelease survival, vertical and horizontal movements, and thermal habitats of five species of pelagic sharks in the central Pacific Ocean (M.K. Musyl, R.W. Brill, D.S. Curran, N.M. Fragoso, L.M. McNaughton, A. Nielsen, B.S. Kikkawa and C.D. Moyes)	✓(8 September 2012)
IOTC–2012–WPEB08–INF17	Migration Pathways, Behavioural Thermoregulation and Overwintering Grounds of Blue Sharks in the Northwest Atlantic (S.E. Campana, A. Dorey, M. Fowler, W. Joyce, Z. Wang, D. Wright and I. Yashayaev)	✓(8 September 2012)
IOTC–2012–WPEB08–INF18	Satellite tagging of blue sharks (*Prionace glauca*) and other pelagic sharks off eastern Australia: depth behaviour, temperature experience and movements (J.D. Stevens, R.W. Bradford and G.J. West)	✓(8 September 2012)
IOTC–2012–WPEB08–INF19	ISSF guidelines for non-entangling FADs (ISSF)	✓(10 September 2012)
IOTC–2012–WPEB08–INF20	A review of bycatch and discard issues in Indian Ocean tuna fisheries (D. Ardill, D. Itano and R. Gillett)	✓(11 September 2012)
IOTC–2012–WPEB08–INF21	Preliminary results of the Orthongel program “eco-FAD” as June 30th 2012 (M. Goujon, A.-L. Vernet , L. Dagorn)	✓(13 September 2012)
IOTC–2012–WPEB08–INF22	KOBE III Bycatch Joint Technical Working Group Harmonisation of Purse-seine Data Collected by Tuna-RFMOs Observer Programmes (ISSF)	✓(13 September 2012)
IOTC–2012–WPEB08–INF23	Spatial and temporal patterns in blue shark (Prionace glauca) catch in south African longline fisheries (K.A. Jolly, C. da Silva, A. Jarre and C.G. Attwood)	✓(17 September 2012)
IOTC–2012–WPEB08–INF24	Preliminary results of bycatch ratio, catch rates and species CPUE distributions of bycatch of sharks in the pelagic longline fishery based in Reunion Island (P. Bach, E. Romanov, N. Rabearisoa, A. Sharp and J.-P. Lamoureux)	✓(17 September 2012)

APPENDIX IV
CONSOLIDATED RECOMMENDATIONS OF THE EIGHTH SESSION OF THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH

Note: Appendix references refer to the Report of the Eighth Session of the Working Party on Ecosystems and Bycatch (IOTC–2012–WPEB08–R)

Regional Observer Scheme

WPEB08.01 (para.24) The WPEB **RECOMMENDED** that the SC consider requesting that the Commission considers how to address the lack of implementation of observer programmes by CPCs for their fleets and the lack of reporting to the IOTC Secretariat, as per the provisions of Resolution 11/04 *on a Regional Observer Scheme*.

WPEB08.02 (para.27) The WPEB **RECOMMENDED** that the SC consider requesting that the Commission allocate additional funds in 2013 to print further sets of the shark, seabird and marine turtle identification cards developed by the IOTC Secretariat, noting that expected costs are in the vicinity of US$6,000 per 1000 sets of cards.

Sharks

Data and reporting requirements

WPEB08.03 (para.36) The WPEB **NOTED** the main shark data issues that are considered to negatively affect the quality of the statistics available at the IOTC Secretariat, by type of dataset and fishery, which are provided in Appendix VIII, and **RECOMMENDED** that the CPCs listed in the Appendix, make efforts to remedy the data issues identified and to report back to the WPEB at its next meeting, noting the status and type of datasets that need to be provided for sharks, and other bycatch species provided at Appendix IX.

WPEB08.04 (para.38) Noting that the information on retained catches and discards of sharks contained in the IOTC database remains very incomplete for most fleets despite their mandatory reporting status, and that catch-and-effort as well as size data are essential to assess the status of shark stocks, the WPEB **RECOMMENDED** that all CPCs collect and report catches of sharks (including historical data), catch-and-effort and biological data on sharks, as per IOTC Resolutions, so that more detailed analysis can be undertaken for the next WPEB meeting.

WPEB08.05 (para.39) Noting that there is extensive literature available on pelagic shark fisheries and interactions with fisheries targeting tuna and tuna-like species, in countries having fisheries for sharks, and in the databases of governmental or non-governmental organisations, the WPEB **AGREED** on the need for a major data mining exercise in order to compile data from as many sources as possible and attempt to rebuild historical catch series of the most commonly caught shark species. In this regard, the WPEB **RECOMMENDED** that the SC considers proposing that the Commission allocates funds for this activity, in the 2013 IOTC budget.

WPEB08.06 (para.41) **NOTING** that despite the mandatory reporting requirements, detailed in Resolutions 05/05, 10/02, 10/06, 12/03, 12/04 and 12/06, bycatch data remain largely unreported by CPCs, and the WPEB **RECOMMENDED** that the SC address these concerns to the Compliance Committee and the Commission in order for them to take steps to develop mechanisms which would ensure that CPCs fulfill their bycatch reporting obligations.

Mozambique fisheries

WPEB08.07 (para.48) The WPEB **NOTED** the absence of information on shark catches from artisanal fisheries in Mozambique and **RECOMMENDED** that information on bycatch from artisanal fisheries is collected for this fishery and reported in due course.

Other recommendations

WPEB08.08 (para.87) Noting the continued confusion in the terminology of various hook types being used in IOTC fisheries, (e.g. tuna hook vs. J-hook; definition of a circle hook), the WPEB reiterated its **RECOMMENDATION** that the IOTC Secretariat develop an identification guide for hooks and pelagic gears used in IOTC fisheries, as staffing and financial resources permit, and to distribute the guide to all CPCs once completed. The WPEB also **AGREED** that circle hooks are defined by hooks having their point turned at least 90° from their shank.

Ecological Risk Assessment: review of current knowledge and potential management implications

WPEB08.09 (para.112) The WPEB **RECOMMENDED** that the SC note the list of the 10 most vulnerable shark species to longline gear, as determined by the productivity susceptibility analysis, and compare it to the list of shark species/groups required to be recorded for longline gear, contained in Resolution 12/03 o*n the recording of catch and effort by fishing vessels in the IOTC area of competence*, provided at Table 5.

TABLE. 5. List of the 10 most vulnerable shark species to longline gear compared to the list of shark species/groups required to be recorded in logbooks, as listed in Resolution 12/03 *on the recording of catch and effort by fishing vessels in the IOTC area of competence*.

PSA vulnerability ranking	Most susceptible shark species to longline gear	FAO Code	Shark species currently listed in IOTC Resolution 12/03 for longline gear	FAO Code
1	Shortfin mako (*Isurus oxyrinchus*)	SMA	Blue shark (*Prionace glauca*)	BSH
2	Bigeye thresher (*Alopias superciliosus*)	BTH	Mako sharks (*Isurus* spp.)	MAK
3	Pelagic thresher (*Alopias pelagicus*)	PTH	Porbeagle shark (*Lamna nasus*)	POR
4	Silky shark (*Carcharhinus falciformis*)	FAL	Hammerhead sharks (*Sphyrna* spp.)	SPN
5	Oceanic whitetip shark (*Carcharhinus longimanus*)	OCS		
6	Smooth hammerhead (*Sphyrna zygaena*)	SPZ		
7	Porbeagle (*Lamna nasus*)	POR		
8	Longfin mako (*Isurus paucus*)	LMA		
9	Great hammerhead (*Sphyrna mokarran*)	SPM		
10	Blue shark (*Prionace glauca*)	BSH		

Development of technical advice on the status of the shark stocks

WPEB08.10 (para.118) The WPEB **RECOMMENDED** that the SC note the management advice developed for a subset of shark species commonly caught in IOTC fisheries for tuna and tuna-like species:

- Blue sharks (*Prionace glauca*) – Appendix X
- Oceanic whitetip sharks (*Carcharhinus longimanus*) – Appendix XI
- Scalloped hammerhead sharks (*Sphyrna lewini*) – Appendix XII
- Shortfin mako sharks (*Isurus oxyrinchus*) – Appendix XIII
- Silky sharks (*Carcharhinus falciformis*) – Appendix XIV
- Bigeye thresher sharks (*Alopias superciliosus*) – Appendix XV

- Pelagic thresher sharks (*Alopias pelagicus*) – Appendix XVI

Update of shark species Executive Summaries for the consideration of the Scientific Committee

WPEB08.11 (para.119) The WPEB **RECOMMENDED** that the IOTC Secretariat update the draft shark Executive Summaries with the latest 2011 catch data, and for these to be provided to the SC for its consideration.

Review of data needs and way forward for the evaluation of shark stocks

WPEB08.12 (para.120) The WPEB **RECOMMENDED** that the SC notes that gillnet fisheries are expanding rapidly in the Indian Ocean, with gillnets often being longer than 2.5 km in contravention with UN and IOTC resolutions, and that their use is considered to have a substantial impact on marine ecosystems. **NOTING** that iIn 2012 the Commission adopted Resolution 12/01 on the implementation of the precautionary approach, the majority of the WPEB **URGED** and therefore the SC may wish to consider recommending that the Commission freeze catch and effort by gillnet fisheries in the Indian Ocean in the near future, until sufficient information has been gathered to determine the impact of gillnet fleets on IOTC stocks and bycatch species caught by gillnet fisheries targeting tuna and tuna-like species, noting that the implementation of any such measure would be difficult to implement.

WPEB08.13 (para.121) The WPEB **RECOMMENDED** that the SC considers making a request to the Commission to allocate funds to carry out training for CPCs having gillnet fleets on species identification, bycatch mitigation and data collection methods and identifies other potential sources of assistance to carry out such activities.

WPEB08.14 (para.122) The WPEB **RECOMMENDED** research and development of mitigation measures to minimize bycatch of the oceanic whitetip shark and its unharmed release for all types of fishing gears, and that CPCs with data on oceanic whitetip sharks (i.e. total annual catches, CPUE time series and size data) make these available to the next WPEB meeting.

WPEB08.15 (para.124) **NOTING** that Resolution 10/02 *mandatory statistical requirements for IOTC members and Cooperating Non-Contracting Parties (CPC's)*, makes provision for data to be reported to the IOTC on "*the most commonly caught shark species and, where possible, to the less common shark species*", without giving any list defining the most common and less common species, and recognising the general lack of shark data being recorded and reported to the IOTC Secretariat, the WPEB **RECOMMENDED** that Resolution 10/02 is revised in order to include the list of most commonly caught elasmobranch species (Table 6) for which nominal catch data shall be reported as part of the statistical requirement for IOTC CPCs.

TABLE 6. List of the most commonly elasmobranch species caught.

Common name	**Species**	Code
Manta and devil rays	Mobulidae	MAN
Whale shark	*Rhincodon typus*	RHN
Thresher sharks	*Alopias spp.*	THR
Mako sharks	*Isurus spp.*	MAK
Silky shark	*Carcharhinus falciformis*	FAL
Oceanic whitetip shark	*Carcharhinus longimanus*	OCS
Blue shark	*Prionace glauca*	BSH
Hammerhead shark	Sphyrnidae	SPY
Other Sharks and rays	–	SKH

Marine turtles

Data and reporting requirements

WPEB08.16 (para.128) The WPEB **RECOMMENDED** that the current IOTC Resolution 12/04 *on the conservation of marine turtles* is strengthened to ensure that CPCs report annually on the level of incidental catches of marine turtles by species, as provided at Table 8.

TABLE 8. Marine turtle species reported as caught in fisheries within the IOTC area of competence.

Common name	Scientific name
Flatback turtle	*Natator depressus*
Green turtle	*Chelonia mydas*
Hawksbill turtle	*Eretmochelys imbricata*
Leatherback turtle	*Dermochelys coriacea*
Loggerhead turtle	*Caretta caretta*
Olive ridley turtle	*Lepidochelys olivacea*

WPEB08.17 (para.129) The WPEB **RECOMMENDED** that the SC note that the lack of data from CPCs on interactions and mortalities of marine turtles in the Indian Ocean is a substantial concern, resulting in an inability of the WPEB to estimate levels of marine turtle bycatch. There is an urgent need to quantify the effects of fisheries for tuna and tuna-like species in the Indian Ocean on marine turtle species, and it is clear that little progress on obtaining and reporting data on interactions with marine turtles has been made. This data is necessary to allow the IOTC to respond and manage the adverse effects on marine turtles, and other bycatch species.

WPEB08.18 (para.130) The WPEB **RECOMMENDED** that marine turtles, as a group, be added to Resolution 12/03 *on the recording of catch and effort by fishing vessels in the IOTC area of competence*, in Annex II (Record once per set/shot/operation) paragraph 2.3 (SPECIES) for longline gear.

WPEB08.19 (para.131) **NOTING** that Resolution 10/02 does not make provisions for data to be reported to the IOTC on marine turtles, the WPEB **RECOMMENDED** that Resolution 10/02 is revised in order to make the reporting requirements coherent with those stated in Resolution 12/04 on the conservation of marine turtles.

Development of management advice for marine turtles

WPEB08.20 (para.145) The WPEB **RECOMMENDED** that the SC note the management advice developed for marine turtles, as provided in the draft resource stock status summary (Appendix XVII).

Update of marine turtle species Executive Summary for the consideration of the Scientific Committee

WPEB08.21 (para.147) The WPEB **RECOMMENDED** that the IOTC Secretariat update the draft marine turtle Executive Summary with the latest 2011 interaction data, and for these to be provided to the SC for its consideration.

Requests contained in IOTC Conservation and Management Measures

WPEB08.22 (para.152) The WPEB **RECOMMENDED** that the SC note the following in regards to the requests to the WPEB outlined in paragraph 11 of Resolution 12/04:

a) *Develop recommendations on appropriate mitigation measures for gillnet, longline and purse seine fisheries in the IOTC area*

Gillnet: The absence of data for marine turtles on effort, spatial deployment and bycatch in the IOTC area of competence makes any recommendation regarding mitigation measures for this gear premature. Improvements in data collection and reporting of marine turtle interactions with gillnets, and research on the effect of gear types (i.e. net construction and colour, mesh size and soak times) are necessary.

Longline: Current information suggests inconsistent spatial catches (i.e. high catches in few sets) and by gear/fishery. The most important mitigation measures relevant for longline fisheries are to:

3. Encourage the use of circle hooks whilst developing further research into their effectiveness using a multiple species approach.
4. Release live animals after careful dehooking/disentangling/line cutting (See handling guidelines in the IOTC marine turtle identification cards).

Purse seine: see c) below

b) *Develop regional standards covering data collection, data exchange and training*

4. The development of standards using the IOTC guidelines for the implementation of the Regional Observer Scheme should be undertaken, as it is considered the best way to collect reliable data related to marine turtle bycatch in the IOTC area of competence.
5. The Chair of the WPDCS to work with the IOSEA MoU Secretariat, which has already developed regional standards for data collection, and revise the observer data collection forms and observer reporting template as appropriate, as well are current recording and reporting requirements through IOTC Resolutions, to ensure that the IOTC has the means to collect quantitative and qualitative data on marine turtle bycatch.
6. Encourage CPCs to use IOSEA expertise and facilities to train observers and crew to increase post-release survival rates of marine turtles.

c) *Develop improved FAD designs to reduce the incidence of entanglement of marine turtles, including the use of biodegradable materials*

All FAD-directed purse seine fisheries should rapidly change to only use FADs based on the following three basic principles:

4. The surface structure of the FAD should not be covered, or only covered with non-meshed material.
5. If a sub-surface component is used, it should not be made from netting but from non-meshed materials such as ropes or canvas sheets.
6. To reduce the amount of synthetic marine debris, and to promote the use of natural or biodegradable materials (such as Hessian canvas, hemp ropes, etc.) in FADs instead of nets.

Seabirds

Development of technical advice on the status of seabirds

WPEB08.23 (para.168) The WPEB **RECOMMENDED** that the SC note the management advice developed for seabirds, as provided in the draft resource stock status summary (Appendix XVIII).

Other matters

Bycatch and discards – I.R. Iran gillnet fisheries

WPEB08.24 (para.180) The WPEB **RECOMMENDED** that the SC considers making a request to the Commission to allocate funds to support a regional review of the data available for gillnet fleets operating in the Indian Ocean. The scientists from all CPCs having gillnet fleets in the Indian Ocean should provide at the next session of the WPEB, a report summarising the known information on bycatch in their gillnet fisheries, including sharks, marine turtles and marine mammals, with estimates of their likely order of magnitude where more detailed data are not available.

Employment of a Fisheries Officer

WPEB08.25 (para.184) Noting the rapidly increasing workload at the IOTC Secretariat, including a wide range of additional duties assigned to it by the SC and the Commission, the WPEB **RECOMMENDED** that the Commission increase the staff of the IOTC Secretariat to incorporate a new Fisheries Officer post to work on a range of matters in support of the scientific process.

Core topics for research

WPEB08.26 (para.185) The WPEB **RECOMMENDED** that the SC add the following core topic areas as priorities for research over the coming year, noting that the first step will be for the SC to establish priorities, taking into account data gaps, capacity among CPCs, and areas for implementation:

- ***Ecological Risk Assessment***
  i. Sharks – interpretation of consultant report
  ii. Marine turtles – interpretation of consultant report
- ***Shark stock status analyses (development of abundance indices)***
  i. Develop/improve accurate CPUE indices for analysis
  ii. Develop methods to estimate historical catch series by gear.
  iii. Develop life history and biological patterns for the species (namely migration patterns and distribution patterns).
- ***Depredation***
  i. Longline fishery depredation
- ***Bycatch mitigation***
  i. Sharks
  ii. Seabirds – line weighting
  iii. Marine turtles
  iv. Marine mammals
- ***Capacity building***
  i. Scientific assistance to CPCs and specific fleets considered to have the highest risk to bycatch species (e.g. gillnet fleets and longline fleets).

Date and place of the Ninth Session of the Working Party on Ecosystems and Bycatch

WPEB08.27 (para.190) Following a discussion on who would host the Ninth Session of the WPEB, and noting that the Working Party on Billfish has suggested holding their meeting in La Réunion in September 2013, the WPEB **RECOMMENDED** that the next session of the WPEB be held in conjunction with the Working Party on Billfish. Japan was offered as an alternative option if necessary. The exact dates and meeting location will be confirmed and communicated by the IOTC Secretariat to the SC for its consideration at its next session to be held in December 2012.

WPEB08.28 (para.192) The WPEB **NOTED** that as quantitative information on sharks becomes available, there should be the possibility for simple stock status analyses based on fisheries and biological indicators and development of stock status indicators for some species in the near future. Expertise in stock assessment from other IOTC working parties, e.g. the Working Party on Tropical Tunas or the Working Party on Billfish, would be of value for such analyses. Therefore, the WPEB **RECOMMENDED** that the SC consider the following options:

- Possibility of a dedicated Working Party on Sharks (WPS), which could be held in alternate years to the WPEB so as not to increase the number of meetings held each year.
- Retaining the WPEB in its current form, but to ensure that each five to six day meeting alternatives its focus between sharks versus all other ecosystem and bycatch issues.

Review of the draft, and adoption of the Report of the Eighth Session of the Working Party on Ecosystems and Bycatch

WPEB08.29 (para.194) The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB08, provided at Appendix IV.

APPENDIX V
IMPLEMENTATION OF THE REGIONAL OBSERVER SCHEME

CPCs	Active Vessels LOA≥24m or High Seas vessels[2]				Progress	List of accredited observers submitted	Observer Trip Reports[3]		
	LL	PS	GN	BB			2010	2011	2012
MEMBERS									
Australia	6	5			Australia has implemented an observer programme that complies with the IOTC Regional Observer Scheme.	**YES: 21**	**2**	**1**	**No**
Belize	7				No information received by the Secretariat.	**No**	**No**	**No**	**No**
China –Taiwan,China	15 447				China has an observer programme. No information received by the Secretariat.	**No** **YES: 54**	**1** **No**	**No** **No**	**No** **No**
Comoros					Comoros does not have vessel more than 24m on which observer should be placed. 2 observers were trained under the IOC Regional Monitoring Project, and 5 by SWIOFP.	**YES: 6**	N/A	N/A	N/A
Eritrea	No information received				No information received by the Secretariat.	**No**	**No**	**No**	**No**
European Union	23	15			EU has an observer programme on-board its purse seine fleets, however the programme is limited due to the piracy activity in the western Indian Ocean. EU has or is developing observer programmes on-board its longline fleets, i.e. La Réunion, Spanish and Portuguese fleets.	Fra: 22 Prt: 3 Spn: 0 UK: 0	**No**	Fra: 12 Prt: 1 Spn: 0 UK: 0	Fra: 1 Prt: 0 Spn: 0 UK: 0
France (OT)		5			France has an observer programme on board it purse seine fleet.	**YES: 15**	**No**	**9**	**No**
Guinea	No information received				No information received by the Secretariat.	**No**	**No**	**No**	**No**
India	51				India has not developed any observer programme so far.	**No**	**No**	**No**	**No**
Indonesia	1183	13	2		Indonesia has an observer programme based in Benoa, Bali with 5 trained observers. The number of observers should double in 2012.	**No**	**No**	**No**	**No**
Iran, Isl. Rep. of		5	1244		No information received by the Secretariat.	**No**	**No**	**No**	**No**
Japan	69	1			Japan has started its observer programme on the 1st of July 2010, and 14 observers are currently being deployed in the Indian Ocean.	**YES: 14**	**6**	**No**	**No**
Kenya	4				Kenya is developing an observer programme and 5 observers have been trained under the SWIOFP training.	**No**	**No**	**No**	**No**
Korea, Rep. of	7				Korea has an observer programme since 2002 with 3 observers	**YES: 11**	**2**	**No**	**No**

[2] The number of active vessels is given for 2011.

[3] Year in which the observed trip has started

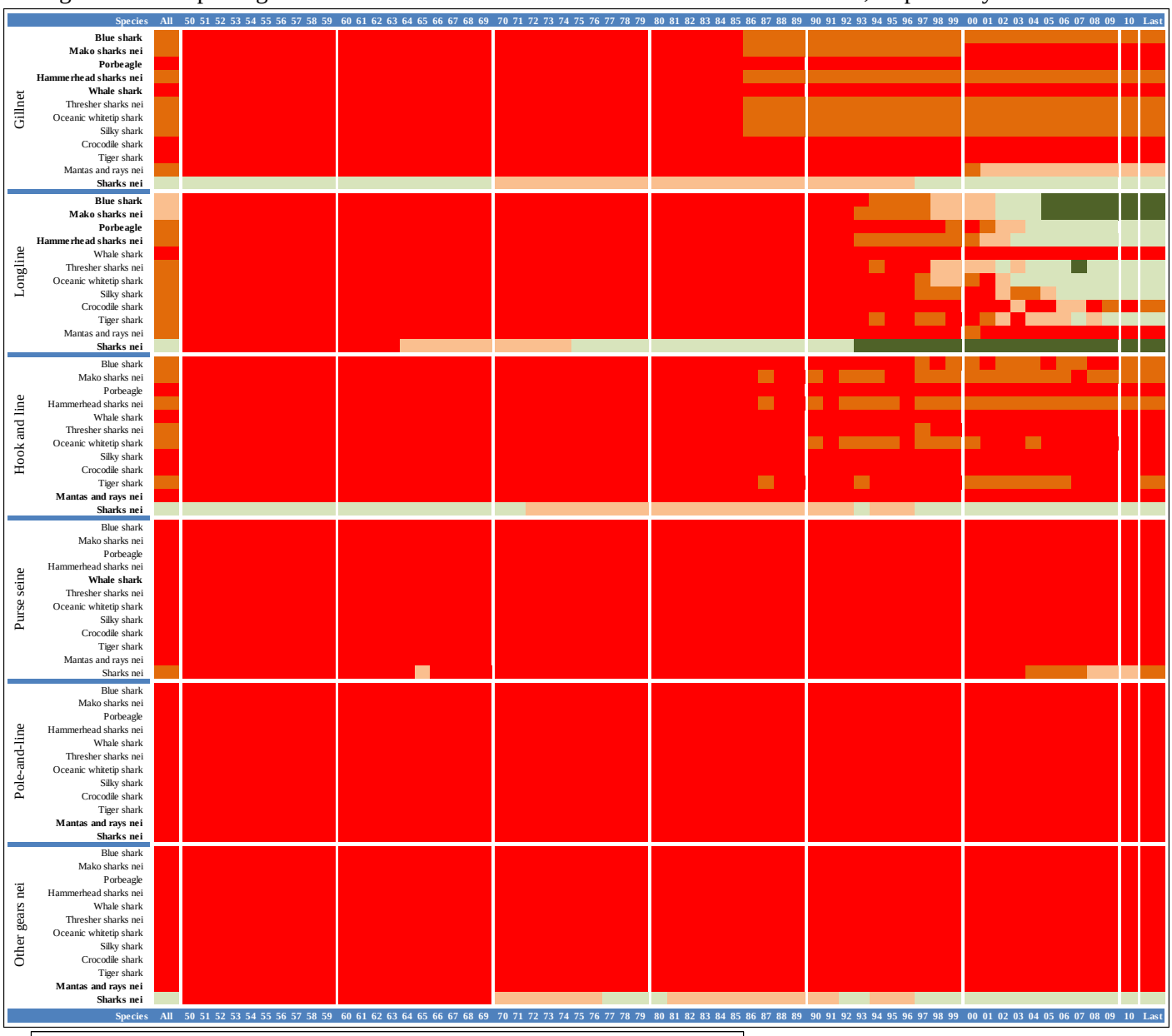
					being deployed in the Indian Ocean giving a14.5% coverage of the fishing operation in 2009.				
Madagascar	3				Madagascar is developing an observer programme. Five and three observers have been trained respectively under the SWIOFP and the IOC projects.	**YES: 7**	**No**	**No**	**No**
Malaysia	8				No information received by the Secretariat.	**No**	**No**	**No**	**No**
Maldives	No information received				Maldives vessels are monitored by field samplers at landing sites. Have in excess of 250 vessels larger than 24m.	**No**	**No**	**No**	**No**
Mauritius	4				Mauritius is developing an observer programme, and, 5 and 3 observers have been trained respectively under the SWIOFP and the IOC projects.	**No**	**No**	**No**	**No**
Mozambique	1				No information received by the Secretariat.	**No**	**No**	**No**	**No**
Oman	No information received				No information received by the Secretariat.	**No**	**No**	**No**	**No**
Pakistan			10		No information received by the Secretariat.	**No**	**No**	**No**	**No**
Philippines	3				No information received by the Secretariat.	**No**	**No**	**No**	**No**
Seychelles	23	8			Seychelles is developing an observer programme. Four and three observers have been trained respectively under the SWIOFP and the IOC projects.	**YES: 7**	**No**	**No**	**No**
Sierra Leone	0	0	0	0				**No**	**No**
Sri Lanka	749				Sri Lanka has not started the implementation of an observer programme.	**No**	**No**	**No**	**No**
Sudan	No information received				No information received by the Secretariat.	**No**	**No**	**No**	**No**
Tanzania, United Rep.of	1				No information received by the Secretariat.	**No**	**No**	**No**	**No**
Thailand	2				Thailand has not developed an observer programme so far.	**No**	**No**	**No**	**No**
United Kingdom	0	0	0	0	UK does not have any active vessels in the Indian Ocean.	N/A	N/A	N/A	N/A
Vanuatu					No information received by the Secretariat.	**No**	**No**	**No**	**No**
Yemen	No information received				No information received by the Secretariat.	**No**	**No**	**No**	**No**
COOPERATING NON-CONTRACTING PARTIES									
Senegal	0	0	0	0	Senegal does not have any active vessels in the Indian Ocean.	**No**	**No**	**No**	**No**
South Africa	15				South Africa has only an observer programme for foreign vessels operating in the EEZ of South Africa at the moment.	**YES: 16**	**No**	**8**[4]	**No**

[4] Reports from South African observers onboard foreign vessels operating in the EEZ of South Africa.

APPENDIX VI
AVAILABILITY OF CATCH DATA FOR SHARKS BY GEAR

Availability of catch data for the main shark species expressed as the amount of fleets (%) for which catch data on sharks are available out of the total number of fleets for which data on IOTC species are available, by fishery, species of shark, and year, for the period 1950–2010

Shark species in bold are those identified by the Commission in 2012, for which data shall be recorded in logbooks and reported to the IOTC Secretariat; reporting of catch data for other species can be done in aggregated form (i.e. all species combined as ***sharks nei*** or ***mantas and rays nei***).
Hook and line refers to fisheries using handline and/or trolling and ***Other gears nei*** to other unidentified fisheries operated in coastal waters
Catch rates of sharks on pole-and-line fisheries are thought to be nil or negligible.
Average levels of reporting for 1950–2010 and 2006–10 are shown column ***All*** and ***Last***, respectively.



APPENDIX VII
STATUS OF FISHERIES STATISTICS FOR SHARKS

Extract from IOTC–2012–WPEB08–09

(Table, figure and appendix references in this Appendix, refer only to those contained in this appendix)

Main species of sharks caught in IOTC fisheries

Following standard international practice, the term shark is accepted to include both sharks and rays.

Table 1 shows the main species of sharks as identified by the Commission in 2012, through the adoption of IOTC Resolution 12/03 *On The recording of Catch and Effort by fishing vessels in the IOTC Area of Competence* (Annexes II and III, 2.3).

Species of sharks that are known to occur on Indian Ocean fisheries directed at IOTC species or pelagic sharks is provided at **Appendix 1**.

Data available on the total catches of sharks in the Indian Ocean

The availability of shark nominal catch data over the period 1950–2010 for those shark species identified by the Commission (**Table 1**), by species, gear type, and year, is presented in **Appendix 2**. The collection and reporting of catches of sharks caught in association with species managed by the IOTC (tuna and tuna-like species) has been very uneven over time. The information on the bycatch of sharks gathered in the IOTC database is thought to be very incomplete. The catches of sharks, when reported, are thought to represent simply the catches of these species that are retained on board (or nominal catches). They refer, in many cases, to dressed weights and no indication is given on the type of processing that the different specimens underwent. The weights or numbers of sharks for which only the fins were kept on board are rarely recorded in the vessels' logbooks. This makes it really difficult any attempt to estimate the total catches of sharks in the Indian Ocean. However, it should be noted that in recent years the levels of reporting of statistics of sharks has improved (**Appendix 2**), following the adoption of new measures by the Commission on sharks and other bycatch, which call for IOTC CPC's to collect and report more detailed statistics on bycatch species to the IOTC.

Catches by species: The main problem areas identified for sharks are indicated below:

Some catch data not available: several countries were not collecting fishery statistics, especially in years prior to the early 1970's, and others have not reported catches of sharks to IOTC (**Fig. 1** and **2**). It is thought that important catches of sharks might have gone unrecorded in several countries. The catches recorded in other cases might not represent the total catches of sharks but simply the amounts retained on board (e.g. dressed weights instead of live weights). The catches of sharks for which only the fins are kept on board or of sharks usually discarded, because of their size or condition, are seldom, if ever, recorded.

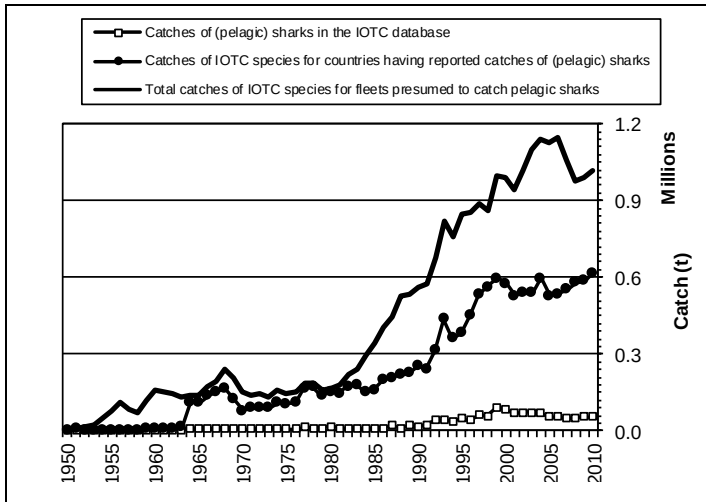


Fig. 1. Catches of pelagic sharks recorded in the IOTC nominal catches database versus the total catches of tuna

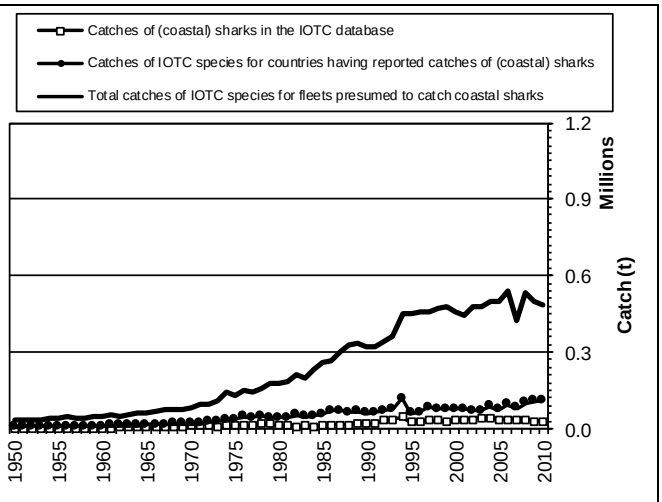


Fig. 2. Catches of coastal sharks recorded in the IOTC nominal catches database versus the total catches of tuna

and tuna-like species recorded for fleets presumed to catch pelagic sharks and the catches of tuna and tuna-like species recorded for fleets for which catches of pelagic sharks are available (1950–2010).	and tuna-like species recorded for fleets presumed to catch coastal sharks and the catches of tuna and tuna-like species recorded for fleets for which catches of coastal sharks are available (1950–2010).
The selection of fleets presumed to catch a majority of pelagic shark species *versus* those presumed to catch mostly coastal shark species was done by using the data in the IOTC database for fleets reporting catches of sharks by species or according to the presumed area of operation for fleets not reporting catches of sharks per species or not reporting catches of sharks at all.	

- **Poor resolution of catch data:** The catches of sharks are usually not recorded by species and/or gear (**Figs 3** and **4**). Be it sharks caught on the high seas or in coastal areas the amount of species that may occur in these areas is usually high. The estimation of catches by species is highly compromised in these cases due to the paucity of the data available. Miss-identification of shark species is also common. The identification of sharks in port is usually compromised by the way in which the different species of sharks are processed, including shark carcasses, shark fins or other shark products (identification keys for sharks refer usually to unprocessed shark specimens).

The main consequence of this is that, at the moment, the estimation of total catches of sharks in the Indian Ocean is compromised by the paucity of the data available.

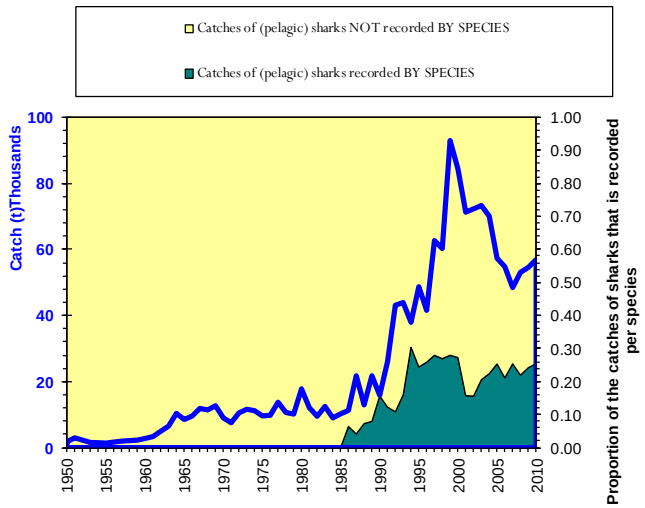


Fig. 3. Proportion of the catches of pelagic sharks that are recorded by species in the IOTC nominal catches database *versus* those recorded in aggregated form (1950–2010) (The total catches of pelagic sharks recorded per year are also shown (blue line, left axis)).

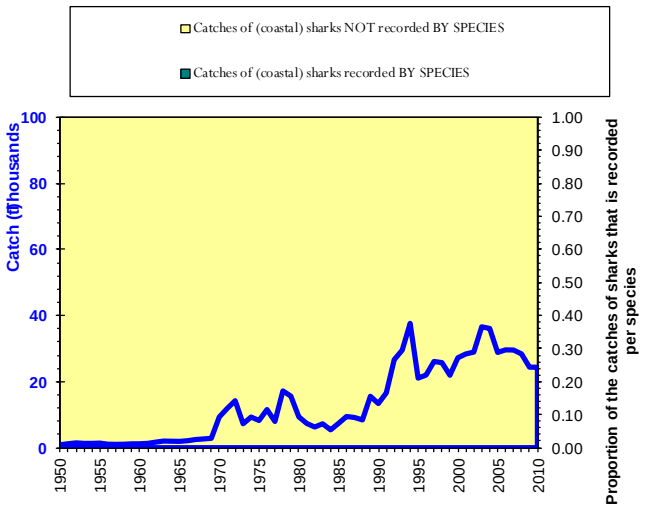


Fig. 4. Proportion of the catches of coastal sharks that are recorded by species in the IOTC nominal catches database *versus* those recorded in aggregated form (1950–2010 (The total catches of coastal sharks recorded per year are also shown (blue line, left axis)).

Catches by gear type: The catches of sharks that are not recorded by gear do not represent a high proportion of the total catches recorded for these species, especially in recent years (**Fig. 5** and **6**).

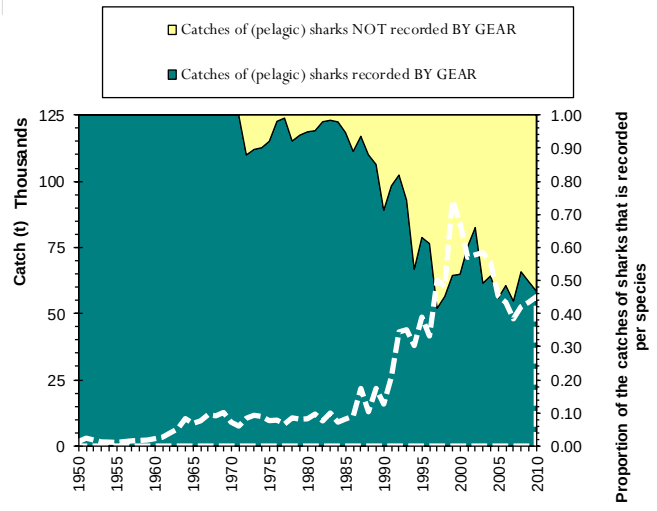


Fig. 5. Proportion of the catches of pelagic sharks that are recorded by gear in the IOTC nominal catches database versus those recorded in aggregated form (1950–2010) (The total catches of pelagic sharks recorded per year are also shown (white line, left axis)).

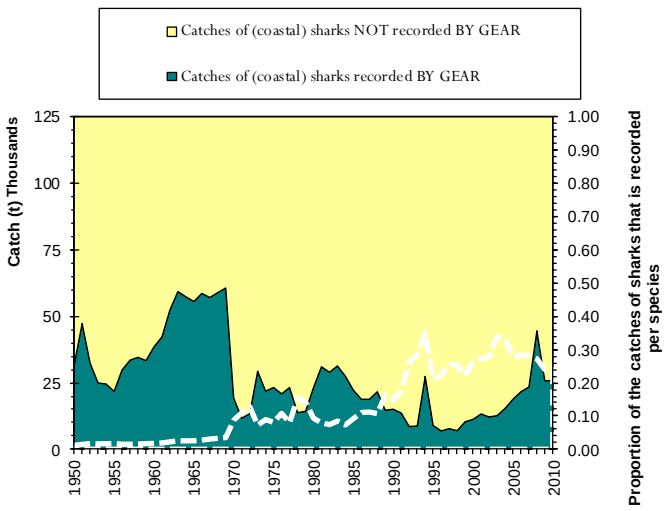


Fig. 6. Proportion of the catches of coastal sharks that are recorded by gear in the IOTC nominal catches database versus those recorded in aggregated form (1950–2010) (The total catches of coastal sharks recorded per year are also shown (white line, left axis)).

While industrial longliners and drifting gillnets harvest important amounts of pelagic sharks, industrial purse seiners, pole-and-lines and most coastal fisheries are unlikely to harvest important amounts of pelagic sharks.

- **Deep-freezing tuna longliners** and **fresh-tuna longliners**: Catches of sharks are thought to represent between 20–40% of the total combined catch for all species. However, the catches of sharks recorded in the IOTC database only make for a small proportion of the total catches of all species over longline fleets. The catches series for sharks are, therefore, thought to be very incomplete. However, levels of reporting have improved in recent years, following the implementation of catch monitoring schemes in different ports of landing of fresh-tuna longliners[5], and the recording of catches of main species of sharks in logbooks and observer programmes. The catches estimated, however, are unlikely to represent the total catches of sharks for this fishery due to the paucity of information on levels of discards of sharks, which are thought high in some areas and for some species.

- **Freezing (fresh) swordfish longliners**: Catches of sharks are thought to represent between 40–60% of the total combined catch for all species. The amounts of sharks caught by longliners targeting swordfish in the Indian Ocean have been constantly increasing since the mid-90's. The catches of sharks recorded for these fleets are thought more realistic than those recorded for other longline fisheries. The high catches are thought to be due to:

    - Gear configuration and time fished: The vessels targeting swordfish use surface longlines and set the lines at dusk or during the night. Many pelagic sharks are thought to be abundant at these depths and most active during dusk or night hours.

    - Area fished: The fleets targeting swordfish have been deploying most of the fishing effort in the Southwest Indian Ocean, in the vicinity of South Africa, southern Madagascar, Reunion and Mauritius. High amounts of sharks are thought to occur in these areas.

    - Changes in the relative amounts of swordfish and sharks in the catches: Some of the vessels targeting swordfish are known to alternate swordfish and sharks, in particular blue shark, as main target, depending on the season, or when catch rates of swordfish are poor.

[5] The IOTC-OFCF (Overseas Fisheries Cooperation Foundation of Japan) Project implemented programmes in cooperation with local institutions in Thailand and Indonesia

- **Industrial tuna purse seiners:** Catches of sharks are thought to represent less than 0.5% of the total combined catch for all species (10% of total discards). In 2012, the **European Union** reported preliminary estimates of catches of sharks for EU-France purse seiners for the period 2003–10, as derived from samples collected by observers during 2003–07. The Secretariat has not received data from other purse seine fleets concerning bycatch levels of sharks (**Iran**, **Seychelles** or **Thailand**).
- **Pole and line fisheries:** There are no catches of sharks recorded for the pole and line fisheries of Maldives and India in the IOTC database. The amounts of sharks caught by these fisheries, if any, are not thought significant.
- **Gillnet fisheries:** The species of sharks caught are thought to vary significantly depending on the area of operation of the gillnets:
    - Gillnets operated in areas having low concentrations of pelagic sharks: The gillnet fisheries of most coastal countries operate these gears in coastal waters. The abundance of pelagic sharks in these areas is thought low.
    - Gillnets operated in areas having high concentrations of pelagic sharks: Gillnets operated in **Sri Lanka**, **Indonesia** and **Yemen** (waters around Socotra), in spite of being set in coastal areas, are likely to catch significant amounts of pelagic sharks.
    - Gillnets operated on the high seas: Vessels from **Taiwan,China** were using drifting gillnets (driftnets) from 1982 to 1992, the year in which the use of this gear was banned worldwide. The catches of pelagic sharks were very high during that period, representing around 25% of the total catch of all species. Driftnet vessels from **Iran** and **Pakistan** have been fishing on the high seas since the early-1990ies, initially in waters of the Arabian Sea but covering a larger area in recent years, as they moved to operate also in tropical waters of the western Indian Ocean and Mozambique Channel. The amounts of sharks that are caught by these fleets are thought high, representing between 25–50% of the total combined catches of sharks and other species.

- **Gillnet/longline fishery of Sri Lanka:** Catches of sharks represent between 2% and 45% of the total combined catch for all species, depending on the year. Between 1,200 and 3,200 vessels (average size of 12 m) operating gillnets and longlines in combination have been harvesting important amounts of pelagic sharks since the mid–80's. The longlines are believed to be responsible for most of the catches of sharks. Since the mid–1990's the proportion of sharks, all species combined, in the catches of gillnet and longline vessels has been constantly decreasing (**Fig. 7**), to represent less than 2% of the total catch in recent years (45% of the catch in 1995). Catches of sharks by vessel by year have also decreased markedly since the mid–90's.

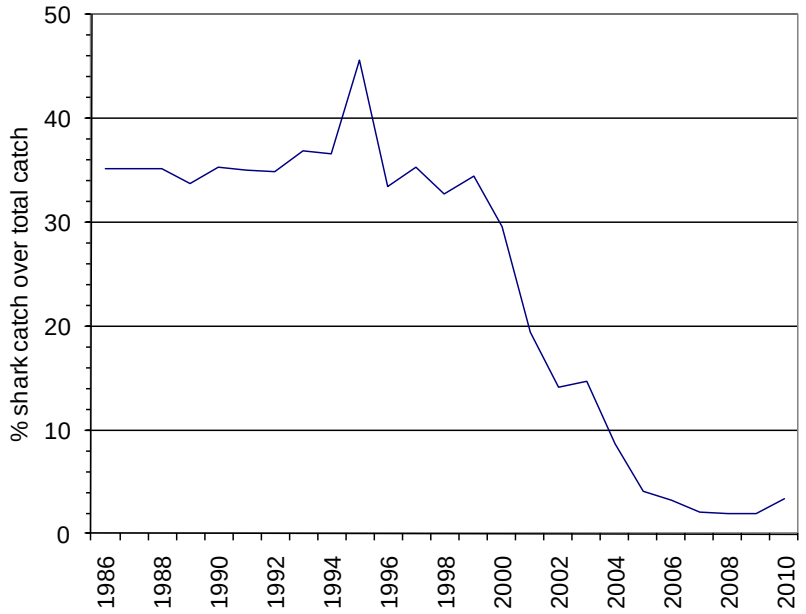


Fig. 7. Proportion that the combined catches of sharks made out of the total combined catches of sharks and IOTC species for the gillnet and longline fishery of Sri Lanka, by year, for the period 1986–2010.

- **Fisheries using handlines and/or trolling:** The majority of fisheries using hand lines and trolling in the Indian Ocean operate these gears in coastal waters. The amounts of pelagic sharks caught are thought, for this reason, low. The amount that other species of sharks make out of the catches of tuna and tuna-like species might change depending on the area fished and time of the day.

Time-area catches: **Figure 8** present data available on sharks for deep-freezing longliners flagged in Taiwan,China, by decade (1980's to 2000s) and type of catch data reported, including total numbers of sharks recorded aggregated and by species on each five degree square grid. In addition, **Fig. 9** presents total numbers of sharks by grid for major shark species, by species, and combined for other species, for the period 2007–10.

Finally, **Fig. 10** present numbers of shark reported for the longline fleet of Japan, by species for the years 2009–10.

It is important to note that time-area catches of sharks by species are only available since 2007 or 2009 for Japan and Taiwan,China, respectively, while these fleets have been operating in the Indian Ocean since the 1950's. Unlike Taiwan,China, for which catches of sharks are available in aggregated form up to the late 1970's, Japan has not provided catches of sharks other than those reported for 2009 and 2010. In addition, the catches available are considered to be incomplete, as they do not include discards.

Time area catches of sharks are also available from other fleets, as recorded in **Table 2**.

Length frequency data: **Fig. 11** shows length frequencies of blue shark as derived from the samples available from longliners flagged in Japan, Republic of Korea, Seychelles, and South Africa, for all periods and areas combined. Figure 12 shows length frequencies derived from the samples available for other

important shark species, for all fleets, periods, and areas combined. Length frequency data of sharks are only available in recent years, for the fleets indicated in **Table 2**.

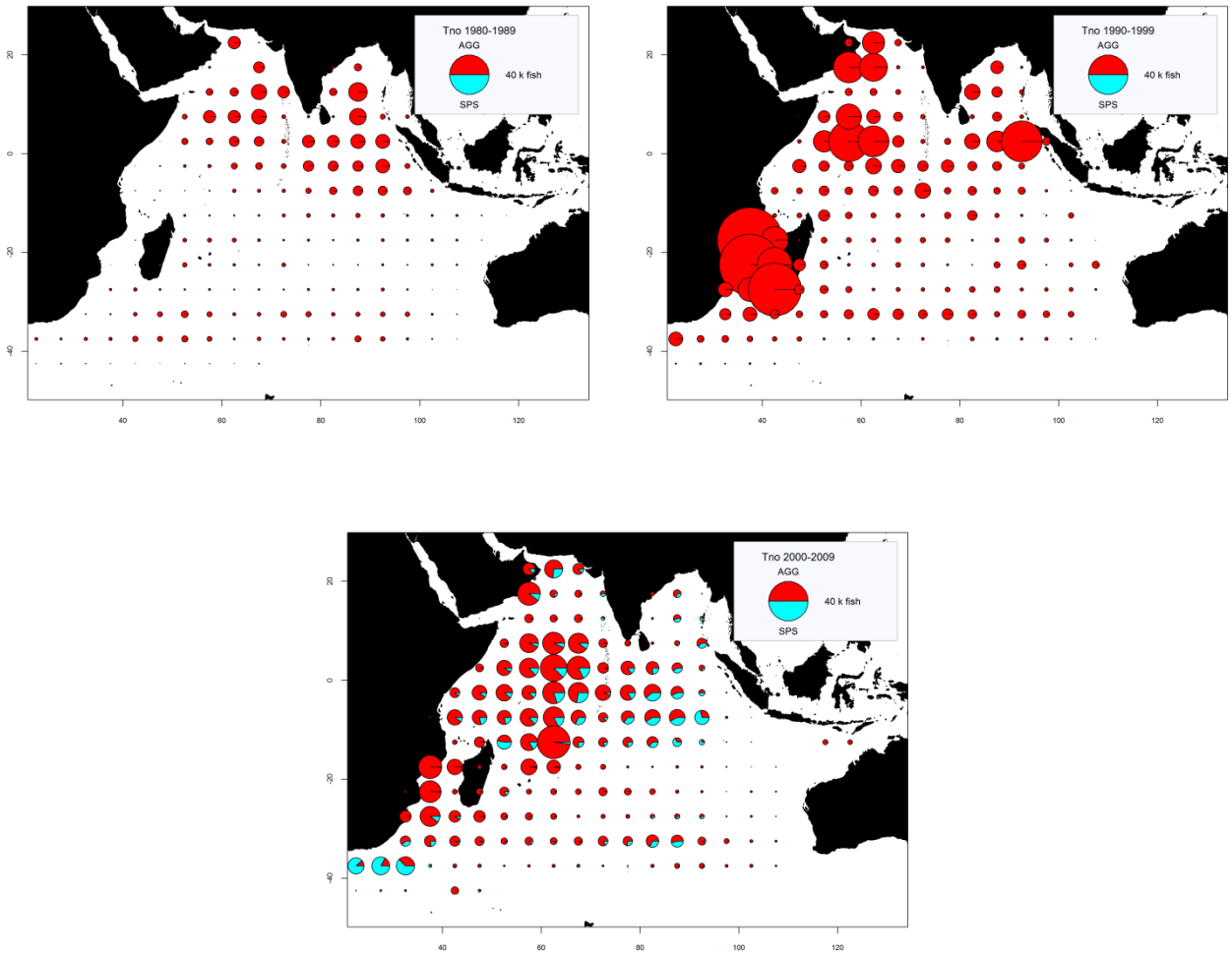


Fig. 8a–c: Time-area catches (total combined in number) of sharks available for the period 1980–2009 for deep-freezing longliners flagged in Taiwan,China, by decade and type of catch reported. Catch reported by species (**SPS**, Blue), Catch reported aggregated (**AGG,** Red).

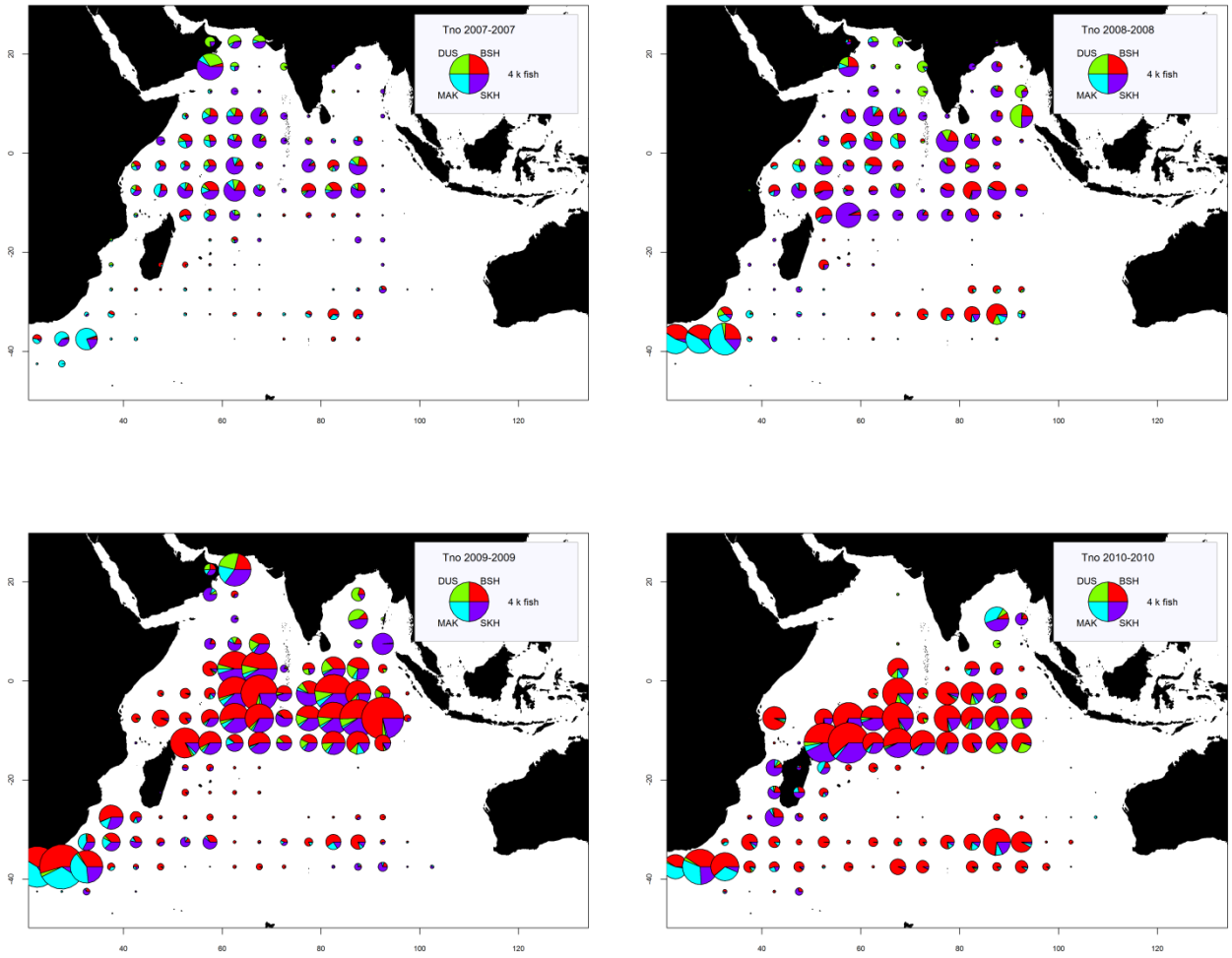


Fig. 9a–d: Time-area catches (total combined in number) of sharks available for the period 2007–2010 for deep-freezing longliners flagged in Taiwan,China, by year and species. Blue shark (**BSH**, red); Dusky shark (**DUS,** green); Mako sharks (**MAK**, blue); Other shark species (**SKH**, purple).

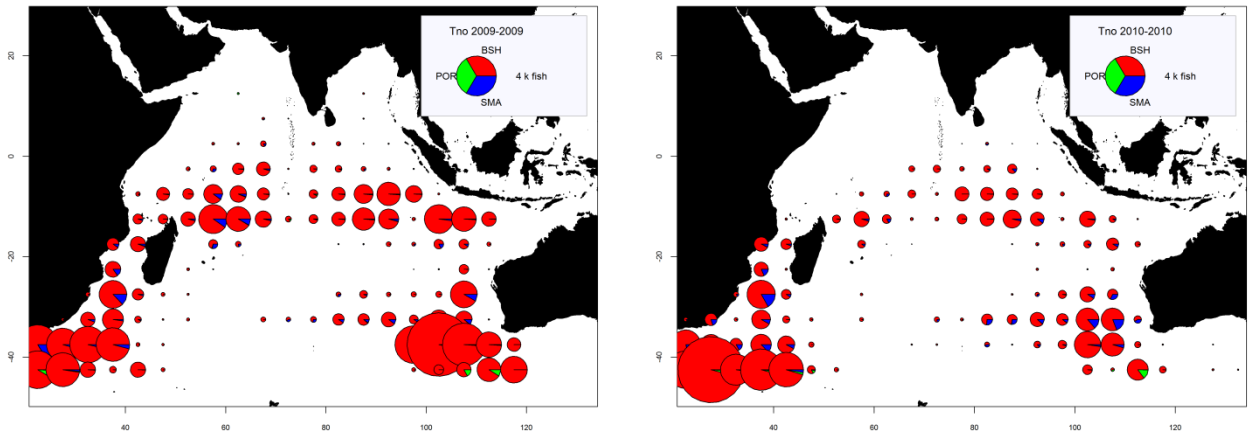


Fig. 10a–b: Time-area catches (total combined in number) of sharks available for the period 2009–2010 for deep-freezing longliners flagged to Japan, by year and species. Blue shark (**BSH**, red); Porbeagle (**POR,** green); Shortfin mako (**MAK**, blue).

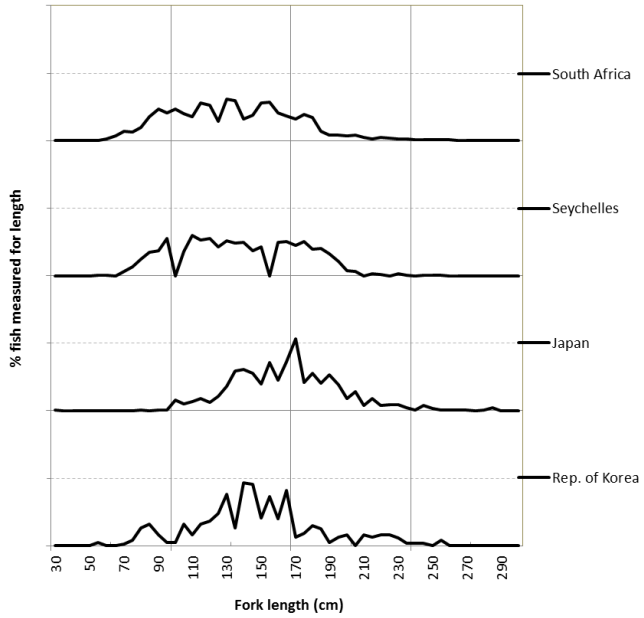


Fig. 11: Length frequency distributions (%) of blue shark derived from the samples available for the longline fleets of South Africa, Seychelles, Japan, and Rep. of Korea (2005–10). Broken horizontal gridlines refer to 10% of the fish.

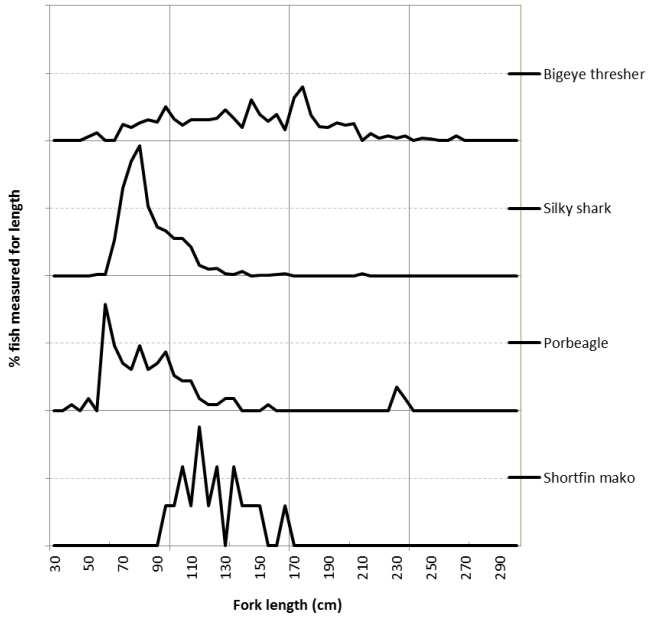


Fig. 12. Length frequency distributions (%) of bigeye thresher, silky shark, porbeagle, and shortfin mako, as derived from the samples available from longline fleets (2005–10). Broken horizontal gridlines refer to 10% of the fish.

APPENDIX VIII
MAIN ISSUES IDENTIFIED CONCERNING DATA ON BYCATCH

The following list is provided by the IOTC Secretariat for the consideration of the WPEB. The list covers the main issues which the Secretariat considers affect the quality of the statistics available at the IOTC, by type of dataset and type of fishery.

SHARKS

1. **Catch-and-Effort data from gillnet fisheries:**
   - **Drifting gillnet** fisheries of **Iran** and **Pakistan**: To date, Iran and Pakistan have not reported catches of sharks, by species, for their gillnet fisheries.
   - **Gillnet/longline** fishery of **Sri Lanka**: Sri Lanka has not reported catch-and-effort data for sharks as per the IOTC standards.
   - **Driftnet fishery of Taiwan,China** (1982–92)**:** Catch-and-effort data does not include catches of sharks by species.
2. **Catch-and-Effort data from Longline Fisheries:**
   - **Historical catches of sharks from major longline** fisheries: To date, **Japan**, **Taiwan,China**, **Indonesia** and **Rep. of Korea,** have not provided estimates of catches of sharks, by species, for years before 2006.
   - **Fresh-tuna longline** fisheries of **Indonesia** and **Malaysia**: Indonesia and Malaysia have not reported catches of sharks by IOTC standards for longliners under their flag. In addition Indonesia has not reported catch-and-effort data for its longline fishery to date.
   - **Deep-freezing longline** fisheries of **EU-Spain**, **India**, **Indonesia**, **Malaysia**, and **Oman:** These countries have not reported catch-and-effort data of sharks by IOTC standards for longliners under their flag.
3. **Catch-and-Effort data from coastal fisheries:**
   - **Coastal** fisheries of **Comoros**[6], **India**, **Indonesia**, **Madagascar**, **Sri Lanka** and **Yemen**: To date, these countries have not provided detailed catches of sharks to the IOTC, in particular Thresher and other pelagic shark species caught by their coastal fisheries.
4. **Discard levels from surface and longline fisheries:**
   - **Discard levels of sharks from major longline** fisheries: To date, **European Union**, **Japan**, **Indonesia** and **Rep. of Korea,** have not provided estimates of discards of sharks, by species, in particular Thresher sharks.
   - **Discard levels of sharks for industrial purse seine** fisheries: To date, the **European Union** (before 2003), **Iran**, **Japan**, **Seychelles**, and **Thailand**, have not provided estimates of discards of sharks, by species, for industrial purse seiners under their flag.
5. **Size frequency data:**
   - **Gillnet** fisheries of **Iran** and **Pakistan:** To date, Iran and Pakistan have not reported size frequency data for their driftnet fisheries.
   - **Longline** fisheries of **China**, **Taiwan,China**, **India, Indonesia, Malaysia, Oman** and **Philippines:** To date, these countries have not reported size frequency data for their longline fisheries, including length frequency of discards of thresher sharks.

[6] The "Direction national des resources haléutiques" of the Comoros conducted a fisheries census in 2011, with the assistance of the IOTC-OFCF Project. In addition, the IOTC Secretariat provided support for the implementation of a sampling system. These activities will make it possible for Comoros to estimate catches of tropical tunas and other species for 2011 and following years.

- **Coastal** fisheries of **Comoros**[7], **India, Indonesia, Madagascar, Sri Lanka** and **Yemen**: To date, these countries have not reported size frequency data for their coastal fisheries.

6. Biological data:

- Surface and longline fisheries, in particular **China**, **Taiwan,China**, **Indonesia** and **Japan**: The Secretariat had to use length-age keys, length-weight keys, ratios of fin-to-body weight, and processed weight-live weight keys, for sharks from other oceans due to the general paucity of biological data available from the Indian Ocean.

OTHER BYCATCH

1. Incidental catches of SEABIRDS:

- **Longline** fisheries operating in areas with high densities of seabirds, notably **Indonesia,** and **Seychelles:** These parties have not reported incidental catches of seabirds for longliners under their flag. In addition, **Japan** has not reported estimates of total incidental catches of seabirds for longliners under its flag.

2. Incidental catches of MARINE TURTLES:

- **Gillnet** fisheries of **Iran** and **Pakistan:** To date, Iran and Pakistan have not reported incidental catches of marine turtles for their driftnet fisheries.
- **Gillnet/longline** fishery of **Sri Lanka**: To date, Sri Lanka has not reported incidental catches of marine turtles for its gillnet/longline fishery.
- **Longline** fisheries of, **India, Indonesia, , Malaysia, Oman, Philippines,** and **Seychelles:** To date, these countries have not reported incidental catches of marine turtles for their longline fisheries. In addition, **Japan** has not reported estimates of total incidental catches of marine turtles for longliners under its flag.

Purse seine fisheries of the **European Union** (excluding 2003–07), **Iran**, **Japan**, **Seychelles**, and **Thailand**: To date these countries have not reported incidental catches of marine turtles for their purse seine fisheries, including incidental catches of marine turtles on Fish Aggregating Devices.

[7] *Ibid.* 7

APPENDIX IX
DATASETS TO BE PROVIDED FOR SHARKS AND OTHER SPECIES

IOTC CPCs are also encouraged to collect and report detailed data on other species, where possible (**Table 1**).

Table 1. Listing of bycatch species of concern to IOTC and reporting requirements, by type of fishery. Fisheries: Purse seine (PS), Longline (LL), Gillnet (GN), Pole-and-line (BB), Hand line (HL), Trolling (TR)

Common name	Scientific name	Species Code	Reporting requirements by fishery					
			PS	**LL**	**GN**	**BB**	**HL**	**TR**
Blue shark	*Prionace glauca*	BSH		**O**	**o**			
Mako sharks	*Isurus spp.*	MAK		**O**	**o**			
Porbeagle	*Lamna nasus*	POR		**O**	**o**			
Hammerhead Sharks	*Sphyrnidae*	SPN		**o**	**o**			
Whale shark	*Rhincodon typus*	RHN	**o**		**o**			
Thresher sharks	*Alopias spp.*	THR	v	v	v			
Crocodile shark	*Pseudocarcharias kamoharai*	PSK		v	v			
Silky shark	*Carcharhinus falciformis*	FAL	v					
Oceanic whitetip shark	*Carcharhinus longimanus*	OCS		v	v			
Tiger shark	*Galeocerdo cuvier*	TIG		v	v			
Great White Shark	*Carcharodon carcharias*	WSH		v				
Pelagic stingray	*Pteroplatytrygon violacea*	PSL		v	v			
Mantas and devil rays	*Manta spp. (Mobulidae)*	MAN	v	v	v			
Other sharks nei		SKH	v	**O**	**o**	**o**	**o**	**o**
Other rays nei		SRX	v	v	v	**o**	**o**	**o**
Other marine fish nei		MZZ	v	**o**	**o**	**o**	**o**	**o**
Marine turtles nei		TTX	**o**	**o**	**o**	**o**	**o**	**o**
Seabirds nei				**o**	**o**			
Marine mammals nei			**o**	**o**	**o**			

Reporting requirements:
O: As from 2008 catch shall be recorded in logbooks and reported to the IOTC
o: As from 2013 catch shall be recorded in logbooks and reported to the IOTC
v: As from 2013 recording and reporting of catches to the IOTC is encouraged

STATUS OF REPORTING BY TYPE OF DATASET

A summary of the type of datasets that need to be provided for sharks, and other bycatch species, respectively, including, in each case: the parties and time periods concerned; deadlines and status of reporting (obligatory or voluntary) are provided in **Tables 2** and **3**. The Parties having provided data; and remarks, in particular focusing on areas were reporting standards are considered to be vague.

The most common bycatch species (shown as **O** and **o**) and other species (shown as v), as identified by the Commission in 2012, are defined in **Table 1**, by type of fishery.

It is important to note that **Table 2** records all parties having provided datasets, regardless of how complete those datasets might be.

Table 2. Types of datasets to be provided for sharks caught on fisheries for IOTC species and parties having provided data in each case.

SHARKS

Historical data on SHARKS according to IOTC reporting requirements

Applies to: All CPC
Time period: All years before 2006
Deadline: June (December) 30th 2006
Binding status: Obligatory (Table 1, **O; o**); Voluntary (Table 1, v)
Parties having provided data for industrial fleets:

- Surface: EU-France; EU-Spain
- Longline: Australia; Belize; China; Taiwan,China; EU-France; EU-Portugal; EU-Spain; EU-UK; France; Guinea; Indonesia; Republic of Korea; Malaysia; Mauritius; Oman; Senegal; Seychelles; South Africa; Thailand

SHARKS

- Driftnet: Pakistan

Remarks: The majority of reports referred to retained catches of all shark species combined, excluded discards, and did not account for shark fins.

Nominal catch data for MAIN SHARK species

Applies to: All CPC
Time period: 2006 and later years
Deadline: June (December) 30th of year following that for which data are due
Binding status: Obligatory (Table 1, **O; o**)
Parties having provided data for industrial fleets:

- Surface: EU-France; EU-Spain
- Longline: Australia; Belize; China; Taiwan,China; EU-Portugal; EU-Spain; EU-UK; Indonesia; Japan; Kenya; Philippines; Sri Lanka; South Africa; Thailand
- Driftnet: Nil

Remarks: The majority of reports referred to retained catches of all shark species combined, excluded discards, and did not account for shark fins.

Nominal catch data for OTHER SHARK species

Applies to: All CPC
Time period: 2006 and later years
Deadline: June (December) 30th of year following that for which data are due
Binding status: Voluntary (Table 1, v)
Parties having provided data for industrial fleets:

- Surface: EU-France; EU-Spain
- Longline: Australia; Belize; China; Taiwan,China; EU-France; EU-Portugal; EU-Spain; EU-UK; France; Indonesia; Japan; Kenya; Republic of Korea; Malaysia; Mauritius; Oman; Philippines; Seychelles; South Africa; Thailand; Uruguay
- Driftnet: Pakistan

Remarks: As above

Catch-and-effort data for MAIN SHARK species

Applies to: All CPC
Time period: 2008 and later years
Deadline: June (December) 30th of year following that for which data are due
Binding status: Obligatory (Table 1, **O; o**)
Parties having provided data for industrial fleets:

- Surface: Nil
- Longline: China; Taiwan,China; EU-Portugal; EU-UK; Japan; Philippines; Seychelles; South Africa; Republic of Korea ;
- Driftnet: Nil

Remarks: Same as above.

Catch-and-effort data for OTHER SHARK species

Applies to: All CPC
Time period: 2008 and later years
Deadline: June (December) 30th of year following that for which data are due
Binding status: Voluntary (Table 1, v)
Parties having provided data for industrial fleets:

- Surface: Nil
- Longline: China; Taiwan,China; EU-France; EU-Portugal; EU-UK; Japan; Republic of Korea; Malaysia; Mauritius; Oman; Seychelles; South Africa; Sri Lanka; Thailand; Uruguay
- Driftnet: Nil

Remarks: Same as above.

Size frequency data for MAIN SHARK species

Applies to: All CPC
Time period: 2008 and later years
Deadline: June (December) 30th of year following that for which data are due
Binding status: Obligatory (Table 1, **O; o**)
Parties having provided data for industrial fleets:

- Surface: Nil
- Longline: Japan; Republic of Korea; Seychelles; South Africa; Sri Lanka;
- Driftnet: Nil

Remarks: Same as above.

Size frequency data for OTHER SHARK species

Applies to: All CPC
Time period: 2008 and later years
Deadline: June (December) 30th of year following that for which data are due
Binding status: Voluntary (Table 1, v)
Parties having provided data for industrial fleets:

- Surface: Nil

SHARKS

- Longline: Indonesia; Japan; Republic of Korea; Seychelles; South Africa; Sri Lanka;
- Driftnet: Nil

Remarks: Same as above.

Estimates of amounts of THRESHER SHARKS discarded dead and size frequency distribution of discards

Applies to: CPC having vessels in the IOTC Record of Authorized vessels
Time period: 2010 and later years
Deadline: IOTC Scientific Committee Meeting in December 2011
Report to: IOTC Scientific Committee
Binding status: Obligatory
Parties having provided data:.Australia,; Taiwan,China; EU-France(LL port sample); Republic of Korea; South Africa;
Remarks: It is unclear if it is required to collect size data on all discards or only on dead discards; collecting size frequency data on thresher sharks before release may compromise survival of those specimens that are caught alive (rates of mortality at capture have been estimated at around 50% in the Atlantic Ocean)

Reports from scientific observers onboard vessels 24m LOA or greater under the IOTC Regional Observer Scheme

Applies to: CPC having vessels 24m LOA or greater in the IOTC Record of Authorized vessels
Time period: Since July 2010
Deadline: No later than 150 days after the end of each observer trip
Report to: IOTC Secretariat
Binding status: Obligatory
Parties having provided data: Australia; China; Taiwan,China; EU-France; Japan; Republic of Korea; South Africa;
Remarks: Refer to Annex 3 for more details about the data submitted.

Reports from scientific observers onboard vessels less than 24m LOA under the IOTC Regional Observer Scheme

Applies to: CPC having vessels less than 24m LOA in the IOTC Record of Authorized vessels
Time period: Progressive implementation to achieve recommended levels of coverage by January 2013
Deadline: No later than 150 days after the end of each observer trip
Report to: IOTC Secretariat
Binding status: Obligatory
Parties having provided data: None
Remarks: Refer to Annex 3 for more details about the data submitted.

Table 2. Types of datasets to be provided for other bycatch of fisheries for IOTC species and parties having provided data in each case.

OTHER SPECIES

Estimates of total incidental catches of SEABIRDS from longline and gillnet fisheries

Applies to: CPC having longline fisheries in the IOTC Area
Time period: 2011 and later years
Deadline: June (December) 30th of year following that for which data are due
Binding status: Obligatory
Parties having provided data for industrial fleets: Not applicable; first report due for December 2012. Australia; Japan (observer); France; Republic of Korea; South Africa; China (nil); Taiwan,China;
Remarks: Requirements do not specify that incidental catches of seabirds have to be reported by species. There is also need to identify for which species of seabirds, out of the many occurring in the Indian Ocean, reporting of data by species is considered to be a priority. Estimation of total levels of bycatch of seabirds by IOTC longline fisheries will be compromised or not possible unless requirements are extended to account for this.

Estimates of total incidental catches of MARINE TURTLES

Applies to: All CPC
Time period: 2010 and later years
Deadline: June (December) 30th of year following that for which data are due
Binding status: Obligatory
Parties having provided data for industrial fleets:

- Surface: EU-France; EU-Spain
- Longline: Australia; China(nil); Taiwan,China; EU-France; EU-Spain; EU-UK; France; Republic of Korea; South Africa; Japan (Observer)
- Driftnet: Nil

Remarks: Requirements do not specify that incidental catches of marine turtles have to be reported by species. Estimation of total levels of bycatch of marine turtles by IOTC fisheries will be compromised or not possible unless requirements are extended to account for this.

Estimates of total incidental catches of MARINE MAMMALS from purse seine, longline, and gillnet fisheries

Applies to: All CPC
Time period: 2006 and later years
Deadline: June (December) 30th of year following that for which data are due
Binding status: Voluntary
Parties having provided data for industrial fleets: Several parties have provided data concerning this requirement.
Remarks: This group refers to species of very different nature, including marine mammals, and other groups of other marine species. For the sake of clarity it would be better to clarify which species or species groups are the focus of this requirement. It would also be better to create specific requirements for marine mammals, along the lines of those created for Seabirds or marine turtles.

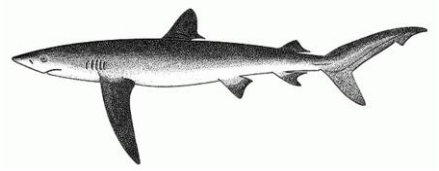
Reports from scientific observers onboard vessels 24m LOA or greater under the IOTC Regional Observer Scheme

Reports from scientific observers onboard vessels less than 24m LOA under the IOTC Regional Observer Scheme

Remarks: Refer to Table 1 (SHARKS)

APPENDIX X
DRAFT RESOURCE STOCK STATUS SUMMARY – BLUE SHARK

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



Status of the Indian Ocean Blue Shark (*Prionace glauca*)

TABLE 1. IUCN threat status of blue shark (*Prionace glauca*) in the Indian Ocean

Common name	Scientific name	IUCN threat status[8]		
		Global status	WIO	EIO
Blue shark	*Prionace glauca*	Near Threatened	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean
SOURCES: IUCN (2007, 2011)

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

The WPEB **RECOMMENDED** the following management advice for blue shark in the Indian Ocean noting that there remains considerable uncertainty about the relationship between abundance and the standardised CPUE series from the Japanese longline fleet, and about the total catches over the past decade.

Stock status. The current IUCN threat status of 'Near Threatened' applies to blue sharks globally (Table 1). 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 and limited 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 relatively late (at 4–6 years), and have relativity few offspring (25–50 pups every year), the blue shark is vulnerable to overfishing. Blue shark assessments in the Atlantic and Pacific oceans seem to indicate that blue shark stocks can sustain relatively high fishing pressure.

Outlook. Maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE. The impact of piracy in the western Indian Ocean has resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into certain areas in the southern and eastern Indian Ocean. It is therefore unlikely that catch and effort on blue shark will decline in these areas in the near future, and may result in localised depletion.

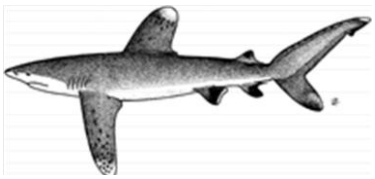
The WPEB considered the following:

- The available evidence indicates risk to the stock status at current effort levels.
- The two primary sources of data that drive the assessment, total catches and CPUE are highly uncertain and should be investigated further as a priority.
- Noting that current reported catches (probably largely underestimated) are estimated at an average ~ 8,924 t over the last five years, ~ 9,416 t in 2010, maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE.
- The WPEB **RECOMMENDED** that mechanisms are developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

[8] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

APPENDIX XI
DRAFT RESOURCE STOCK STATUS SUMMARY – OCEANIC WHITETIP SHARK

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



Status of the Indian Ocean Oceanic Whitetip Shark (*Carcharhinus longimanus*)

TABLE 1. IUCN threat status of oceanic whitetip shark (*Carcharhinus longimanus*) in the Indian Ocean

Common name	Scientific name	IUCN threat status[9]		
		Global status	WIO	EIO
Oceanic whitetip shark	*Carcharhinus longimanus*	Vulnerable	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean
SOURCES: IUCN (2007, 2011)

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

The WPEB **RECOMMENDED** the following management advice for oceanic whitetip sharks in the Indian Ocean, noting that there remains considerable uncertainty about the relationship between abundance and the standardised CPUE series from the Japanese longline fleet, and about the total catches over the past decade.

Stock status. The current IUCN threat status of 'Vulnerable' applies to oceanic whitetip sharks globally (Table 1). There is a paucity of information available on this species in the Indian Ocean and this situation is not expected to improve in the short to medium term. There is no quantitative stock assessment and limited basic fishery indicators currently available for oceanic whitetip sharks 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. Despite the lack of data, it is apparent from the information that is available that oceanic whitetip shark abundance has declined significantly over recent decades.

Outlook. Maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE. The impact of piracy in the western Indian Ocean has resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into certain areas in the southern and eastern Indian Ocean. It is therefore unlikely that catch and effort on oceanic whitetip sharks will decline in these areas in the near future, and may result in localised depletion.

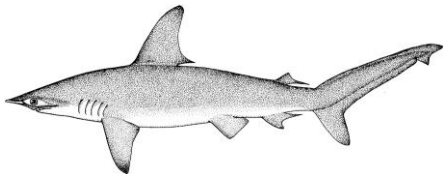
The WPEB considered the following:

- The available evidence indicates considerable risk to the stock status at current effort levels.
- The two primary sources of data that drive the assessment, total catches and CPUE are highly uncertain and should be investigated further as a priority.
- Noting that current catches (probably largely underestimated) are estimated at an average ~265 t over the last five years, ~450 t in 2010, maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE.
- The WPEB **RECOMMENDED** that mechanisms are developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

[9] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

APPENDIX XII
DRAFT RESOURCE STOCK STATUS SUMMARY – SCALLOPED HAMMERHEAD SHARK

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



Status of the Indian Ocean Scalloped Hammerhead Shark (*Sphyrna lewini*)

TABLE 1. IUCN threat status of scalloped hammerhead shark (*Sphyrna lewini*) in the Indian Ocean.

Common name	Scientific name	IUCN threat status[10]		
		Global status	WIO	EIO
Scalloped hammerhead	*Sphyrna lewini*	Endangered	Endangered	Least concern

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean
SOURCES: IUCN (2007, 2011)

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. The current IUCN threat status of 'Endangered' applies to blue sharks globally and specifically for the western Indian Ocean (Table 1). 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. 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.

Outlook. Maintaining or increasing effort will probably result in further declines in biomass and productivity. The impact of piracy in the western Indian Ocean has resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into certain areas in the southern and eastern Indian Ocean. It is therefore unlikely that catch and effort on scalloped hammerhead shark will decline in these areas in the near future, and may result in localised depletion.

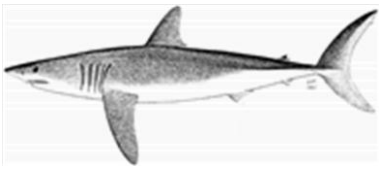
The WPEB considered the following:

- The available evidence indicates considerable risk to the stock status at current effort levels.
- The primary source of data that drive the assessment (total catches) is highly uncertain and should be investigated further as a priority.
- Noting that current reported catches (probably largely underestimated) are estimated at an average ~16 t over the last five years, ~22 t in 2010, maintaining or increasing effort will probably result in further declines in biomass and productivity.
- The WPEB **RECOMMENDED** that mechanisms are developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

[10] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

APPENDIX XIII
DRAFT RESOURCE STOCK STATUS SUMMARY – SHORTFIN MAKO SHARK

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



Status of the Indian Ocean Shortfin Mako Shark (*Isurus oxyrinchus*)

TABLE 1. – IUCN threat status of shortfin mako shark (*Isurus oxyrinchus*) in the Indian Ocean

Common name	Scientific name	IUCN threat status[11]		
		Global status	WIO	EIO
Shortfin mako shark	*Isurus oxyrinchus*	Vulnerable	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean
SOURCES: IUCN (2007, 2011)

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

The WPEB **RECOMMENDED** the following management advice for shortfin mako shark in the Indian Ocean, noting that there remains considerable uncertainty about the relationship between abundance and the standardised CPUE series from the Japanese longline fleet, and about the total catches over the past decade.

Stock status. The current IUCN threat status of 'Vulnerable' applies to shortfin mako sharks globally (Table 1). Trends in the Japanese CPUE series suggest that the longline vulnerable biomass has declined from 1994 to 2003, and has been increasing since then. 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 30 years), females mature at 18–21 years, and have relativity few offspring (<25 pups every two or three years), the shortfin mako shark is vulnerable to overfishing.

Outlook. Maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE. The impact of piracy in the western Indian Ocean has resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into certain areas in the southern and eastern Indian Ocean. It is therefore unlikely that catch and effort on shortfin mako shark will decline in these areas in the near future, and may result in localised depletion.

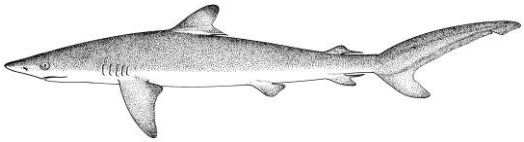
The WPEB considered the following:

- The available evidence indicates considerable risk to the stock status at current effort levels.
- The two primary sources of data that drive the assessment, total catches and CPUE are highly uncertain and should be investigated further as a priority.
- Noting that current reported catches are estimated (probably largely underestimated) at an average ~990 t over the last five years, ~738 t in 2010, maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE.
- The WPEB **RECOMMENDED** that mechanisms are developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

[11] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

APPENDIX XIV
DRAFT RESOURCE STOCK STATUS SUMMARY – SILKY SHARK

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



Status of the Indian Ocean Silky Shark (*Carcharhinus falciformis*)

TABLE 1. IUCN threat status of silky shark (*Carcharhinus falciformis*) in the Indian Ocean

Common name	Scientific name	IUCN threat status[12]		
		Global status	WIO	EIO
Silky shark	*Carcharhinus falciformis*	Near Threatened	Near Threatened	Near Threatened

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean
SOURCES: IUCN (2007, 2011)

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. The current IUCN threat status of 'Near Threatened' applies to silky sharks in the western and eastern Indian Ocean and globally (Table 1). 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. Silky 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 20 years), mature relatively late (at 6–12 years), and have relativity few offspring (<20 pups every two years), the silky shark is vulnerable to overfishing. Despite the lack of data, it is clear from the information that is available that silky shark abundance has declined significantly over recent decades.

Outlook. Maintaining or increasing effort will probably result in declines in biomass, productivity and CPUE. The impact of piracy in the western Indian Ocean has resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into certain areas in the southern and eastern Indian Ocean. It is therefore unlikely that catch and effort on silky shark will decline in these areas in the near future, and may result in localised depletion.

The WPEB considered the following:

- The available evidence indicates considerable risk to the stock status at current effort levels.
- Total catches are highly uncertain and should be investigated further as a priority.
- Noting that current reported catches (probably largely underestimated) are estimated at an average ~ 670 t over the last five years, ~1, 153 t in 2010, maintaining or increasing effort will probably result in further declines in biomass.
- The WPEB **RECOMMENDED** that mechanisms are developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

[12] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

APPENDIX XV
DRAFT RESOURCE STOCK STATUS SUMMARY – BIGEYE THRESHER SHARK

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

Status of the Indian Ocean Bigeye Thresher Shark (*Alopias superciliosus*)

TABLE 1. IUCN threat status. of bigeye thresher shark (*Alopias superciliosus*) in the Indian Ocean

Common name	Scientific name	IUCN threat status[13]		
		Global status	WIO	EIO
Bigeye thresher shark	*Alopias superciliosus*	Vulnerable	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean
SOURCES: IUCN (2007, 2011)

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

The WPEB **RECOMMENDED** the following management advice for bigeye thresher shark in the Indian Ocean, noting that there remains considerable uncertainty in the stock status due to lack of information necessary for assessment or to for the development of other indicators of the stock.

Stock status. The current IUCN threat status of 'Vulnerable' applies to bigeye thresher shark globally (Table 1). 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 and limited basic fishery indicators currently available for bigeye thresher shark in the Indian Ocean therefore the stock status is highly uncertain. Bigeye thresher sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (+20 years), mature at 9-13 years, and have few offspring (2-4 pups every year), the bigeye thresher shark is vulnerable to overfishing.

Outlook. Current longline fishing effort is directed to other species, however bigeye thresher sharks is a common bycatch these fisheries. Hooking mortality is apparently very high, therefore IOTC regulation 10/12 prohibiting retaining of any part of thresher sharks onboard and promoting life release of thresher shark are apparently ineffective for species conservation. Maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE. However there are few data to estimated CPUE trends, in view of IOTC regulation 10/12 and reluctance of fishing fleet to report information on discards/non-retained catch. The impact of piracy in the western Indian Ocean has resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into other areas in the southern and eastern Indian Ocean. It is therefore unlikely that catch and effort on bigeye thresher shark will decline in these areas in the near future, which may result in localised depletion.

The WPEB considered the following:

- The available evidence indicates considerable risk to the status of the IO stock at current effort levels.
- Two important sources of data that inform the assessment, total catches and CPUE are highly uncertain and should be investigated further as a priority.
- Noting that current catches (probably largely underestimated) are estimated at an average ~4 t over the last five years, ~5 t in 2010, maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE.
- The WPEB **RECOMMENDED** that mechanisms are developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.
- The WPEB **AGREED** that three options should be considered for amendment of Resolution 08/04 concerning the recording of the catch by longline fishing vessels in the IOTC area in order to improve data collection and statistics on sharks that would allow the development of stock status indicators.

[13] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

APPENDIX XVI
DRAFT RESOURCE STOCK STATUS SUMMARY – PELAGIC THRESHER SHARK

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

Status of the Indian Ocean Pelagic Thresher Shark (*Alopias pelagicus*)

TABLE 1. IUCN threat status of pelagic thresher shark (*Alopias pelagicus*) in the Indian Ocean

Common name	Scientific name	IUCN threat status[14]		
		Global status	WIO	EIO
Pelagic thresher shark	*Alopias pelagicus*	Vulnerable	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean
SOURCES: IUCN (2007, 2011)

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

The WPEB **RECOMMENDED** the following management advice for pelagic thresher shark in the Indian Ocean, noting that there remains considerable uncertainty in the stock status due to lack of information necessary for assessment or to for the development of other indicators of the stock.

Stock status. The current IUCN threat status of 'Vulnerable' applies to pelagic thresher shark globally (Table 1). 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 and limited basic fishery indicators currently available for pelagic thresher shark in the Indian Ocean therefore the stock status is highly uncertain. Pelagic thresher sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (+ 20 years), mature at 8-9 years, and have few offspring (2 pups every year), the pelagic thresher shark is vulnerable to overfishing.

Outlook. Current longline fishing effort is directed to other species, however pelagic thresher sharks is a common bycatch these fisheries. Hooking mortality is apparently very high, therefore IOTC regulation 10/12 prohibiting retaining of any part of thresher sharks onboard and promoting life release of thresher shark are apparently ineffective for species conservation. Maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE. However there are few data to estimated CPUE trends, in view of IOTC regulation 10/12 and reluctance of fishing fleet to report information on discards/non-retained catch. The impact of piracy in the western Indian Ocean has resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into other areas in the southern and eastern Indian Ocean. It is therefore unlikely that catch and effort on pelagic thresher shark will decline in these areas in the near future, which may result in localised depletion.

The WPEB considered the following:

- The available evidence indicates considerable risk to the status of the IO stock at current effort levels.
- Two important sources of data that inform the assessment, total catches and CPUE are highly uncertain and should be investigated further as a priority.
- Noting that current catches (probably largely underestimated) are estimated at 2 t in 2010, maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE.
- The WPEB **RECOMMENDED** that mechanisms are developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.
- The WPEB **AGREED** three options should be considered for amendment of Resolution 08/04 concerning the recording of the catch by longline fishing vessels in the IOTC area in order to improve data collection and statistics on sharks that would allow the development of stock status indicators.

[14] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

APPENDIX XVII
DRAFT RESOURCE STOCK STATUS SUMMARY – MARINE TURTLES

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

Status of Indian Ocean Marine Turtles

TABLE 1. IUCN threat status for all marine turtle species reported as caught in fisheries within the IOTC area of competence.

Common name	Scientific name	IUCN threat status[15]
Flatback turtle	*Natator depressus*	Data deficient
Green turtle	*Chelonia mydas*	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Critically Endangered
Leatherback turtle	*Dermochelys coriacea*	Critically Endangered
Loggerhead turtle	*Caretta caretta*	Endangered
Olive ridley turtle	*Lepidochelys olivacea*	Vulnerable

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No assessment has been undertaken by the IOTC WPEB for marine turtles due to the lack of data being submitted by CPCs. However, the current International Union for Conservation of Nature (IUCN) threat status for each of the marine turtle species reported as caught in IOTC fisheries to date is provided in Table 1. It is important to note that a number of international global environmental accords (e.g. Convention on Migratory Species (CMS), Convention on Biological Diversity (CBD)), as well as numerous fisheries agreements obligate States to provide protection for these species. While the status of marine 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 marine turtles due to capture by gillnets and to a lesser extent purse seine fishing and longline is not known.

Outlook. Resolution 09/06 *on marine turtles* includes an evaluation requirement (para. 9) by the Scientific Committee in time for the 2011 meeting of the Commission (para.10). However, given the lack of reporting of marine turtle interactions by CPCs to date, such an evaluation was not able to be undertaken. Unless IOTC CPCs become compliant with the data collection and reporting requirements for marine turtles, the WPEB will continue to be unable to address this issue. Notwithstanding this, it is acknowledged that the impact on marine turtle populations from fishing for tuna and tuna-like species may increase if fishing pressure increases, or if the status of the marine turtle populations worsens due to other factors such as an increase in fishing pressure from other fisheries or anthropological or climatic impacts.

The WPEB **RECOMMENDED** the following:

- The available evidence indicates considerable risk to the status of marine turtles in the Indian Ocean.
- The primary source of data that drive the ability of the WPEB to determination a status for the Indian Ocean, total interactions by fishing vessels, is highly uncertain and should be addressed as a matter of priority.
- Current reported interactionsare a known to be a severe underestimate: 7 interactions reported in 2009.
- Maintaining or increasing effort in the Indian Ocean without appropriate mitigation measures in place, will likely result in further declines in biomass.
- That appropriate mechanisms are developed by the Compliance Commission to ensure CPCs comply with their data collection and reporting requirements for marine turtles.

[15] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

APPENDIX XVIII
DRAFT RESOURCE STOCK STATUS SUMMARY – SEABIRDS

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

Status of Seabirds in the Indian Ocean

TABLE 1. IUCN threat status for all seabird species reported as caught in fisheries within the IOTC area of competence.

Common name	Scientific name	IUCN threat status[16]
Albatross		
Atlantic Yellow-nosed Albatross	*Thalassarche chlororynchos*	Endangered
Black-browed albatross	*Thalassarche melanophrys*	Endangered
Indian yellow-nosed albatross	*Thalassarche car teri*	Endangered
Shy albatross	*Thalassarche cauta*	Near Threatened
Sooty albatross	*Phoebetria fusca*	Endangered
Light-mantled albatross	*Phoebetria palpebrata*	Near Threatened
Amsterdam albatross	*Diomedea amsterdamensis*	Critically Endangered
Tristan albatross	*Diomedea dabbenena*	Critically Endangered
Wandering albatross	*Diomedia exulans*	Vulnerable
White-capped albatross	*Thalassarche steadi*	Near Threatened
Petrels		
Cape/Pintado petrel	*Daption capense*	Least Concern
Great-winged petrel	*Pterodroma macroptera*	Least Concern
Grey petrel	*Procellaria cinerea*	Near Threatened
Northern giant-petrel	*Macronectes halli*	Least Concern
White-chinned petrel	*Procellaria aequinoctialis*	Vulnerable
Others		
Cape gannet	*Morus capensis*	Vulnerable
Flesh-footed shearwater	*Puffinus carneipes*	Least Concern

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No assessment has been undertaken by the IOTC WPEB for seabirds due to the lack of data being submitted by CPCs. However, the current International Union for Conservation of Nature (IUCN) threat status for each of the seabird species reported as caught in IOTC fisheries to date is provided in Table 1. It is important to note that a number of international global environmental accords (e.g. Convention on Migratory Species (CMS), Convention on Biological Diversity (CBD)), as well as numerous fisheries agreements obligate States to provide protection for these species. While the status of seabirds is affected by a range of factors such as degradation of nesting habitats and targeted harvesting of eggs, the level of mortality of seabirds due to fishing gear in the Indian Ocean is poorly known, although where there has been rigorous assessment of impacts in areas south of 25 degrees (e.g. in South Africa), very high seabird bycatch rates have been recorded in the absence of a suite of proven bycatch mitigation measures.

Outlook. Resolution 10/06 *On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries* includes an evaluation requirement (para. 8) by the Scientific Committee in time for the 2011 meeting of the Commission. However, given the lack of reporting of seabird interactions by CPCs to date, such an evaluation cannot be undertaken at this stage. Unless IOTC CPCs become compliant with the data collection and reporting requirements

[16] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

for seabirds, the WPEB will continue to be unable to address this issue. Notwithstanding this, it is acknowledged that the impact on seabird populations from fishing for tuna and tuna-like species, particularly using longline gear may increase if fishing pressure increases. Any fishing in areas with high abundance of procellariiform seabirds is likely to cause incidental capture and mortality of these seabirds unless measures that have been proven to be effective against Southern Ocean seabird assemblages are employed.

The WPEB **RECOMMENDED** the following:

- The available evidence indicates considerable risk to the status of seabirds in the Indian Ocean.
- The primary source of data that drive the ability of the WPEB to determination a status for the Indian Ocean, total interactions by fishing vessels, is highly uncertain and should be addressed as a matter of priority.
- Current reported interactions are a known to be a severe underestimate.
- That more research is conducting on the identification of hot spots of interactions between seabirds and fishing vessels.
- Maintaining or increasing effort in the Indian Ocean without refining and implementing appropriate mitigation measures, will likely result in further declines in biomass.
- That appropriate mechanisms are developed by the Compliance Commission to ensure CPCs comply with their data collection and reporting requirements for seabirds.
- Resolution 10/06 on reducing the incidental bycatch of seabirds in longline fisheries includes an evaluation requirement (para. 8) by the Scientific Committee in time for the 2011 meeting of the Commission, noting that this deadline is now overdue.