# Report of the Ninth Session of the IOTC Working Party on Ecosystems and Bycatch

La Réunion, France, 12–16 September, 2013

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## ACRONYMS

| | |
|---|---|
| ACAP | Agreement on the Conservation of Albatrosses and Petrels |
| BSH | Blue shark |
| CoC | Compliance Committee, of the IOTC |
| 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 |
| IUU | Illegal, Unreported and Unregulated, fishing |
| LL | Longline |
| LSTLV | Large-scale tuna longline vessel |
| MCS | Monitoring, Control and Surveillance |
| MoU | Memorandum of Understanding |
| MSY | Maximum sustainable yield |
| n.a. | Not applicable |
| NGO | Non-Governmental Organisation |
| NPOA | National Plan of Action |
| PSA | Productivity Susceptibility Analysis |
| ROS | Regional Observer Scheme |
| SC | Scientific Committee of the IOTC |
| SB | Spawning biomass (sometimes expressed as SSB) |
| $SB_{MSY}$ | Spawning stock biomass which produces MSY |
| 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. |

## IOTC REPORT TERMINOLOGY

***Level 1:*** **RECOMMENDED, RECOMMENDATION**: Any conclusion from a subsidiary body of the Commission which is to be formally provided to the next level in the structure of the Commission for its consideration/endorsement (e.g. from a Working Party to the Scientific Committee). The intention is that the higher body will consider the recommended action for endorsement.

***Level 2:*** **REQUESTED**: A request from an IOTC body to a particular CPC, the IOTC Secretariat, or other body (not the Commission) to carry out a specified task. Ideally this should be highly specific and contain a timeframe for the completion of the task.

***Level 3:*** **AGREED**: Any point of discussion from a meeting which the IOTC body considers to be an agreed course of action for the IOTC body, or a general point of agreement among participants of the meeting.
**NOTED/NOTING**: Any point of discussion from a meeting which the IOTC body considers to be important enough to record in a meeting report for perpetuity.

***Any other term:*** Any other term may be used in addition to the above key terms to highlight to the reader the importance of the relevant paragraph in a report. However, other terms used are considered for explanatory/informational purposes only and have no rating within the reporting terminology hierarchy described above (e.g. Considered; Urged; Acknowledged).

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**EXECUTIVE SUMMARY**

The Ninth Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Ecosystems and Bycatch (WPEB) was held in La Reunion, France, from 12 to 16 September 2013. A total of 32 participants (48 in 2012) attended the Session. The meeting was opened by Mr Ludovic Courtois, Secrétaire général du Comité régional des pêches maritimes et des élevages marins (CRPMEM) de La Réunion, who welcomed participants to La Reunion and formally opened the Ninth Session of the IOTC Working Party on Ecosystems and Bycatch.

The Chair, Dr. Charles Anderson also subsequently welcomed participants to La Reunion, including the Invited Expert, Dr. Ronel Nel, from the Nelson Mandela Metropolitan University, Port Elizabeth, South Africa.

**Employment of a Fisheries Officer**

**NOTING** the rapidly increasing scientific workload at the IOTC Secretariat, including a wide range of additional duties on ecosystems and bycatch assigned to it by the SC and the Commission, and that the new Fishery Officer (Science) supporting the IOTC scientific activities has not been given a mandate by the Commission to work on ecosystems and bycatch matters, the WPEB strongly **RECOMMENDED** that the Commission approve the hiring of a Fishery Officer (Bycatch) to work on bycatch matters in support of the scientific process. (para.12)

**Regional observer scheme**

The WPEB **RECOMMENDED** that the Compliance Committee and Commission consider how to address the lack of implementation of regional observer schemes by CPCs for their fleets and reporting to the IOTC Secretariat as per the provision of Resolution 11/04 *on a Regional Observer Scheme*, noting the update provided in Appendix VI. (para.35)

The WPEB **RECOMMENDED** that as a priority, the IOTC Secretariat should immediately commence work with CPCs that are yet to develop and implement a Regional Observer Scheme that would meet the requirements contained in Resolution 11/04, and provide an update at the next session of the WPEB. (para.37)

**Training for CPCs having gillnet fleets on species identification, bycatch mitigation and data collection methods and also to identify other potential sources of assistance – Development of plans of action**

The WPEB **RECOMMENDED** that the Commission allocate funds in its 2014 and 2015 budgets for the IOTC Secretariat to carry out training for CPCs having gillnet fleets on bycatch mitigation methods, species identification, and data collection methods (budget estimate: Table 4). (para.64)

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

The WPEB **RECOMMENDED** that the Commission note the list of the 10 most vulnerable shark species to longline gear (Table 7) and purse seine gear (Table 8) in the Indian Ocean, as determined by a productivity susceptibility analysis, compared to the list of shark species/groups required to be recorded for each gear, contained in Resolution 13/03 o*n the recording of catch and effort by fishing vessels in the IOTC area of competence*. At the next revision to Resolution 13/03, the Commission may wish to add the missing species/groups of sharks and rays. (para.123)

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

**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 10) for which nominal catch data shall be reported as part of the statistical requirement for IOTC CPCs. (para.138)

**Review of Resolution 12/04 on the conservation of marine turtles**

The WPEB **RECOMMENDED** that at the next revision of IOTC Resolution 12/04 *on the conservation of marine turtles*, the measure is strengthened to ensure that where possible, CPCs report annually on the total estimated level of incidental catches of marine turtles, by species, as provided at Table 12. (para.168)

**Resolution 10/02 Mandatory statistical [reporting] requirements for IOTC Members and Cooperating Non-Contracting Parties (CPCs)**

**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* and Resolution 13/03 on *On the recording of catch and effort by fishing vessels in the IOTC area of competence*. (para.169)

**Format of future WPEB Sessions**

The WPEB **RECOMMENDED** that the SC note the following: (para.253)

- The WPEB **DISCUSSED** the future format in order to focus the efforts of scientists working on different groups of bycatch species to address more efficiently, the mandate of the group.
- The WPEB **CONSIDERED** a range of options which the SC is asked to consider:
  - **Option 1**: The current WPEB be split into two; A dedicated Working Party on Sharks (WPS) and a Working Party on Ecosystems and Bycatch (WPEB).
  - **Option 2**: Retaining the WPEB in its current form, with alternating focus of sharks in one year, followed by other ecosystem and bycatch issues in the next year.
  - **Option 3**: Maintaining the WPEB with clear guidelines to deal with sharks every year, as well as other issues and bycatch groups in alternate years or as required.
- The WPEB **AGREED** that shark issues were important to address on a yearly basis.

**Election of a Chairperson and Vice-Chairperson for the next biennium**

The WPEB **RECOMMENDED** that the SC note the new Chairperson, Dr. Rui Coelho (EU,Portugal) and Vice-Chairperson, Dr. Evgeny Romanov (La Réunion), of the WPEB for the next biennium. (para.263)

**Report of the Ninth Session of the Working Party on Ecosystems and Bycatch**

The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB09, provided at Appendix XXI, as well as the management advice provided in the draft resource stock status summary for each of the seven shark species, as well of those for marine turtles and seabirds: (para.265)

**Sharks**

- 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

**Other species/groups**

- Marine turtles – Appendix XVII
- Seabirds – Appendix XVIII

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 | 2010 | 2011 | 2012 | 2013 | 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<br>*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.<br>○ Blue sharks – Appendix X<br>○ Oceanic whitetip sharks – Appendix XI<br>○ Scalloped hammerhead sharks – Appendix XII<br>○ Shortfin mako sharks – Appendix XIII<br>○ Silky sharks – Appendix XIV<br>○ Bigeye thresher sharks – Appendix XV<br>○ Pelagic thresher sharks – Appendix XVI |
| Silky shark<br>*Carcharhinus falciformis* | Unknown Unknown | | | | | | |
| Oceanic whitetip shark<br>*Carcharhinus longimanus* | Unknown Unknown | | | | | | |
| Scalloped hammerhead shark<br>*Sphyrna lewini* | Unknown Unknown | | | | | | |
| Shortfin mako<br>*Isurus oxyrinchus* | Unknown Unknown | | | | | | |
| Bigeye thresher shark<br>*Alopias superciliosus* | Unknown Unknown | | | | | | |
| Pelagic thresher shark<br>*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 Ninth Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Ecosystems and Bycatch (WPEB) was held in La Reunion, France, from 12 to 16 September 2013. A total of 32 participants (48 in 2012) attended the Session. The list of participants is provided at Appendix I. The meeting was opened by Mr. Ludovic Courtois, Secrétaire général du Comité régional des pêches maritimes et des élevages marins (CRPMEM) de La Réunion, who welcomed participants to La Reunion and formally opened the Ninth Session of the IOTC Working Party on Ecosystems and Bycatch (WPEB09).

2. The Chair, Dr. Charles Anderson also subsequently welcomed participants to La Reunion, including the Invited Expert, Dr. Ronel Nel, from the Nelson Mandela Metropolitan University, Port Elizabeth, South Africa.

***Meeting participation fund***

3. **NOTING** that the IOTC Meeting Participation Fund (MPF), adopted by the Commission in 2010 (Resolution 10/05 *On the establishment of a Meeting Participation Fund for developing IOTC Members and non-Contracting Cooperating Parties*), was used to fund the participation of 11 national scientists to the WPEB09 meeting (7 in 2012), all of which were required to submit and present a working paper at the meeting, the WPEB **RECOMMENDED** that this fund be maintained into the future.

4. The WPEB **RECALLED** that the MPF was established for the purposes of supporting scientists and representatives from IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs) who are developing States to attend and contribute to the work of the Commission, the Scientific Committee and its Working Parties.

5. **NOTING** that the Commission had directed the Secretariat (via Resolution 10/05) to ensure that the MPF be utilised, as a first priority, to support the participation of scientists from developing CPCs in scientific meetings of the IOTC, including Working Parties, rather than non-science meetings, the WPEB **RECOMMENDED** that the Secretariat strictly adhere to the directives of the Commission contained in Resolution 10/05, including paragraph 8 which states that '*The Fund will be allocated in such a way that no more than 25% of the expenditures of the Fund in one year is used to fund attendance to non-scientific meetings*.' Thus, 75% of the annual MPF shall be allocated to facilitating the attendance of developing CPC scientists to the Scientific Committee and its Working Parties.

# 2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

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

7. The WPEB **NOTED** with thanks that most of the working papers were submitted to the IOTC Secretariat prior to the 15 day pre-meeting deadlines, and that all papers were provided prior to the commencement of the meeting. The submission of papers 15 days prior to the meeting allows all participants to thoroughly review each paper and therefore be able to comment and contribute to discussions during the meeting.

# 3. OUTCOMES OF THE FIFTEENTH SESSION OF THE SCIENTIFIC COMMITTEE

8. The WPEB **NOTED** paper IOTC–2013–WPEB09–03 which outlined the main outcomes of the Fifteenth Session of the Scientific Committee, specifically related to the work of the WPEB and **AGREED** to consider how best to progress these issues at the present meeting.

# 4. OUTCOMES OF SESSIONS OF THE COMMISSION

## *4.1 Outcomes of the Seventh Session of the Commission*

9. The WPEB **NOTED** paper IOTC–2013–WPEB09–04 which outlined the main outcomes of the Seventeenth Session of the Commission, specifically related to the work of the WPEB, 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.

10. The WPEB **NOTED** the 11 Conservation and Management Measures (CMMs) adopted at the Seventeenth Session of the Commission (consisting of 11 Resolutions and 0 Recommendations), and in particular the following Resolutions which have a direct impact on the work of the WPEB:
    - Resolution 13/03 *On the recording of catch and effort data by fishing vessels in the IOTC area of competence*
    - Resolution 13/04 *On the conservation of cetaceans*

- Resolution 13/05 *On the conservation of whale sharks* (*Rhincodon typus*)
- Resolution 13/06 *On a scientific and management framework on the Conservation of sharks species caught in association with IOTC managed fisheries*
- Resolution 13/08 *Procedures on a fish aggregating devices (FADs) management plan, including more detailed specification of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species*
- Resolution 13/11 *On a ban on discards of bigeye tuna, skipjack tuna, yellowfin tuna and a recommendation for non-targeted species caught by purse seine vessels in the IOTC area of competence*

***Employment of a Fisheries Officer***

11. **NOTING** that the Commission at its 17th Session approved a new Fishery Officer (Science) position at the IOTC Secretariat, the WPEB **REQUESTED** that the Secretariat expedite the recruitment process so that the successful candidate can commence work as soon as possible.

12. **NOTING** the rapidly increasing scientific workload at the IOTC Secretariat, including a wide range of additional duties on ecosystems and bycatch assigned to it by the SC and the Commission, and that the new Fishery Officer (Science) supporting the IOTC scientific activities has not been given a mandate by the Commission to work on ecosystems and bycatch matters, the WPEB strongly **RECOMMENDED** that the Commission approve the hiring of a Fishery Officer (Bycatch) to work on bycatch matters in support of the scientific process.

### *4.2 Review of Conservation and Management Measures relevant to Ecosystems and Bycatch*

13. The WPEB **NOTED** paper IOTC–2013–WPEB09–05 which aimed to encourage the WPEB to review the existing Conservation and Management Measures (CMMs) relevant 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.

14. 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 WPEB08

15. The WPEB **NOTED** paper IOTC–2013–WPEB09–06 which provided an update on the progress made in implementing the recommendations from the previous WPEB, which were endorsed by the SC, and to provide alternative recommendations for those yet to be completed.

16. The WPEB **NOTED** that any recommendations developed during a Session, must be carefully constructed so that each contains the following elements:
    - a specific action to be undertaken (deliverable);
    - clear responsibility for the action to be undertaken (i.e. a specific CPC of the IOTC, the Secretariat, another subsidiary body of the Commission or the Commission itself);
    - a desired time frame for delivery of the action (i.e. by the next working party meeting, or other date).

17. The WPEB **REQUESTED** that the Secretariat continue to annually prepare a paper on the progress of the recommendations arising from the previous WPEB, incorporating the final recommendations adopted by the Scientific Committee and endorsed by the Commission.

## 6. REVIEW OF DATA AVAILABLE ON ECOSYSTEMS AND BYCATCH

### *6.1 Review of the statistical data available for ecosystems and bycatch species*

***IOTC database***

18. The WPEB **NOTED** paper IOTC–2013–WPEB09–08 which provided an overview of the standing of a range of information received by the IOTC Secretariat for bycatch (including byproduct) species, in accordance with IOTC Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*, for the period 1950–2011. A summary is provided at Appendix IV.

19. The WPEB **NOTED** the main data issues that are considered to negatively affect the quality of the statistics for bycatch (including byproduct) species available at the IOTC Secretariat, by type of dataset and fishery, which are provided in Appendix V, and **REQUESTED** 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.

20. The WPEB **RECALLED** that presenting data at a working party meeting does not constitute a formal submission to the IOTC. These data should be submitted formally to the IOTC Secretariat in accordance with the IOTC mandatory statistical requirements, outlined in Resolution 10/02, and other Resolutions for bycatch species.

***6.2 Progress on reporting and outcomes from the Compliance Committee (enforcement measures taken)***

21. The WPEB **NOTED** paper IOTC–2013–WPEB09–09 which highlighted the outcomes of discussions held at the 10th Session of the IOTC Compliance Committee (CoC10), subsequent to the recommendations from the WPEB08 and SC15 in 2012.

22. The WPEB **RECALLED** that in 2012, the WPEB08 made a number of recommendations to the CoC, Commission and CPCs relating to the lack of compliance by IOTC CPCs with the requirements outlined in CMMs for ecosystems and bycatch topics. Although these recommendations were endorsed by the SC15 in December 2012, they were not explicitly considered by the CoC.

23. The WPEB **NOTED** that at each CoC meeting, the Secretariat presents a range of documents that summarise the level of compliance by all CPCs with a range of CMMs adopted by the Commission. However, the information considered by the CoC relates to the level of compliance in terms of submission of data or other elements, but does not currently consider the quality or completeness of the data submitted. The CoC then reviews the level of implementation of CMMs by each CPC, and develops a list of significant non-compliance issues for each concerned CPC. These issues form the core of discussions when the CoC assesses the performance of each CPC in relation to their obligations to the Commission.

24. The WPEB **NOTED** that in line with discussions at the CoC and Commission, and explanations provided by the concerned CPCs, the issues of concern are refined accordingly and presented to each of the concerned CPCs in the form of a Letter of Feedback. While Resolution 10/09 does not provide guidance as to what actions CPCs are expected to undertake following the reception of the Letter of Feedback, it can only be logically expected that the concerned CPCs will take certain actions towards addressing the concerns identified by the CoC and report those actions back to the Chair of the Commission.

25. The WPEB **NOTED** that the IOTC Compliance Section, under direction from the CoC and the Commission has commenced several initiatives to assess and review all compliance aspects related to the implementation of the IOTC CMMs, including those relevant to the WPEB. The general objective of the initiative is twofold:
    - Strengthen compliance with, and implementation of, active IOTC CMMs. In this case, implementation obligations relates to the reporting obligations of the CPCs including reporting on vessels (authorised and active vessels, IUU, fishing capacity and Fleet Development Plan), mandatory statistical requirements (Nominal catch, catch & effort, size frequency, FAD), management standards and monitoring, control and surveillance (MCS) tools (documents on board, marking of fishing vessels and gears, logbook, ban on driftnets, area closure, ports inspections, Vessel Monitoring System, regional observers scheme, at sea transhipments programme), implementation of management measures on bycatch and non-IOTC species and statistical documentation programme;
    - Provide technical support to the developing States – coastal CPCs of the IOTC responsible for the implementation of the Port State Measures to facilitate and strengthen the implementation of the Port State Measures Resolution, thus ensure the long-term conservation and sustainable use of the species under the IOTC mandate.

26. The WPEB **NOTED** that the Compliance Section undertakes annual assessments to identify and facilitate corrective actions for CPCs who are non-compliant with IOTC CMMs. The assessments allow a clearer understanding of the difficulties encountered by CPCs and the challenges they face to implement the IOTC CMMs at policy, legal, institutional/administrative and operational levels. The Compliance Support Missions (CSM) are undertaken on a country-by-country basis by the IOTC Compliance Section. The assessment process includes:
    a. Preparation of the assessment based on the compliance issues, review of national fisheries legislation, administrative structure/arrangements;
    b. Presentation of the compliance issues to the CPC and identification of constraints;
    c. Identification of corrective actions and pragmatic solutions;
    d. Development of a corrective actions plan designed to assist the CPC to improve and/or strengthen the implementation of the CMMs.

27. The WPEB **NOTED** that any non-compliance issues identified by the science Working Parties, be considered by the SC and consolidated into a paper for submission to the next CoC meeting in 2014. The aim is to ensure that the non-compliance concerns of the SC are given sufficient consideration by the CoC.

### *6.3 Regional observer scheme – Update*

28. The WPEB **NOTED** paper IOTC–2013–WPEB09–10 which provided an update on the national implementation of the IOTC regional observer scheme (ROS) for each IOTC CPC, noting that the ROS started on 1st July 2010 (Resolution 09/04 superseded by Resolution 10/04 and Resolution 11/04), including the following abstract provided by the authors:

"*At the 13th Session of the Commission (S13), the Commission adopted Resolution 09/04 on a Regional Observer Scheme, superseded in 2010, and again in 2011 by Resolution 11/04 on a Regional Observer Scheme. In 2010, the Commission addressed concerns raised by some CPCs with artisanal fleets, on which it is difficult to deploy on-board observers due to the small-size of the artisanal vessels and/or to their large numbers which would require high deployment levels and in 2011, the Commission extended the period for submitting the Observer Trip Report from 90 days to 150 days. Resolution 11/04 on a Regional Observer Scheme makes provision for the development and implementation of national observer programmes among the IOTC CPCs starting in July 2010 and covering 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*". – (see paper for full abstract).

29. **NOTING** the update of the implementation of the Regional Observer Scheme (Appendix VI), the WPEB again **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 (Resolution 09/04 superseded by Resolution 10/04 and Resolution 11/04).

30. The WPEB **NOTED** that 13 CPCs have submitted a list of accredited observers and only 7 CPCs have submitted observer trips reports since the commencement of the scheme. A total of 82 observer trip reports have been submitted to the IOTC Secretariat: 11 reports for 2010, 44 reports for 2011, 27 reports for 2012 and 0 for 2013 to date.

31. The WPEB **NOTED** that observer reports are very unevenly distributed among CPCs. In 2011 and 2012, the only full years of implementation of the ROS to date, it was estimated from the reports and effort data available, that only two and three CPCs have achieved the minimum 5% observer coverage required for a gear type in Resolution 11/04, respectively.

32. The WPEB **EXPRESSED** its strong concern regarding the 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. Such a low level of implementation and reporting is detrimental to the work of the WPEB and SC, in particular regarding the estimation of incidental catches of non-targeted species, as requested by the Commission. In particular, the WPEB **NOTED** that the IOTC Regional Observer Scheme could be a significant source of potential data for marine turtles (e.g. sex and species composition, etc.) for some longline and gillnet fisheries.

33. The WPEB **URGED** all IOTC CPCs to urgently submit, and keep up-to-date, their list of accredited observers to the IOTC Secretariat and 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)*

34. The WPEB **AGREED** that the timely submission of observer trip reports to the IOTC Secretariat is necessary to ensure that the WPEB and SC are able 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 IOTC scientists to better assess the impacts of fisheries for tuna and tuna-like species, on bycatch species.

35. The WPEB **RECOMMENDED** that the Compliance Committee and Commission consider how to address the lack of implementation of regional observer schemes by CPCs for their fleets and reporting to the IOTC Secretariat as per the provision of Resolution 11/04 *on a Regional Observer Scheme*, noting the update provided in Appendix VI.

36. The WPEB **RECOGNISED** that the implementation of a national observer scheme is not a simple task, e.g. due to piracy activities, and that the financial and human costs involved in the deployment of observers are important to consider, in particular for CPCs with large fishing fleets. However, the WPEB **AGREED** that the minimum

observer coverage of 5% set out by Resolution 11/04 is already below the minimum necessary coverage estimated by simulations, and that it should not be lowered.

37. The WPEB **RECOMMENDED** that as a priority, the IOTC Secretariat should immediately commence work with CPCs that are yet to develop and implement a Regional Observer Scheme that would meet the requirements contained in Resolution 11/04, and provide an update at the next session of the WPEB.

***Identification cards for shark, seabirds and marine turtles***

38. The WPEB **EXPRESSED** its thanks to the IOTC Secretariat and other experts involved in the development of the identification cards for marine turtles, seabirds and sharks and **RECOMMENDED** that the cards be translated into the following languages, in priority order: Farsi, Arabic, Spanish and Portuguese, and that the Commission allocate funds for this purpose.

39. The WPEB **RECOMMENDED** that the Commission allocate additional funds in 2014 to translate and print further sets of the shark, seabird and marine turtle identification cards (budget estimate: Table 2).

**TABLE 2**. Estimated translation, production and printing costs for 1000 sets of identification guides for marine turtles, seabirds and sharks.

| Description | Unit price | Units required | Total |
|---|---|---|---|
| Translation (per language) | $1000 | 3 | 3,000 |
| Typesetting | $1000 | 3 | 3,000 |
| Marine turtles ID cards | $5 | 1000 | 5,000 |
| Seabird ID cards | $7 | 1000 | 7,000 |
| Shark ID cards | $7 | 1000 | 7,000 |
| Total estimate (US$) | | | **24,000** |

40. The WPEB **REQUESTED** that the IOTC Secretariat examine the feasibility of producing the cards in electronic (e-book) format for future use using smart media/hardware. An example of a current e-book for species identification may be found at: http://www.afma.gov.au/static/seabird/

## 7. NEW INFORMATION ON BIOLOGY, ECOLOGY, FISHERIES AND ENVIRONMENTAL DATA RELATING TO ECOSYSTEMS AND BYCATCH SPECIES

***7.1 Review new information on environment and ecosystem interactions, including climate change issues affecting pelagic ecosystems in the IOTC area of responsibility***

***7.2 Data from other sources (papers from CPCs)***

NOTE: All papers for this section were presented under Agenda item 14.

## 8. REVIEW OF NATIONAL BYCATCH ISSUES IN IOTC MANAGED FISHERIES AND NATIONAL PLANS OF ACTION (IN PARTICULAR FOR SHARKS AND SEABIRDS)

41. The WPEB **NOTED** paper IOTC–2013–WPEB09–07 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 15th Session of the SC, the SC NOTED the current status of development and implementation of Nation Plans of Action for sharks and seabirds and RECOMMENDED that all CPCs without an NPOA-Sharks or NPOA-Seabirds expedite the development and implementation of their NPOA, and to report progress to the WPEB in 2013, 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 2012, the Commission adopted Resolution 12/04 on the conservation of marine turtles. Contained within Resolution 12/04, is a requirement to report on progress in the implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations, as follows: Para 5: CPCs shall report to the Commission in the annual implementation report, in accordance with Article X of the IOTC Agreement, their progress of implementation of the FAO Guidelines and this Resolution.*"

42. 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 33 IOTC CPCs have an NPOA-Sharks (7 more in development), with seven others in development, while only five CPCs have an NPOA-

Seabirds (0 in development). A single CPC has determined than an NPOA-Sharks is not needed, and four have similarly determined than an NPOA-Seabirds is not needed.

43. The WPEB **REQUESTED** that all CPCs without an NPOA-Sharks and/or NPOA-Seabirds expedite the development and implementation of a NPOA, and to report progress to the SC in 2013 and WPEB in 2014, 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.

44. The WPEB **REQUESTED** that the IOTC Secretariat continue to periodically revise the table summarising progress towards the development of NPOA-Sharks and NPOA-Seabirds by each CPC for the consideration at each WPEB and the SC meeting. The current version is provided at Appendix VII.

45. The WPEB **NOTED** the request from Mauritius to work with the IOTC Secretariat over the coming year to determine if a NPOA-Sharks is necessary for Mauritius given that Mauritius does not issue fishing licences to Mauritian or foreign flagged vessels targeting shark to fish within its EEZ.

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

46. The WPEB **REQUESTED** that the IOTC Secretariat incorporate CPC progress in the implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations, as required in Resolution 12/04, into the annual WPEB and SC paper titled, *Status of development and implementation of national plans of action for seabirds and sharks, and implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations*.

47. The WPEB **REQUESTED** the IOTC and IOSEA Secretariat's work collaboratively with any CPC requesting assistance to develop their national management plans for the reduction of marine turtle bycatch in tuna fisheries.

***EU-POA for sharks***

48. The WPEB **NOTED** paper IOTC–2013–WPEB09–45 which outlined the provision of scientific advice for the purpose of the implementation of the EUPOA sharks, including the following abstract provided by the authors:
"*The scope of the European Union Plan of Action for Sharks covers directed commercial, by-catch commercial, directed recreational, and by-catch recreational fishing of any chondrichthyans within European Union waters. It also includes any fisheries covered by current and potential agreements and partnerships between the European Union and third countries, as well as fisheries in the high seas and fisheries covered by RFMOs managing or issuing non-binding recommendations outside European Union waters. Scientific advice for the purpose of the management of shark species in the high seas is carried out mainly via the Scientific Committees of the relevant Regional Fisheries Management Organisations (RFMO), as well as through specific projects by national institutes, and other research organisms. However, the level of knowledge concerning many shark populations in the high seas of the Atlantic, Indian and Pacific Oceans is far from satisfactory. It is therefore necessary to identify gaps in the current knowledge of fisheries, biology and ecology of sharks that should be filled in order to support advice on sustainable management of elasmobranches' fisheries and undertaking studies to fill those gaps.*" – (see paper for full abstract)

49. The WPEB **NOTED** that the project, apart from identifying the main data gaps for the provision of scientific advice on sharks, provided an estimation of shark catches by fishery and country for all tuna RFMOs.

50. The WPEB **NOTED** that the project proposed a general framework to develop the research program in support of the scientific advice for shark management; which includes: (1) a research framework to identify the main species and fleets that needs to be prioritised for the collection of fishery data and information in order to assure the assessment of principal shark species regionally in the Tuna RFMOs; (2) a general recommendation for all Tuna RFMOs to improve the data collection to fill the gaps identified above; and (3) options for management and mitigation measures for sharks.

51. The WPEB **NOTED** that the project reviewed comprehensively the biology of 18 shark and 6 ray species for the Atlantic, Indian and Pacific Oceans which will be very valuable for prioritising future research.

## 9. GILLNET FISHERIES: PROBLEMS AND NEEDS

### *9.1 Regional review of the current and historical data available for gillnet fleets operating in the Indian Ocean*

52. The WPEB reiterated its previous **RECOMMENDATION** that the Commission considers allocating funds to support a regional review of the current and historical data available for gillnet fleets operating in the Indian Ocean. As an essential contribution to this review, scientists from all CPCs having gillnet fleets in the Indian

Ocean, in particular those from I.R. Iran, Oman, Pakistan and Sri Lanka, should collate the known information on bycatch in their gillnet fisheries, including sharks, marine turtles and marine mammals, with estimates of the likely order of magnitude where more detailed data are not available. A consultant should be hired for 30 days to assist CPCs with this task (budget estimate: Table 3).

**TABLE 3**. Estimated costs for the hiring of a consultant to undertake a regional review of gillnet fleets.

| Description | Unit price | Units required | Total |
|---|---|---|---|
| Contract days | $350 | 30 | 10,500 |
| Travel costs (field) | $3,000 | 3 | 9,000 |
| Travel costs to attend WPEB | $5,000 | 1 | 5,000 |
| Total estimate (US$) | | | **24,500** |

53. The WPEB **REQUESTED** that the IOTC Secretariat seek additional sources of funding to further expand the regional review of the data available for gillnet fleets operating in the Indian Ocean, and to seek collaboration with other bodies working in the Indian Ocean such as the BOBLME project and the Convention on Migratory Species (CMS), which is coordinating a similar review for the Gulf region through its Abu Dhabi office.

***Pakistan gillnet fisheries***

54. The WPEB **NOTED** paper IOTC–2013–WPEB09–15 which provided an update on shark bycatch of tuna gillnet fisheries of Pakistan, including the following abstract provided by the authors:

"*The working paper presents an update on the shark by-catch of tuna gillnet fisheries of Pakistan. This includes the landing data of sharks collected by observers from the period of June 2012 – May 2013. The most common shark species in the gillnet operations identified through the landing data are shortfin mako shark (Isurus oxyrinchus), bigeye thresher shark (Alopias superciliosus) and silky shark (Carcharhinus falciformis). All of the 3 species are of international concern whereas shortfin mako is expected to be species of interest for international scale – stock assessments in the foreseeable future. Nominal catches of elasmobranchs were reported from 1999 – 2007 indicating a decline in the apex predators (Shahid and Khan, 2012). The data presented herein, summarizes the by catch of elasmobranch from tuna gillnet operations data.*"

55. The WPEB **NOTED** that gillnet fisheries are expanding rapidly in Pakistan waters with high levels of bycatch being reported.

56. 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.

57. **NOTING** that monofilament gillnets are recognised to have highly detrimental impacts on fishery ecosystems, as they are non-selective, and that the use of monofilament gillnets have already been banned in a large number of IOTC CPCs, the WPEB **REQUESTED** that each CPC using monofilament gillnets to estimate total catch and bycatch, etc., taken by monofilament gillnets in comparison to other net material, and to report the findings at the next WPEB meeting.

58. **NOTING** that shark identification remains problematic, the WPEB **URGED** Pakistan to continue to improve species identification.

59. 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.

***I.R. Iran gillnet fisheries***

60. The WPEB **NOTED** paper IOTC–2013–WPEB09–40 which provided an estimation of bycatch and discards by Iranian fishing vessels (gillnets) in IOTC area of competence in 2012, including the following abstract provided by the authors:

"*In order to assess the level of bycatch and discard of Iranian tuna fishing vessels (Gillnets) in the IOTC competence of area, observers (port samplers) were placed in three main fishing harbors; where tuna vessels landing there. We also carried out interviews with some fishermen of the vessels. Finally the log books of the vessels were controlled and compared against the information which was collected by the port samplers. In this study we assessed the amount of catch, bycatch and discard for ten Iranian vessels. Data collection was carried out by observers who are professional in identification of species and were familiar*

*with the Iranian tuna fishing fleets. The period of study was from 10 October to end of December 2012. The areas fished by the vessels were the north-west Indian Ocean (latitude 5-25º (N) and longitude 50-70° (E)).*" – (see paper for full abstract)

61. The WPEB **COMMENDED** the efforts by the I.R. Iran to assess the levels of bycatch, landed and discarded, by its gillnet fleet, through the use of port samplers and logbooks. The total length of gillnets used, consist of 90 m panels which are usually combined up to 2.5 kms, and have a stretched mesh size of 16 cm.

62. The WPEB **NOTED** the difficulties experienced by the I.R. Iran in deploying observers on board its vessels due to safety concerns and the lack of dedicate space for the observer to reside.

63. **NOTING** that there are some problems with identification of species, the WPEB **AGREED** that the IOTC Secretariat should utilise a portion of the annual IOTC Capacity Building budget to undertake training workshops on bycatch identification, data collection and compliance with IOTC CMMs relevant to bycatch.

### *9.2 Training for CPCs having gillnet fleets on species identification, bycatch mitigation and data collection methods and also to identify other potential sources of assistance – Development of plans of action*

64. The WPEB **RECOMMENDED** that the Commission allocate funds in its 2014 and 2015 budgets for the IOTC Secretariat to carry out training for CPCs having gillnet fleets on bycatch mitigation methods, species identification, and data collection methods (budget estimate: Table 4).

**TABLE 4**. Estimated costs for CPCs with large gillnet fleets on bycatch mitigation methods, species identification and data collection methods. Two training workshops: I.R. Iran/Oman and Sri Lanka.

| Description | Unit price | Units required | Total |
|---|---|---|---|
| Production of training material | $1,000 | 1 | 1,000 |
| Travel costs (IOTC Staff) (I.R.Iran/Oman, Sri Lanka) | $4,000 | 3 | 12,000 |
| Travel costs (Experts) (I.R.Iran/Oman, Sri Lanka) | $4,000 | 3 | 12,000 |
| Workshop venue – to be paid by hosts | $0 | 2 | $0 |
| Total estimate (US$) | | | **25,000** |

## 10. SHARKS AND RAYS

### *10.1 Review of new information on the status of sharks and rays*

65. The WPEB **NOTED** paper IOTC–2013–WPEB09–08 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 1950–2011 (Appendix VIII). Statistics for 2012 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 IX.

***Data and reporting requirements for sharks***

66. The WPEB **NOTED** the standing of catch statistics for the main species of sharks, by major fisheries (gears), for the period 1950–2011 (Appendix VIII) and **EXPRESSED** strong concern as 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.

67. 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 **REQUESTED** 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 IV.

68. **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 length frequency data on sharks, as per IOTC Resolutions, so that more detailed analysis can be undertaken for the next WPEB meeting.

69. **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 Commission allocates funds for this activity, in the 2014 and 2015 IOTC budgets (budget estimate: Table 5).

**TABLE 5**. Estimated costs for the hiring of a consultant to undertake a literature review of shark interactions.

| Description | Unit price | Units required | Total |
|---|---|---|---|
| Contract days | $350 | 30 | 10,500 |
| Travel costs (field) | $3,000 | 3 | 9,000 |
| Travel costs to attend WPEB | $5,000 | 1 | 5,000 |
| Total estimate (US$) | | | **24,500** |

70. 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.

### *10.2 Review new information on the biology, stock structure, bycatch mitigation measures, fisheries and associated environmental data*

***Indonesian shark fisheries***

71. The WPEB **NOTED** paper IOTC–2013–WPEB09–12 which provided the size distribution and sex ratio of scalloped hammerhead sharks (*Sphyrna lewini*) from southern areas of Java and Nusa Tenggara, Indonesia, including the following abstract provided by the authors:

"*Hammerhead shark is one of the most common shark species in the tropics. The sharks were caught by longline and drift gill nets either bycatch or target catch. Research on the length frequency and sex ratio of scalloped hammerhead shark (Sphyrna lewini) was conducted at two shark landing sites in southern Java in 2010, namely Oceanic Fishing Port of Cilacap and Fish Landing Site Tanjung Luar, East Lombok, West Nusa Tenggara. Data were collected from the surveyed areas including the length of frequency and the sex composition. The research objective was to obtain data and information for management and conservation of scalloped hammerhead sharks. The results showed that the size distribution of scalloped hammerhead sharks females and males were between 51 cm to 300 cm TL and 127 cm to 244 cm TL, respectively. Sex ratio of male and female were unequal, where female caught more frequent than male. The catch during the study was dominated by the immature fishes. This condition reminds that sharks resources should be managed wisely for their sustainability.*"

72. The WPEB **NOTED** that the Indonesian gillnet and longline fisheries target scalloped hammerhead sharks in the shallow coastal waters of Indonesia. However, as the two gears are used interchangeably by Indonesian vessels, landings cannot be separated accurately by gear used.

73. The WPEB **NOTED** the results of the study indicated that Indonesian vessels landed more than 50,000 t of sharks in 2011 (included catches outside the IOTC area of competence). The WPEB also **NOTED** that there were discrepancies of shark catches from this study and those in the IOTC database.

74. The WPEB **REQUESTED** that Indonesia work with the IOTC Secretariat to compare and verify the data holding at the Secretariat prior to the next WPEB meeting.

75. The WPEB **EXPRESSED** concern over the 783 t of thresher shark landed in 2011, despite the IOTC ban on the retention of thresher sharks in 2010 (Resolution 10/12) which was superseded in 2012 by Resolution 12/09.

***Kenyan shark fisheries***

76. The WPEB **NOTED** paper IOTC–2013–WPEB09–13 which provided an overview of shark bycatch from small scale tuna fishery interactions along the Kenyan coast, including the following abstract provided by the authors:

"*In Kenya and to a great extent most parts of the WIO region, shark catches majorly occur as bycatch in artisanal tuna fisheries and prawn trawls, including sport fishing activities. However, the extent to which these various fisheries catch sharks is not known but may be significant. The species structure, distribution, catch rates and levels of fisheries-shark interactions are not well documented. This information is, however, necessary to assess exploitation levels of shark species and for setting regulatory, conservation and*

*management frameworks. This study therefore aimed at filling this information gap. Data was collected from fisher landings at various sites along the Kenya coast and by observers on commercial and scientific trawl surveys. Landings at 5 beaches were inspected for 15 days per month for 12 months (August 2012 to July 2013). Specimens were identified to species and, sex, length and weight recorded for each shark landed or trawled as by-catch.*" – (see paper for full abstract)

77. The WPEB **NOTED** that the size composition of sharks caught suggest that the fishery is targeting juvenile sharks in shallow coastal areas.

78. The WPEB **AGREED** that there is a need for collaborative research between coastal (inshore fisheries) and offshore fisheries for IOTC species as the impacts of coastal fisheries targeting juveniles is likely to have a broader impact on shark populations.

***Madagascar shark fisheries***

79. The WPEB **NOTED** paper IOTC–2013–WPEB09–13 Rev_1 which provided an overview of sharks caught by Malagasy longliners in 2012, including the following abstract provided by the authors:
"*Madagascar started exploring longline fishery in 2007 by shifting from trawl gear to small longliners. The number of vessels, targeting tuna and tuna-like species in the IOTC area of competence, has been increasing. In 2012, Malagasy flag deployed 8 longliners less than 24 m off the east coast (Annexe1). Note that some of them are multigear, whereby fishing vessels may target demersal resources and at other times they may target tuna and tuna-like species. The following results were obtained from the Malagasy observer program database and from pelagic species companies' declarations. The trend of total declared catches decreased throughout recent years and ranged from 497 tons to 388 tons in 2010 and 2012, respectively. The decline of catches is due to the reduction of number of big vessels. Indeed, a significant declining trend in percentage of shark landings (from 17% to 13%) was observed over the period. This paper figured out that monthly effort ranged from 14,000 hooks deployed in April to 49,447 hooks deployed in October.*" – (see paper for full abstract)

80. **NOTING** that sharks are being caught by the new and rapidly expanding longline fleet of Madagascar which is based primarily off the eastern coast and is as yet poorly monitored, 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.

81. The WPEB **NOTED** that blue sharks are usually discarded due to its low value and that the sex ratio for most species should be rechecked if possible. Ideally, the study should be replicated over several years to examine temporal trends in catches and landings.

***Transhipment of shark products at sea***

82. The WPEB **NOTED** paper IOTC–2013–WPEB09–16 Rev_1 which provided a summary of the transhipment of shark products by longliners in the Indian Ocean, including the following abstract provided by the authors:
*"The Indian Ocean Tuna Commission (IOTC) Regional Observer Programme (ROP) monitors transhipments at sea between large-scale tuna longline fishing vessels (LSTLVs) and carrier vessels. This programme has been operating in the IOTC area under Resolution 11/05 since 1 January 2009 (initially under Resolution 06/02, followed by 08/02). This Resolution requires observers deployed on carrier vessels to verify the identity of the LSTLV and monitor quantities of transhipped products to ensure they are consistent with those recorded in the transhipment declaration. Monitoring of transhipments enhances the traceability of products and the programme also helps deter Illegal, Unreported and Unregulated (IUU) activity in the Indian Ocean region. Although sharks are not part of the 16 species directly under the IOTC mandate, sharks are frequently caught as bycatch in association with other species, and can be as much a target as tuna for some fleets (WPEB, 2012). As such, the IOTC Members and non-Contracting Parties are required to report information at the same level of detail as for the 16 IOTC species (Resolution 10/02).*" – (see paper for full abstract)

83. The WPEB **NOTED** that the main species transhipped were the blue shark (*Prionace glauca*) and mako sharks (*Isurus spp.*), however, many sharks were not identified to species level.

84. The WPEB **AGREED** that the identification of species is usually compromised by the way in which different species are processed as identification keys usually refer to unprocessed specimens. Species identification of frozen fish (of various product types) will always be limited as compared to freshly caught, pre-dressed fish. The variable nature by which product is transhipped from one transhipment operation to another and even within a single transhipment operation can have significant influence on observers' methodology and in the ultimate effectiveness of successfully identifying and tallying transhipped product.

85. The WPEB **AGREED** that for these data to be more useful, improved taxonomic identification of sharks is needed. Prior experience working with pelagic (tuna and/or swordfish) longline fisheries and increased transhipment observer experience will greatly help the observers' species identification skills and tallying of product. LSTLVs can also assist by giving more detail in the transhipment declaration on the species of shark products transhipped, as currently records are only labelled 'sharks' as no further details are specified in Resolution 11/05.

86. The WPEB **NOTED** that carcasses may be transhipped at one time while the fins of those sharks are transhipped later once they are dry, or they may be transhipped simultaneously so there is often no way of relating the fins to their carcass. There are also issues with some vessels shipping together and transferring different products from the same sharks, or fins being left to dry longer while the carcasses are transhipped.

87. The WPEB **NOTED** that the total quantity of shark products transhipped (5,747 t annual average standardised round weight) represents approximately 6% of the total pelagic shark catch reported in the Indian Ocean. Transhipment also takes place in ports, namely Port Louis, Mauritius, for deep-freezing longline vessels. Use of this information together is likely to provide a more complete picture and reduce the bias associated with only observing at-sea-transhipments. However, species identification of sharks that are transhipped in bulk remains a constraint.

88. The WPEB **REQUESTED** that the WPDCS review the round weight and live weight definitions for the transhipment program as there appears to be confusion.

***Thailand shark fisheries***

89. The WPEB **NOTED** paper IOTC–2013–WPEB09–17 which provided an overview of shark bycatch in the Thai longline fishery operating in the Indian Ocean in 2012, including the following abstract provided by the authors:

"*This report was based on the data extracted from fishing logsheets by two Thai tuna longliners namely, "Mook Andaman 018" and "Mook Andaman 028", which declared to Department of Fisheries, Thailand. Data from their logsheets displayed important information of their fishing operation and effort. In 2012, fishing grounds were mainly in the Western coast of Indian Ocean. The total catches were 470.40 tons with 387 days of fishing effort. The average catch rate of total catch was 10.83 individual fish/1,000 hooks. The major catch species were bigeye tuna (Thunnus obesus), yellowfin tuna (T. albacares), swordfish and shark. Sharks are present as an important role in the ocean ecosystem. The fishing operation was reduced their population. Among the bycatch of tuna longline fishery, the percentage of sharks to the total catch is 4.64% by weight and 3.94% by number. Numbers of shark were 544 individual fishes with 18,528 kg. The catch rate was 0.5 individual fish/1,000 hooks, 17.10 kg/1,000 hooks. Catch data of sharks are classed into a single group of "sharks", due to species misidentification.*"

90. **NOTING** the confusion in terminology between catches and landings in the paper, the WPEB **RECALLED** that in 2012, the SC adopted a "*Glossary of scientific terms, acronyms and abbreviations, and report terminology*, which is proved as paper IOTC–2013–WPEB09–INF17. Paragraph 19 of the SC15 report states:

"***NOTING** paper IOTC–2012–SC15–INF03 which provided a glossary of scientific terms, acronyms and abbreviations, and report terminology, for the most commonly used scientific terms in IOTC reports and Conservation and Management Measures (CMM), the SC **ENCOURAGED** all authors of papers to be submitted to the IOTC to use the definitions contained in the glossary. The SC indicated that it may wish to modify these incrementally in the future*."

91. **NOTING** that shark landings by the Thailand longline fleet are currently reported as aggregated shark catches rather than by species, the WPEB **REMINDED** Thailand of the need to develop a scientific observer scheme so that catches may be better reported at the species level and to estimate the total annual landing of sharks.

92. 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.

***Sri Lankan shark fisheries***

93. The WPEB **NOTED** paper IOTC–2013–WPEB09–18 which provided a review on shark fishery resources in Sri Lanka, including the following abstract provided by the authors:

"*Sharks are of considerable importance to the marine fisheries conducted with large mesh gillnets and longliners in the offshore waters within and beyond the EEZ of Sri Lanka. PELAGOSE (NARA) data base and field level information were based on this study. The shark fishery was a targeted fishery in Sri Lanka a decade ago but it has changed and sharks have become a bycatch. Decline in the directed (target) shark fishery was observed due to disincentives such as price decline, high operating cost, effective Monitoring Control & Surveillance activities and implementation of the several measures for conservation and management of sharks. At present, the contribution of sharks to the total large pelagic*

*fish production is less than 4%.The catches are comprised mainly of silky sharks in the offshore fisheries. Shark land generally as a whole with fins attached and fully utilized them without any waste. Shark meat is consumed in large quantities and fins are exported. National Plan of Action for Sharks is currently being prepared with stakeholder consultation and giving due recognition to all resolution pertaining to shark conservation and management initiatives of IOTC.*"

94. 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. Sri Lanka should continue to work with the IOTC Secretariat to ensure that data collection programs and reporting meets IOTC standards.

95. The WPEB **NOTED** the historical proportion of shark landings to other large pelagic fish has declined from approximately 50% of total landings from 1950 to the mid-1970's, to less than 4% of the total catch since 2005 (Fig. 1).

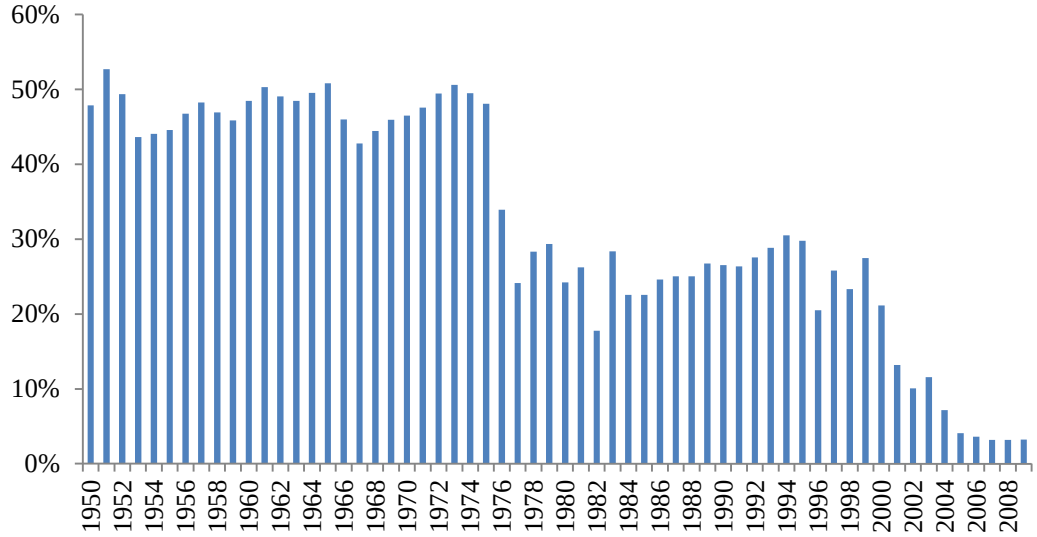


**Fig. 1**. Percentage contribution of sharks to total large pelagic fish production: 1950–2009.

***EU project for the provision of scientific advice***

96. The WPEB **NOTED** paper IOTC–2013–WPEB09–19 Rev_1 which outlines an EU project for the provision of scientific advice for the purpose of the implementation of the EUPOA sharks: a brief overview of the results for Indian Ocean, including the following abstract provided by the authors:

"*The objective of this project was to obtain scientific advice for the purpose of implementing the EUPOA on sharks as regards the facilitation of monitoring fisheries and shark stock assessment on a species-specific level in the high seas. The study was focused on major elasmobranch species caught by both artisanal and industrial large pelagic fisheries on the High Seas of the Atlantic, Indian and Pacific area, which are currently monitored and potentially managed by respective Tuna RFMOs. Estimated "potential" shark species catch in the Indian Ocean is around 160,000 t for 22,000 t. presently declared (7 times higher than declared). Considering all sharks that are not reported at species level, the total amount of shark declared was around 100,000 tons and, thus, the underreporting reduced to 1.6 times higher. 19 fisheries among the 195 fisheries found in IOTC database generate 86 % of potential investigated shark catches*." – (see paper for full abstract)

97. The WPEB **NOTED** that the extended review of available information on pelagic shark species worldwide would provide a solid reference basis for tuna RFMOs and commended the EU for undertaking such a venture.

98. The WPEB **NOTED** that the report was developed by EU scientists to identify data gaps for sharks in tuna RFMOs worldwide and to set shark research priorities for the future.

99. The WPEB **AGREED** that there was a need for further scientific observations and at-sea sampling for correct estimation of shark bycatch ratios in gillnet fisheries operating in the Indian Ocean.

100. The WPEB **NOTED** that this review also incorporated results of the ERA analysis developed for IOTC last year and provides useful information for shark status in IOTC area of competence.

101. The WPEB **NOTED** that this project also estimated potential and average shark catches by fleet and species which allow identification of the sharks species most impacted by different fisheries as well as the major fleets that are responsible for the shark catches. The WPEB **NOTED** that this exercise would be very valuable in order

to focus the data mining exercise and research priorities for improving the scientific advice in support of the management of shark species.

***Mozambique dropline fishery for sharks***

102. The WPEB **NOTED** paper IOTC–2013–WPEB09–20 which provided estimates of shark bycatch by the dropline fleet in the north coast of Mozambique: results of the acoustic/dropline survey conducted in 2012, including the following abstract provided by the authors:

"*The dropline gear, original from Seychelles, for targeting slope demersal fish species was tested during the implementation of the acoustic survey aimed to estimate the abundance and distribution of these fishes in the slopes of North Coast of Mozambique. The primary role of the dropline was to bring the species assemblage in the surveyed area. An associated objective of the survey was also to evaluate the gear performance in order to consider the possibility of introducing a dropline fishery. A total of 19 fishing stations were sampled covering the area between the latitudes 14°50'S and 12°00'S at depth's contour of 100 to 400m. Each station was composed by a set of three droplines with a soak time of 30 minutes. Each dropline gear was composed of 45 Mustard tuna circle hooks (sizes 11/0, 12/0 or 13/0) baited with mackerel and squid. The total number of target species (snappers and blueskin seabream) caught during the survey was 12 (30Kg), while the number of sharks was 14.*" – (see paper for full abstract)

103. **NOTING** that deepwater squalid sharks are more susceptible to overfishing than pelagic species, the WPEB **AGREED** that fisheries targeting them either directly or indirectly (as bycatch), should be carefully managed to ensure that impacts on the stocks are within sustainable levels.

104. The WPEB **REQUESTED** that Mozambique present information on its pelagic shark catches at the next WPEB meeting.

***FADs and shark mortality***

105. The WPEB **NOTED** paper IOTC–2013–WPEB09–21 that quantified shark mortality in fish aggregating devices, including the following abstract provided by the authors:

"*Increasing catch rates are considered the main impact of dynamic fisheries practices on marine ecosystems, but other effects can be equally important and are often ignored. Here we quantify a major, previously unknown source of shark mortality: entanglement in drifting fish aggregating devices, now widely used in the global tropical tuna purse-seine fishery. Using satellite tagging and underwater observational data, we developed two novel, independent, and complementary approaches, which quantify and highlight the scale of this problem. Entanglement mortality of silky sharks (Carcharhinus falciformis) in the Indian Ocean was 5–10 times that of the known bycatch of this imperiled species from the region's purse-seine fleet. More importantly, these estimates from a single ocean (480 000–960 000 silky sharks) mirror those from all world fisheries combined (400,000–2 million silky sharks), a situation that clearly requires immediate management intervention and extensive monitoring.*"

106. **NOTING** the small sample size and the geographical area of the research, the WPEB **AGREED** that FADs with netting material are likely to be important sources of mortality for juvenile silky sharks.

107. The WPEB **AGREED** that as funding is available, the study should be replicated in other areas of the Indian Ocean so determine potential regional and species influences.

108. The WPEB **RECALLED** that in 2013, the Commission adopted Resolution 13/08 *Procedures on a fish aggregating devices (FADs) management plan, including more detailed specification of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species*. This Resolution introduced amendments to Resolution 12/08 by including principles for the design and deployment of FADs to reduce the entanglement of sharks, marine turtles or any other species as well as the inclusion in the suggested Guidelines for Preparation of FAD Management Plans for each CPC with more detailed specifications of catch reporting from FAD sets. This Resolution also prohibits the abandonment at sea, in the IOTC area of competence, of drifting FADs composed of synthetic materials.

109. The WPEB **RECALLED** paragraph 6 of Resolution 13/08 that states:

"*……. To reduce the entanglement of sharks, marine turtles or any other species, the design and deployment of FADs shall be based on the principles set out in Annex III, which will be applied gradually from 2014. From 2015 on, CPCs shall submit to the Commission, 60 days before the Annual Meeting, a report on the progress of the management plans of FADs, including reviews of the initially submitted Management Plans, and including reviews of the application of the principles set out in Annex III."*

110. The WPEB **AGREED** that fleets using FADs should be able to gradually introduce FADs that comply with paragraph 6 of Resolution 13/08, so that by the end of 2015, most if not all FADs should comply with the principles agreed to by the Commission.

111. The WPEB **EXPRESSED** concern on the estimated total extent of FAD-associated mortality of silky sharks in the Indian Ocean and requested that CPCs using FADs provide an update on the progress in implementing Resolution 13/08 at the next WPEB meeting.

***Information papers on sharks***

112. The WPEB **NOTED** the range of information papers on sharks, as presented in IOTC–2013–WPEB09–02 and thanked the contributors for the information.

113. The WPEB **NOTED** an informal presentation on "*Hooks, leaders and fish – collateral damage: a request for essence of knowledge*", including the following abstract provided by the authors:

"*Terminal gear such as hooks and leaders are principal part of longline gear affecting directly its catchability. Application of various rigging material often had interpretation as straight forward relation: like wire leaders produce higher shark bycatch and monofilament leaders produce lower shark bycatch, however such interpretation often not supported by dedicated field experiments. A need of extensive review of available vast literature in order to develop 'decision-making' or 'recommendation-making' tree in order to have more clear ideas for management decisions or to develop research priorities.*"

114. The WPEB **NOTED** that type of bait used also have strong impact on hooking success for various target species.

115. The WPEB **AGREED** that further dedicated wide-scale research on the effect of terminal gear configuration is necessary to obtain data on catchability of target and bycatch species for in the Indian Ocean.

116. **NOTING** that other RFMOs (I-ATTC) and development bodies (SPC) have developed regional "longline terminal gear identification guides", the WPEB **AGREED** that the development of such guide for the Indian Ocean fisheries is likely to result in an improvement of data for stock assessment purposes, in particular catchability of target species.

117. 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 **RECOMMENDED** that the Commission allocate funds in the 2014 IOTC Budge to develop an identification guide for fishing hooks and pelagic fishing gears used in IOTC fisheries. The total estimated production and printing costs for the first 1000 sets of the identification cards is around a maximum of US$16,500 (Table 6). The IOTC Secretariat shall seek funds from potential donors to print additional sets of the identification cards at US$5,500 per 1000 sets of cards.

**TABLE 6**. Estimated production and printing costs for 1000 sets of identification guide for fishing hooks and pelagic fishing gears used in IOTC fisheries.

| Description | Unit price | Units required | Total |
|---|---|---|---|
| Purchase images | US$100 | 25 | 2,500 |
| Contract days | US$350 | 20 | 7,000 |
| Printing plates / plate | US$100 | 15 | 1,500 |
| Printing /1000 sets | US$5500 | 1 | 5,500 |
| Total estimate (US$) | | | **16,500** |

***Review of research proposals on Thresher sharks***

118. The WPEB **NOTED** paper IOTC–2013–WPEB09–INF03 that outlined a Portuguese research plan for the improvement of knowledge on pelagic sharks caught in the swordfish fishery in the Indian Ocean. The research plan includes the sampling of thresher sharks, and potentially oceanic white-tip sharks. Annual progress of the work and a final report on completion of the project will be presented to the IOTC WPEB and the IOTC Scientific Committee as required by Resolution 12/09 and Resolution 13/06.

119. **RECALLING** Resolution 12/09 *on the conservation of thresher sharks (family Alopiidae) caught in association with fisheries in the IOTC area of competence*, that permits the collection of biological samples of thresher sharks by scientific observers, if the samples are being collected as part of the research project approved by the IOTC Scientific Committee (or IOTC Working Party on Ecosystems and Bycatch (WPEB)), the WPEB **APPROVED** the EU,Portugal research project.

### *10.3 Stock status indicators for sharks and rays*

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

120. The WPEB **RECALLED** the 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*."

121. 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.

122. The WPEB **RECALLED** that the preliminary Ecological Risk Assessment (ERA) for shark species caught in longline fisheries managed by the Indian Ocean Tuna Commission (IOTC) was presented to the WPEB08 and the final report at SC15 in 2012.

123. The WPEB **RECOMMENDED** that the Commission note the list of the 10 most vulnerable shark species to longline gear (Table 7) and purse seine gear (Table 8) in the Indian Ocean, as determined by a productivity susceptibility analysis, compared to the list of shark species/groups required to be recorded for each gear, contained in Resolution 13/03 o*n the recording of catch and effort by fishing vessels in the IOTC area of competence*. At the next revision to Resolution 13/03, the Commission may wish to add the missing species/groups of sharks and rays.

**TABLE 7**. 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 | | |

**TABLE 8**. List of the 10 most vulnerable shark species to purse seine 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 purse seine gear | FAO Code | Shark species listed in IOTC Resolution 12/03 for purse seine gear | FAO Code |
|---|---|---|---|---|
| 1 | Oceanic whitetip shark (*Carcharhinus longimanus*) | OCS | Whale sharks (*Rhincodon typus*) | RHN |
| 2 | Silky shark (*Carcharhinus falciformis*) | FAL | | |
| 3 | Shortfin mako (*Isurus oxyrinchus*) | SMA | | |
| 4 | Great hammerhead (*Sphyrna mokarran*) | SPM | | |
| 5 | Pelagic stingray (*Pteroplatytrygon violacea)* | PLS | | |
| 6 | Scalloped hammerhead (*Sphyrna lewini*) | SPL | | |
| 7 | Smooth hammerhead (*Sphyrna zygaena*) | SPZ | | |
| 8 | Longfin mako (*Isurus paucus*) | LMA | | |

| | | |
|---|---|---|
| 9 | Dusky shark (*Carcharhinus obscurus*) | DUS |
| 10 | Tiger shark (*Galeocerdo cuvier*) | GAC |

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

124. The WPEB **NOTED** paper IOTC–2013–WPEB09–22 which provided standardised CPUE for blue sharks and shortfin mako sharks caught by the EU,Portugal longline fishery in the Indian Ocean between 1999 and 2012 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 made to recover 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 (GLM). Several different modeling 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."*

125. The WPEB **RECOGNISED** that the CPUE standardisation undertaken by EU,Portugal scientists was thorough and addressed the key concerns raised by the WPEB in 2012. The paper followed the guidelines for the presentation of CPUE series adopted by the SC in 2012.

126. The WPEB **NOTED** that CPUE's are affected by the ratio variable, and species targeting is important to account for in an analysis for standardisation. A sensitivity analysis was conducted to examine the effect of species targeting for both species. The analysis would be further improved by using vessel effects and Generalised linear mixed model (GLMM) techniques in future years.

127. The WPEB **NOTED** a stable trend in the series for blue shark (Fig. 2) and shortfin mako shark (Fig. 3), although the analysis are based on relatively short time periods, although this is the time period in which the EU,Portugal fleet has been operating in the Indian Ocean. It would be difficult to interpret long-term trends in the abundance of blue shark without data from other fleets (Japanese) operating from the 1950s.

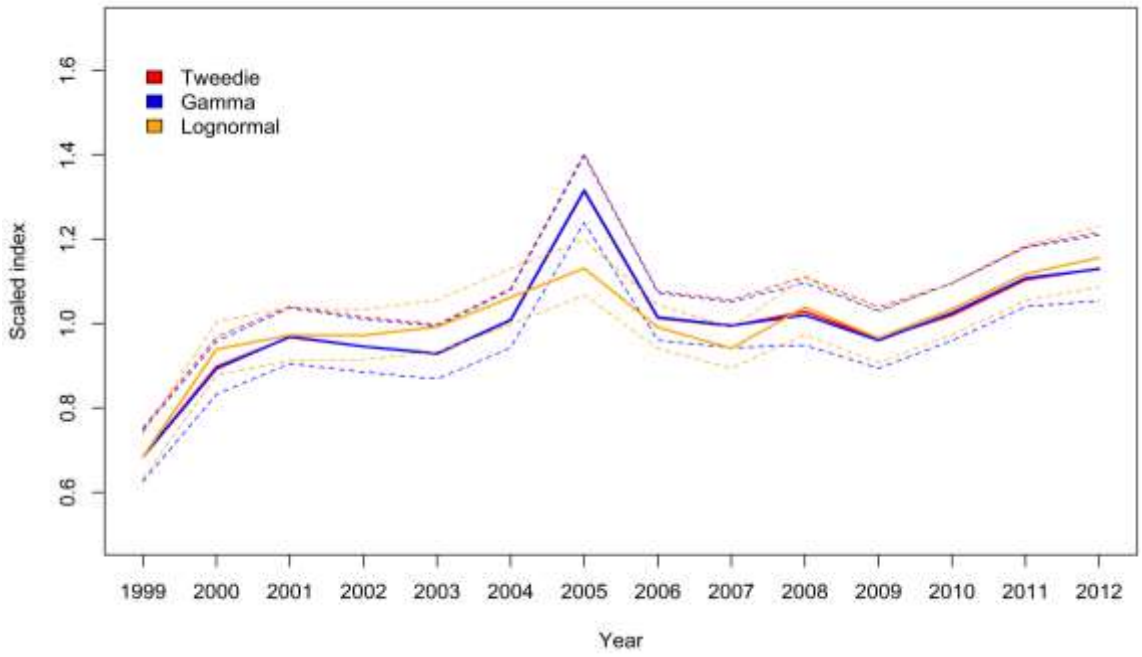


**Fig. 2.** Blue shark: Scaled annual index of abundance for blue shark (BSH) captured by the EU,Portugal pelagic longline fleet operating in the Indian Ocean. The solid lines refer to the standardized series calculated with the different GLM models, and the dotted lines refer to the respective 95% confidence intervals.

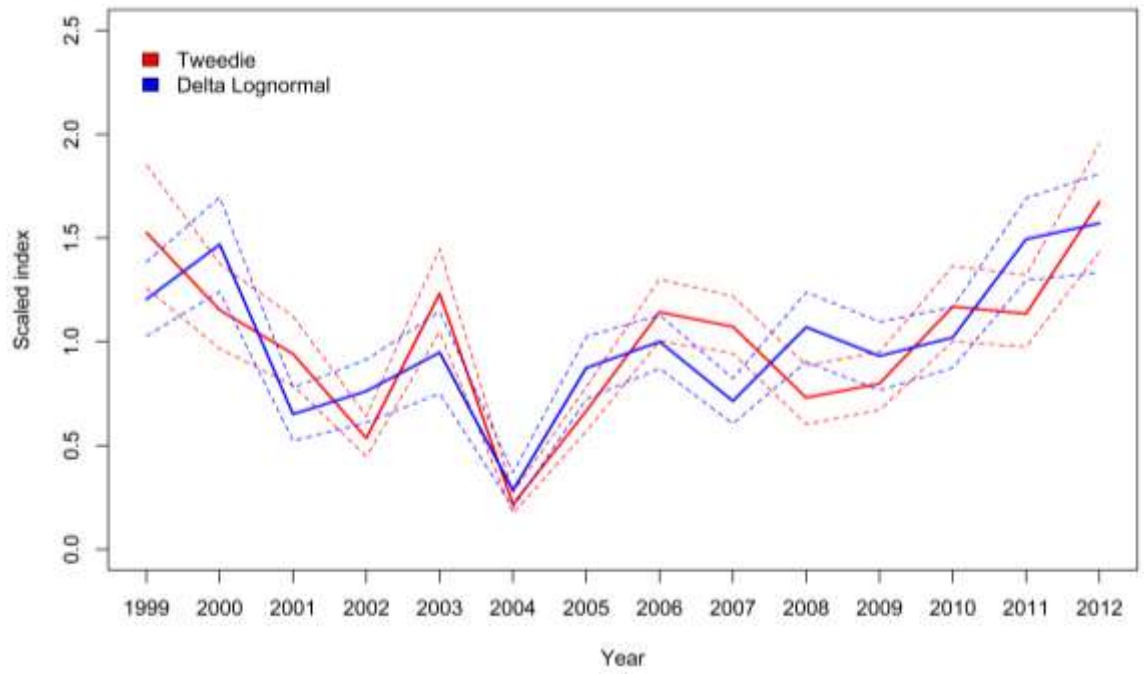


**Fig. 3.** Shortfin mako shark: Scaled annual index of abundance for shortfin mako shark (SMA) captured by the EU,Portugal pelagic longline fleet operating in the Indian Ocean. The solid lines refer to the standardized series calculated with the two different models, and the dotted lines refer to the respective 95% confidence intervals.

***Fisheries Research Agency (FRA), Japan – Discussion paper***

128. The WPEB **NOTED** paper IOTC–2013–WPEB09–44 which considered ways to improve tasks for CPUE standardisation and stock assessments of sharks in the IOTC–WPEB meetings, including the following abstract provided by the authors:
"*We (scientists in NRIFSF) have been recognizing essential problems to handle CPUE standardization and stock assessment of sharks in the IOTC-WPEB meetings. In this document, we list various points to improve. We hope that, through the discussion for this time in WPEB09, we can find out good solutions to move way forwards.*"

129. The WPEB **NOTED** that problems identified with the Japanese shark CPUE series during the 2012 meeting of the WPEB are still unresolved.

130. The WPEB **NOTED** the request from the National Research Institute of Far Seas Fisheries (NRIFSF), Fisheries Research Agency (FRA), Japan, for the IOTC Secretariat to solve the problems identified in the shark CPUE series presented by Japanese scientists to the WPEB in 2012. The WPEB **ENCOURAGED** the FRA scientists to work collaboratively with the IOTC Secretariat to improve the Japanese shark CPUE series in subsequent years.

131. The WPEB **NOTED** the willingness of the IOTC Secretariat to work collaboratively with Japanese scientists to improve the CPUE standardisation identified during the WPEB08 meeting in 2012.

***CPUE discussion summary***

132. 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 2012 (IOTC–2013–WPEB09–INF01). Comparison of catch to derived CPUE should be examined and detailed in the meeting paper.

133. The WPEB **NOTED** that CPUE time series including historic data would provide a more complete picture of stocks. The WPEB **ENCOURAGED** all CPCs to provide additional CPUE series if available even for shorter time periods.

134. The WPEB **RECALLED** the matters that should be taken into account when undertaking CPUE standardisation analysis, as **NOTED** in the WPEB08 report (IOTC–2012–WPEB08–R, paragraphs 103, 104, 105 and 106).

***Selection of CPUE series***

135. The WPEB **NOTED** the trends between the standardised blue shark CPUE for Japan presented at the previous WPEB meeting in 2012 (since 1994) and the updated EU,Portugal series presented at the current meeting (Fig. 4).

136. The WPEB **AGREED** to provide the updated standardised CPUE data for blue sharks (Fig. 4) and standardised CPUE data for shortfin mako sharks (Fig. 5) as stock status indicators.

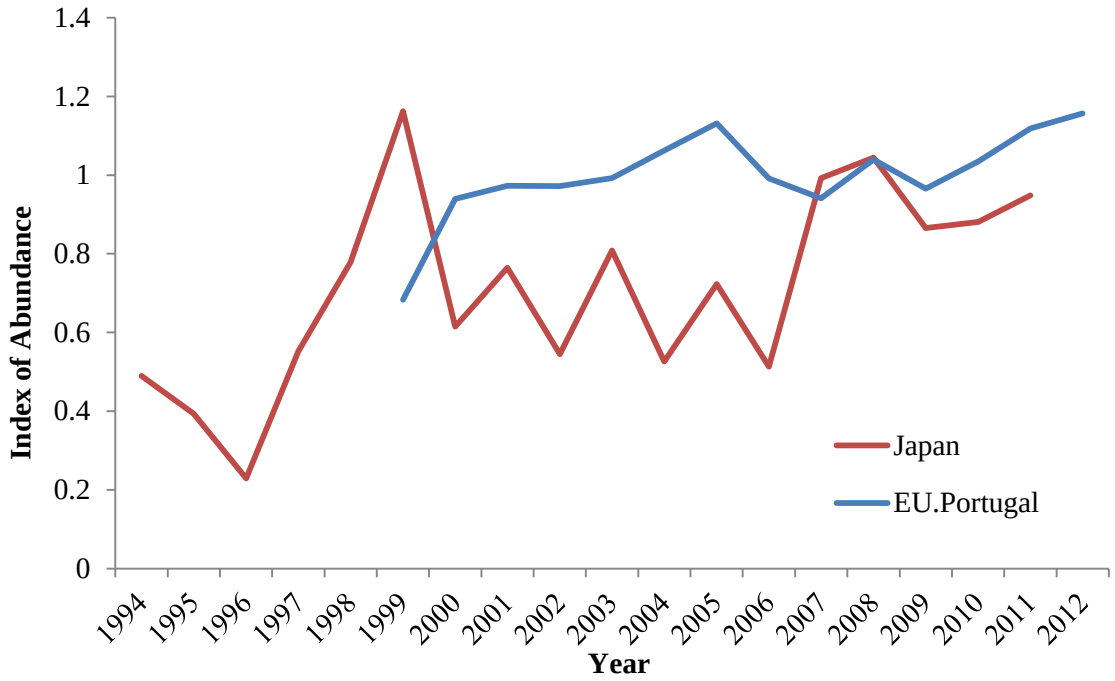


**Fig. 4.** Blue shark: Comparison of the blue shark standardised CPUE series for the longline fleets of Japan (1994–2011) and EU,Portugal (1999–2012).

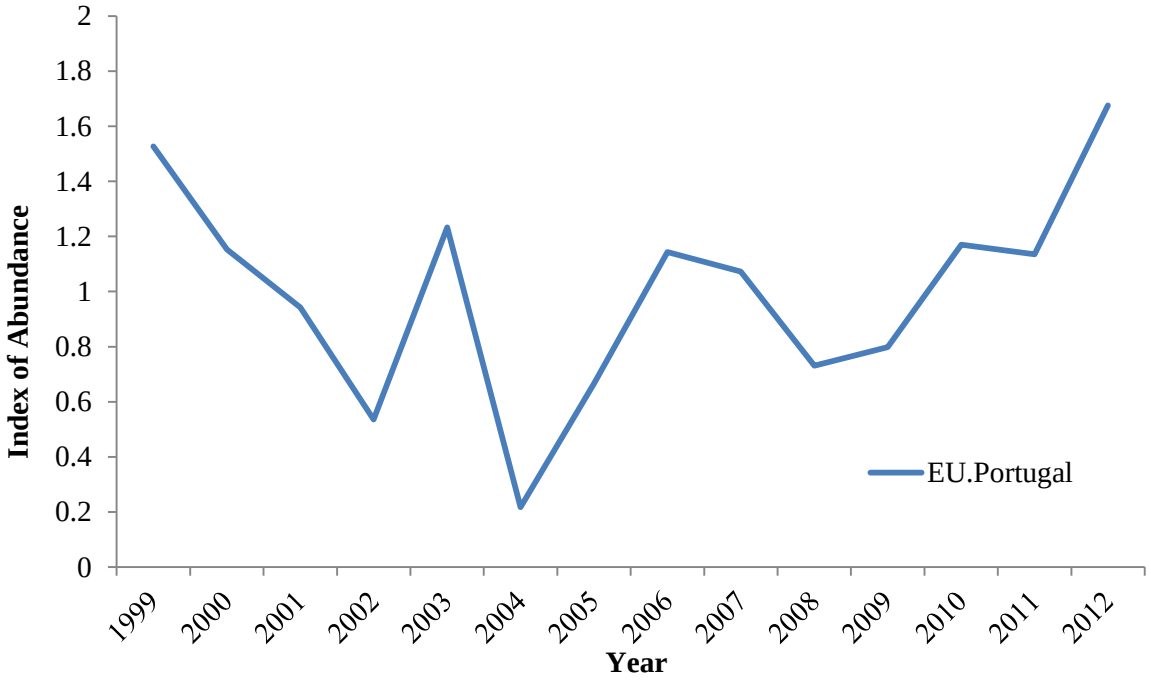


**Fig. 5.** Shortfin mako shark: Standardised CPUE series for the longline fleet of EU,Portugal (1999–2012).

***Parameters for future analyses: CPUE standardisation and stock assessments***

137. The WPEB **RECALLED** from the WPEB08 meeting, that in order to obtain comparable CPUE standardisations, the set of parameters detailed in Table 9, 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 9.** 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).*<br>Explore core area(s) as an alternative<br>TBD |
| CE Resolution | Operational data |
| GLM Factors | Year, Quarter, Area, HBF, environmental, species ratios + interactions |

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

138. **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 10) for which nominal catch data shall be reported as part of the statistical requirement for IOTC CPCs.

**TABLE 10.** 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 |

### *10.5 Development of technical advice on the status of the shark stocks*

***Best practice guidelines for the safe release and handling of encircled whale sharks***

139. The WPEB **NOTED** that "*Good practices to reduce the mortality of sharks and rays caught incidentally by tropical tuna purse seiners*", was develop in the framework of EU-funded MADE programme and was presented at the WPEB08 (IOTC–2012–WPEB08–INF07).

140. **NOTING** paragraph 6 of Resolution 13/05 on the conservation of whale sharks which states:

> "*The Commission requests that the IOTC Scientific Committee develop best practice guidelines for the safe release and handling of encircled whale sharks, taking into account those developed in other regional fisheries management organisations including the Western and Central Pacific Fisheries Commission, and that these guidelines be submitted to the 2014 Commission meeting for endorsement.*";

the WPEB **REVIEWED** documents WCPFC–SC8–2012/EB–WP–19 (*Guidelines for the Safe Release of Encircled Animals, including Whale Sharks)* and document IOTC–2012–WPEB08–INF07 (*Good practices to reduce the mortality of sharks and rays caught incidentally by tropical tuna purse seiners*).

141. The WPEB **RECOMMENDED** the following *Guidelines for the safe release and handling of encircled whale* sharks, that should be added as an additional page in the IOTC shark identification guides:

- The methods listed below depend on the condition of the particular purse seine set, e.g. the size and orientation of the encircled animal, size of fish in the purse seine set and operation style.
  - Cutting the net when the whale shark is at the surface and separated from the tuna and when the operation presents no danger for the crew;
  - Standing the animal on the net and rolling it outside the bunt. A rope placed under the animal and attached to the float line could help rolling the whale shark out of the net;
  - Brailing sharks (only for small individual less than 2–3 meters).
- The crew should never:
  - Pull up the shark by its tail;
  - Tow the shark by its tail.

142. The WPEB **AGREED** that a research program aimed at assessing the post-release survivorship of whale sharks should be carried out, as there is currently no study on the post-release survivorship of whale sharks with various release techniques, as no information exists on the impacts of these methods on the released animals.

***Management advice***

143. The WPEB **ADOPTED** 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

### *10.6 Update of shark species Executive Summaries for the consideration of the Scientific Committee*

144. The WPEB **REQUESTED** that the IOTC Secretariat update the draft status summaries for sharks with the latest 2012 interaction data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration in December 2013.

## 11. MARINE TURTLES

### *11.1 Review of data available at the Secretariat for marine turtles*

145. The WPEB **NOTED** paper IOTC–2013–WPEB09–08 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 IV.

146. The WPEB **NOTED** that there continues to be 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***

147. The WPEB **NOTED** the IOTC Resolutions relevant to marine turtle species (notably Resolutions 10/02, 12/04 and 13/03), including the data recording and reporting (Table 11) requirements by which Contracting Parties and Cooperating Non-Contracting Parties (CPCs) are required to collect and report all marine turtle interaction data.

**TABLE 11.** 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. |

148. 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.

### *11.2 Review new information on marine turtle biology, ecology, fisheries interactions and bycatch mitigation measures*

***IOSEA update***

149. The WPEB **NOTED** paper IOTC–2013–WPEB09–24 that analysed national reports submitted to the SC and to IOSEA, and provided an overview of issues relevant to marine turtle bycatch, including fleet numbers and distribution, monitoring activities, turtle mitigation measures, and research, including the following abstract provided by the authors:

"*The Indian Ocean Tuna Commission (IOTC) is the main regional fisheries management organisation mandated to manage tuna and tuna-like species in the Indian Ocean and adjacent seas. While its primary objective is to assure the conservation and optimum utilisation of fish stocks, the IOTC has paid increasing attention in recent years to the impacts of its fisheries on other marine species, such as marine turtles, seabirds and sharks. IOSEA and IOTC have developed a good working relationship, which has included collaboration in the production of regular status reports on marine turtles, the development of turtle ID cards for fishermen and, most recently, co-funding of the production of a region-wide Ecological Risk Assessment (ERA) for marine turtles.*" – (see paper for full abstract).

150. The WPEB **REQUESTED** that all CPCs should consider and follow the recommendations arising from the Report, specifically, that more detailed information be provided in National Reports to the IOTC Scientific Committee regarding the efficacy of mitigation measures undertaken, as well as ongoing and planned bycatch mitigation research.

151. The WPEB **NOTED** that IOSEA was developing an online facility for reporting and displaying international marine turtle tag 'recoveries' and encouraged participants to inform relevant organisations of the possibility of reporting tagged marine turtles online: http://www.ioseaturtles.org/.

***Post-nesting migration of green turtles***

152. The WPEB **NOTED** paper IOTC–2013–WPEB09–25 which outlined post nesting migration of green turtle (*Chelonia mydas*) in the western Indian Ocean, including the following abstract provided by the authors:

"*Marine turtles do not recognize political boundaries, nor do they have regard for Exclusive Economic Zones (EEZ s), cooperative agreements, international conventions, or memoranda of understanding between countries. So is it in the Southwest Indian Ocean (SWIO), a region that hosts some of the most important green turtle nesting sites in the world, most of which are isolated on remote islands (e.g. Europa and Glorieuses, Aldabra and Cosmoledo, Moheli and Mayotte). This region of the world is known to have year round nesting of green turtles but all sites display a marked nesting season. However, very little is known about migratory pathways that sea turtles ply between their nesting and feeding grounds in this region where this species faces numerous threats such as fisheries interaction at both open sea and coastal waters.*"

153. The WPEB **NOTED** that the movements of 105 satellite-tracked adult green turtles were examined in order to identify temporal corridors and regional feeding hot spots that are of high importance for the implementation of targeted mitigating measures. The study revealed a complex picture that depended not only on the species, but also on the life-stage of the turtle. The importance of identifying critical nesting sites and migration corridors within the framework of the new IOSEA Marine Turtle Site Network was also emphasised.

***Movement and diving behaviour of loggerhead turtles***

154. The WPEB **NOTED** paper IOTC–2013–WPEB09–26 that reported on the movement and diving behaviour of late juvenile loggerhead sea turtles (*Caretta caretta*) in the western Indian Ocean, including the following abstract provided by the authors:

"*We conducted a satellite tracking study on juvenile loggerhead sea turtles in the Indian Ocean, where they have been poorly studied up to date. Eighteen individuals were released from Reunion Island (21.2°S, 55.3°E) to investigate movement and diving patterns of late juvenile stage in the region. Eleven turtles roughly swam towards Oman (20.5°N, 58.8°E), where one of the world largest rookery of loggerheads is located. Three individuals contrastingly went southwards off the coast South-Africa and Madagascar, countries that also host loggerhead nesting grounds. Fourteen transmitters allowed the processing of animal diving profile and we observed a dichotomy between diurnal and nocturnal diving behavior with a greater number of shorter dives occurring during the day. Diving behavior also differed according to movement behavior as individuals spent more time at subsurface (<10m) during transit phases. Our study provides a better understanding of the oceanic movements and diving behavior of juvenile loggerheads, and key information for conservation of this species, which is of major concern in the Indian Ocean and worldwide.*"

155. The WPEB **NOTED** the research aimed at elucidating the developmental cycle for loggerhead turtles in the Indian Ocean based on satellite-tracking, genetics and stable isotope analyses, and drift simulation modelling (the so-called COCA LOCA project). An important dimension of this project was the collaboration that had been forged with La Réunion fishers to secure suitable animals for tracking purposes.

***Information papers on marine turtles***

156. The WPEB **NOTED** papers IOTC–2013–WPEB09–INF07 and IOTC–2013–WPEB09–INF08 which described recent research in North America using widely available fishing lights or ultra-violet light to illuminate gillnets, allowing marine turtles to avoid the nets without affecting the target species catch rates or catch value.

157. The WPEB **NOTED** that WWF provided funding for trials of the gillnet lights in the Gulf of Mexico. 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 2013/14.

158. The WPEB **AGREED** that a future session of the WPEB solicit and review more papers on marine turtle catch mitigation techniques for gillnets (i.e. concerning bycatch mitigation measures under investigation or use in the Indian Ocean and other regions), with a view to developing further technical advice for the SC.

159. **NOTING** that the phenomenon of ghost fishing, as a consequence of lost or discarded nets, was particularly relevant to marine turtles (with specific examples of cryptic mortality reported from the Maldives and the Seychelles), the WPEB **REQUESTED** that data on marine turtle strandings and on nets washed ashore be collected wherever possible (for example, in association with the turtle conservation NGOs (http://www.ioseaturtles.org/useful_contact.php) and reported to the WPEB at its next session.

### *11.3 Review of new information on the status of marine turtles*

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

160. The WPEB **NOTED** paper IOTC–2013–WPEB09–23, an Ecological Risk Assessment and Productivity - Susceptibility Analysis of marine turtles overlapping with fisheries in the IOTC region, including the following abstract provided by the authors:

> "*Interactions between sea turtles and fishing activities have been listed as a significant threat to sea turtles. This study aimed to assess which sea turtle species/populations in the Indian Ocean (IO) are at risk from interactions with tuna-related fisheries. The approach used was a desktop study to compile (1) all available data on sea turtle population demographics, rookery sizes and at-sea distributions; and (2) collate all information of longline, purse seine and gillnet effort and sea turtle interactions in the Indian Ocean.*" – (see paper for full abstract)

161. The WPEB **NOTED** that the results of the Ecological Risk Assessment for marine turtles conducted in 2012, jointly funded by IOTC and IOSEA, was originally presented to SC in 2012 and these had been supplemented by further data and analysis in 2013, at the request of the SC.

162. The WPEB **AGREED** that while the paucity of data, particularly with regard to gillnet fisheries remain as an impediment to a more robust analysis, the ERA estimated that gillnet total catch was an order of magnitude higher than turtles interacting with longline and purse seine gears. Marine turtle data were reviewed for all six species of marine turtles found in the Indian Ocean, representing 20 biologically distinct populations.

163. The WPEB **NOTED** that no new mitigation measures were proposed by the ERA, based on the available data, but the general recommendations contained in Resolution 12/04 were validated (including use of dehookers on longliners and the implementation of FADs the do not enmesh marine life). It was noted that higher species resolution and spatial data may change the estimated catch rates as it would allow for seasonal and temporal analysis, including the evaluation of different gear types and target species.

164. 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.

165. 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.

166. The WPEB **RECOMMENDED** that the ERA for marine turtles be kept under review, and that consideration be given to updating it periodically in light of newly received data and other information.

### *11.4 Review of Resolution 12/04 on the conservation of marine turtles*

167. 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*. Appropriate equipment for longliners includes line cutters, dehooking devices and dipnets for safely bringing marine turtles onboard.

168. The WPEB **RECOMMENDED** that at the next revision of IOTC Resolution 12/04 *on the conservation of marine turtles*, the measure is strengthened to ensure that where possible, CPCs report annually on the total estimated level of incidental catches of marine turtles, by species, as provided at Table 12.

**TABLE 12.** 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* |

***Resolution 10/02 Mandatory statistical [reporting] requirements for IOTC Members and Cooperating Non-Contracting Parties (CPCs)***

169. **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* and Resolution 13/03 on *On the recording of catch and effort by fishing vessels in the IOTC area of competence*.

***Requests contained in IOTC Conservation and Management Measures***

170. The WPEB **RECALLED** 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.

171. The WPEB **RECALLED** and updated its previous **RECOMMENDATION** 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, fishing 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, soak times, light deterrents) 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 *Marine turtle identification cards for Indian Ocean fisheries*).

**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 ecological FADs[1] based on the principles outlined in Annex III of Resolution 13/08 *Procedures on a fish aggregating devices (FADs) management plan, including more detailed specification of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species*.

172. **NOTING** that a number of training workshops had been successfully organised in relation to seabird bycatch mitigation, the WPEB **AGREED** that consideration should be given to adding a component on marine turtles to future workshops, in cooperation with IOSEA, thereby maximising the resources available.

173. The WPEB **ENCOURAGED** participants to submit as information papers for the next WPEB meeting, published papers or other information highlighting recent developments in marine turtle bycatch mitigation research occurring in the Indian Ocean (and other ocean basins).

### *11.5 Development of technical advice for marine turtles*

174. The WPEB **ADOPTED** the management advice developed for marine turtles, as provided in the draft status summary (Appendix XVII).

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

175. The WPEB **REQUESTED** that the IOTC Secretariat update the draft status summary for marine turtles with the latest 2012 interaction data, and in accordance with specialist advice provided during the meeting; supplemented as appropriate by additional expert advice to be solicited from the IOSEA Advisory Committee, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration in December 2013.

## 12. SEABIRDS

### *12.1 Review of data available at the Secretariat for seabirds*

176. The WPEB **NOTED** paper IOTC–2013–WPEB09–08 which summarised the standing of a range of data and statistics received by the IOTC Secretariat for seabirds, 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 IV.

177. The WPEB **NOTED** that there continues to be very limited information on interactions with seabirds available in the IOTC Secretariat's databases for most longline fleets and for all gillnet fleets that operate in the Indian Ocean.

***Data and reporting requirements***

178. 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 13). Contracting and Cooperating Non-Contracting Parties (CPCs) are required to collect and report incidental bycatch of seabirds.

**TABLE 13.** 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** | 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. |
| IOTC Resolution 12/06: *On reducing the incidental bycatch of seabirds in longline fisheries* | 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. |

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

### *12.2 Review new information on seabird biology, ecology, fisheries interactions and bycatch mitigation measures*

***Incidental catch in gillnets***

179. The WPEB **NOTED** paper IOTC–2013–WPEB09–27 that provided a global review of the incidental catch of seabirds in gillnet fisheries, including the following abstract provided by the authors:

"*Based on bird feeding ecology we identified 148 seabird species as susceptible to bycatch in gillnets, of which 81 have been recorded caught. The highest densities of susceptible species occur in temperate and sub-polar regions of both hemispheres, with lower densities in tropical regions. Gillnet fisheries are widespread and particularly prevalent in coastal areas. A review of reported bycatch estimates suggests that at least 400,000 birds die in gillnets each year. The highest bycatch has been reported in the Northwest Pacific, Iceland and the Baltic Sea. Species suffering potentially significant impacts of gillnet mortality include common guillemot (Uria aalge), thick-billed guillemot (Uria lomvia), red-throated loon (Gavia stellata), Humboldt penguin (Spheniscus humboldti), Magellanic penguin (Spheniscus magellanicus), yellow-eyed penguin (Megadyptes antipodes), little penguin (Eudyptula minor), greater scaup (Aythya marila) and long-tailed duck (Clangula hyemalis). Although reports of seabird bycatch in gillnets are relatively numerous, the magnitude of this phenomenon is poorly known for all regions. Further, population modelling to assess effects of gillnet bycatch mortality on seabird populations has rarely been feasible and there is a need for further data to advance development of bycatch mitigation measures*."

180. The WPEB **NOTED** that paragraph 8 of Resolution 12/06 requests the SC to analyse the effect of this Resolution based on information provided by the WPEB no later than during the 2016 Commission meeting so it is **REQUESTED** that any work on this is ready to be considered by the time of the 2015 WPEB.

181. The WPEB **NOTED** that there is very little information on the level of interactions between the gillnet fisheries and seabirds in the Indian Ocean and that research examining the level of mortality should be carried out.

***Information papers on seabirds***

182. The WPEB **NOTED** paper IOTC–2013–WPEB09–INF10 which outlined how Canadian fishery closures provide a large scale test of the impact of gillnet bycatch on seabird populations; and paper IOTC–2013–WPEB09–INF11 which outlined how Arctic Terns *Sterna paradisaea* from The Netherlands migrate record distances across three oceans to Wilkes Land, East Antarctica.

***Seabird identification guides***

183. The WPEB **EXPRESSED** its thanks to the IOTC Secretariat and other experts involved in the development of the IOTC *Seabird Identification Guides*. At the next revision of the guides, it was suggested that the ACAP seabird identification guides for use in observer programmes, which contain photos of seabird corpses for assisting the identification of dead seabirds caught at sea, be combined with the IOTC guides.

### *12.3 Review of new information on the status of seabirds*

184. **NOTING** that no new information on the status of seabirds in the Indian Ocean was presented during the WPEB09 meeting, and that the Commission has scheduled a review of the effectiveness of Resolution 12/06 at its Session in 2016, the WPEB **AGREED** that new information should be presented and discussed no later than at the WPEB meeting in 2015.

### *12.4 Development of technical advice for seabirds*

185. The WPEB **ADOPTED** the management advice developed for seabirds, as provided in the draft status summary (Appendix XVIII).

### *12.5 Update of seabird Executive Summary for the consideration of the Scientific Committee*

186. The WPEB **REQUESTED** that the IOTC Secretariat update the draft status summary for seabirds with the latest 2012 interaction data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration in December 2013.

## 13. MARINE MAMMALS

### *13.1 Review new information on marine mammal biology, ecology, fisheries interactions and bycatch mitigation measures (all)*

***Cetacean mortality in gillnets – Arabian Sea***

187. The WPEB **NOTED** paper IOTC–2013–WPEB09–28 which provided an assessment of cetacean mortality of the gillnet fishery of the northern Arabian Sea, including the following abstract from the authors:

"*Information on cetacean mortality by tuna gillnet operations in the northern Arabian Sea is limited and there is a need to collect more data from the area. The study highlighted the mortality of a number of dolphin species in gillnets including Indo-Pacific humpback dolphin (Sousa chinensis), bottlenose dolphin (Tursiops aduncus / truncatus), spinner dolphin (Stenella longirostris), Pan-tropical spotted dolphin (Stenella attenuata), long beaked common dolphin (Delphinus capensis tropicalis), and Risso's dolphin (Grampus griseus), striped dolphin (Stenella coeruleoalba) and rough tooth dolphin (Steno bredanensis). No baleen whales were observed during the study, however, a few cases of gillnet entanglement have been observed previously and smaller toothed whales, including dwarf sperm whales, were observed in tuna gillnets on more than two occasions.*"

188. **NOTING** that this type of study is useful but that it only covered a limited portion of the fleet, the WPEB **REQUESTED** that this study be continued and that more information is provided on the results and the methodology involved, acknowledging that the way this information is collected is critical to interpreting the results. The potential use of observers on these small scale vessels was of particular interest.

189. The WPEB **COMMENDED** the authors for undertaking such a study and urged the authors to provide more detail on the methods used and interpretation of the results at the next WPEB meeting.

***Cetacean identification guides***

190. The WPEB **NOTED** paper IOTC–2013–WPEB09–29 which suggested that identification guides should be produced for cetaceans in the Indian Ocean, including a proposed format for the identification cards. The following abstract was developed from the author's paper:

"*In order to improve recording and reporting of cetacean bycatch by stakeholders including observers, samplers and fishers, WWF offer to prepare and print Species Identification Guide for dolphins and whales occurring in the Indian Ocean. This Species Identification Guide will include 45 species of whales and dolphins in the Indian Ocean.*"

191. The WPEB **NOTED** that there are already several cetacean species identification guides that are publically available, including the FAO World Wide Guide for the identification of marine mammals and the WIOMSA guide. Nevertheless, it was **AGREED** that these identification guides are not suitable for use on vessels as they are not waterproof and a guide specific to the Indian Ocean may be preferable to a worldwide document.

192. The WPEB **AGREED** that a cetacean identification guide should be produced for the Indian Ocean, noting that the inclusion of a species distribution map such as the one illustrated in paper IOTC–2013–WPEB09–29 would be helpful in addition to details on blow patterns and profiles for large-sized whales to assist long distance identification. As the taxonomy of cetaceans is still evolving and new species are still being described, at least one current expert in the field should be brought in to offer technical advice during the guide development to ensure the guide is accurate and up to date.

***Risso's dolphin: Sri Lanka***

193. The WPEB **NOTED** paper IOTC–2013–WPEB09-30 reviewing the impact of the Sri Lankan tuna gillnet fishery on Risso's dolphins *(Grampus griseus)*. The following abstract was provided by the author:

"*Cetaceans were observed off the south coast of Sri Lanka in the month of April, every year over a seven year period, 2007-2013. During 48 days at sea a total of 290 cetacean sightings were recorded. Risso's dolphins (Grampus griseus) were only seen once, despite being reported as common around Sri Lanka in the early 1980s. Reviews of published records of cetacean sightings and bycatch landings around Sri Lanka both confirm declines in relative abundance of Risso's dolphins. They have been taken in large numbers by Sri Lankan fisheries, particularly tuna gillnet fisheries, and appear to have been almost extirpated locally*."

194. The WPEB **NOTED** that cetaceans move according to the monsoon so there is likely to be seasonal variation, however, it was confirmed that other researchers working in the area throughout the year have verified the findings of this paper.

195. The WPEB **NOTED** that this paper analyses percentages so the results are dependent on the levels of other species, however, sightings data suggest that no other species are increasing in abundance and predictions formed in 1991 also support the theory that the species has declined in abundance. Furthermore, extensive surveys conducted from Indian research vessels in Indian and Sri Lankan waters between 2003 and 2007 reported just four sightings of Risso's dolphins out of 473 total cetacean sightings.

196. The WPEB **NOTED** that the interaction of Risso's dolphins with longlines around Réunion Island is mostly in the form of depredation on bait. The dolphins are rarely hooked, but when this occurs are they released alive with a hook still attached.

197. The WPEB **NOTED** that the Indian Ocean is a designated sanctuary for whales and that there are substantial numbers of blue whales near the Sri Lankan coast.

***Depredation in the La Réunion longline fishery***

198. The WPEB **NOTED** the presentation by the Réunion Island Association of Fishermen which described the current fisheries operating in La Réunion, including trends in landings, effort and sales and the depredation occurring.

199. The WPEB **NOTED** that depredation around La Réunion results in the loss of around 5% of total catch, although this value varies from year to year. Pilot whales and pseudo-orcas are the most common cetaceans interacting with longline gear.

200. The WPEB **NOTED** that the reason for the increased levels of depredation this year are unknown, but that combined with the reduced CPUE and catches this year the overall impact on the fishers has been even greater than in previous years making this a key area for further investigation.

201. The WPEB **NOTED** the research undertaken in Japan into acoustic pingers to mitigate against depredation. While 45% of Japanese tuna longliners use Dolphin Dissuasive Devices (DDD), dolphins have become accustomed to constant sounds and so new devices are being trialled which only release a sound on approach of a cetacean. The estimated reduction in the level of depredation associated with use of these devices is high at 80%.

202. The WPEB **NOTED** paper IOTC–2013–WPEB09–47 which provided results of a study assessing the level of depredation in Réunion Island fisheries through a self-reporting data collection programme. This paper had the following abstract provided by the authors:

"*This paper describes a self-reporting program for Reunion Island based longline fisheries covering vessels of a range 8-16 m LOA operating in the EEZs of Reunion Island and east part of Madagascar. Overall coverage rate in terms of observed hooks is 12%, range from 5 to 23%. Depredation affects 30-40% of effort, while sharks are responsible for 20-30% of attacks and cetaceans for ~10%. For 6 quarters out of 9 observed highest CPUEs – in sets attacked by sharks. In presence of shark CPUE always higher than in non-attacked sets! In average set sharks damage 2 times less fish (2 fish in shark attacked sets vs. 5 in cetacean-attacked sets). Cetacean-attacked sets are major source of discards up to 36% of fish caught. Percentage of commercial discards for all observed vessels is 6.5%. However for fisheries based on marginal profit even minor losses might produce overall disastrous effect. The warning factors: increase of depredation-related discards due to decreased CPUE and increased severity of attacks*."

203. The WPEB **NOTED** that catches subject to depredation are not landed and as a result are not recorded in logbooks. There may potentially be a bias in fisher reporting as the incentive to self-report might vary depending on the level of depredation experienced, so the validation that is carried out is important in this type of approach.

204. The WPEB **NOTED** that there are currently plans for a research project to investigate depredation mitigation methods more fully for both demersal and pelagic fisheries in Réunion Island which should begin in 2014.

***Information papers on marine mammals***

205. The WPEB **NOTED** paper IOTC–2013–WPEB09–INF12 which described non-lethal strategies for mitigating odontocete bycatch and depredation in longline fisheries: physical and psychological deterrence at the hook, including the following abstract provided by the authors:

"*In 2009, the Australian Government (in collaboration with the Fijian Government, FFA, WWF and four major pelagic longline licence holders) embarked on a project to mitigate the economic and conservation impacts of toothed whale depredation and by-catch in pelagic longline fisheries. The impetus for the project arose from concerns tabled a workshop held in Apia (Samoa) in 2002. This project provides a rare opportunity to tackle both problems simultaneously. The aim was (i) to develop two devices that physically or psychologically deterred depredating whales by simulating gear tangles (several fisher reports indicate these are avoided), and (ii) assess their effectiveness under rigorous experimental conditions in an operational environment*."

206. The WPEB **NOTED** paper IOTC–2013–WPEB09–INF13 which outlined the seasonal distribution, movements and taxonomic status of blue whales (*Balaenoptera musculus*) in the northern Indian Ocean, including the following abstract provided by the authors:

"*There is a distinct population of blue whales, Balaenoptera musculus, in the northern Indian Ocean. The taxonomic status of these animals has long been uncertain, with debate over whether this population represents a distinct subspecies, and if so which name should apply. They have most frequently been assigned to B. musculus brevicauda, but are currently considered to be B. m. indica. The movements of these blue whales within the northern Indian Ocean are poorly understood. This paper reviews catches (n = 1,288), sightings (n = 448, with a minimum of 783 animals), strandings (n = 64) and acoustic detections (n = 6 locations); uses ocean colour data to estimate seasonality of primary productivity in different areas of the northern Indian Ocean; and develops a migration hypothesis. It is suggested that most of these whales*

*feed in the Arabian Sea off the coasts of Somalia and the Arabian peninsula during the period of intense upwelling associated with the southwest monsoon (from about May to October).*" – (see paper for full abstract)

### *13.2 Review of Resolution 00/02 On a survey of predation of longline caught fish*

207. **NOTING** that the requirements contained in Resolution 00/02 o*n a survey of predation of longline caught fish* was completed by the WPEB and SC in past years, the WPEB **RECOMMENDED** that Resolution 00/02 be revoked by the Commission.

208. The WPEB **AGREED** that depredation is a source of hidden mortality and therefore more information is needed on an ocean-wide scale. There is a need to undertake further survey work to quantify the level of depredation in IOTC fisheries, particularly in longline fisheries operating in the southwest Indian Ocean where depredation rates are reported to be very high, however, such survey should be incorporated into the WPEB work plan with appropriate funding from the Commission, rather than in a binding Resolution on all IOTC CPCs.

209. The WPEB **NOTED** the encouraging news from Sri Lanka that while previous incidents of interactions between fishers and marine mammals were common, these are currently low. The government have expressed concern about the impact of gillnets and so have been enforcing the regulation on the maximum length of nets and provided subsidies for fishers to use longlines rather than gillnets. It was mentioned that as the fleet comprises small-scale vessels, observer monitoring is not possible.

210. The WPEB **NOTED** that pseudo-orcas were previously sited frequently in the Maldives but are now very rarely seen. Sightings have become more common in Réunion Island over a similar time period. These observations may reflect a decline in abundance or a shift in distribution. The WPEB **NOTED** that around Réunion Island the mortality of pseudo-orcas due to fisheries interactions are very rare as this species is usually able to effectively predate on the caught fish without get caught.

### *13.3 Development of technical advice for marine mammals*

211. The WPEB **AGREED** that the WPEB work plan should include the following depredation research elements:
    - depredation levels by fishery and region of the Indian Ocean
    - economic impacts of depredation on specific fisheries and regions of the Indian Ocean

212. The WPEB **AGREED** that all CPCs should review their data holdings to determine the level of marine mammal interactions, including depredation levels, with fishing gears and for this to be presented at the next WPEB meeting.

213. The WPEB **RECOMMENDED** that depredation events be incorporated into Resolution 13/03 at its next revision, so that interactions may be quantified at a range of spatial scales. Depredation events should also be quantified by the regional observer scheme.

214. The WPEB **NOTED** that gillnets are known to have a major impact on cetaceans which needs to be addressed. As gillnets have been a prominent feature of every discussion section, it was **AGREED** that a coherent plan of work on gillnets is drawn up, including cetaceans as one aspect within this.

215. The WPEB **NOTED** that the effects of gillnets are not well known and so the effects of other fishing methods should also be considered, particularly swordfish longlining. Nevertheless, the WPEB **ACKNOWLEDGED** that the data of the gillnet fisheries are very sparse compared with other fleets and better monitoring is needed to investigate the ecosystem effects of these fleets.

216. The WPEB **REQUESTED** that an interactive webpage be added to the new IOTC website detailing depredation events and other useful information for fishers.

217. **NOTING** that there is a lot of scattered information in the literature, the WPEB **AGREED** it would be useful to have an ocean-wide overview of the status of cetaceans in the Indian Ocean to identify key gaps in information.

## 14. OTHER BYCATCH AND BYPRODUCT SPECIES INTERACTIONS

### *14.1 Review new information on other bycatch and byproduct biology, ecology, fisheries interactions and bycatch mitigation measures*

***Targeting bigger schools***

218. The WPEB **NOTED** paper IOTC–2013–WPEB09–31 which reported on whether targeting bigger schools can reduce ecosystem impacts of fisheries, including the following abstract provided by the authors:

"*Sustainability of living resource exploitation relies on an ecosystem management approach. Within tropical tuna purse seine fisheries using fish aggregating devices (FADs), such an approach incorporates the reduction of bycatch, in particular vulnerable species such as elasmobranchs. The levels of total*

*bycatch (in mass) from fishing operations using FADs is known to be five times higher than when tuna are caught in free-swimming schools. We intend to find practical solutions to reduce bycatch in FAD sets through the investigation of the relationships between the ratio of bycatch to target catch across different set size classes in all oceans. Ratios were always highest when catches were small, with the smallest class of catches responsible for the highest total portion of bycatch (23%–43%) while only contributing negligibly to the total target catch (3%–10%). Reducing the number of fishing sets (a part of the total effort) while maintaining the same total yield could contribute to a substantial reduction in the impacts of human activities.*"

219. The WPEB **NOTED** that targeting bigger schools may improve fleet efficiency by avoiding small, less economic schools of tuna. However, behaviour is not accounted for which is why the small schools maybe targeted.

***Mauritius bycatch***

220. The WPEB **NOTED** paper IOTC–2013–WPEB09–32 which provided an overview of the bycatch landed by local and foreign tuna longliners in Mauritius for the period 2009 to 2012, including the following abstract provided by the authors:

"*This paper presents by-catch estimates landed by national and foreign longliners fishing inside and outside the EEZ of Mauritius for the period 2009 to 2012. Some 100 licences are issued annually to foreign longliners to fish in the Exclusive economic zone (EEZ) of Mauritius. The average annual landing from these vessels during the period under report amounted to 3 102 tonnes of albacore tuna which is the targeted species followed by 796 tonnes of yellowfin tuna (Thunnus albacares), 360 tonnes of big-eye tuna (Thunnus obesus) and 1 106 tons of by-catch comprising billfish, other tuna-like species and sharks. A total of 21 196 tonnes of tuna and tuna-like species was transhipped in Port-Louis by non-licensed fishing vessels targeting albacore (Thunnus alalunga), from 2009 to 2012. The proportion of by-catch landed during this period varied between 28.9% and 39.4%. The total catch landed by non-licensed longliners targeting big-eye tuna has increased over the years from 3 495 tonnes in 2009 to 8 125 tonnes in 2012. The proportion of by-catch in the total catch is nearly the same (33.1%-47.0%) as compared to the level of by-catch of albacore-targeting fishing vessels (37.9%-39.4 %).*" – (see paper for full abstract)

***Indonesia bycatch***

221. The WPEB **NOTED** paper IOTC–2013–WPEB09–33 which provided an overview of the commonly discarded fishes on Indonesian tuna longline fishery in Indian Ocean, including the following abstract provided by the authors:

"*Incidental by-catch and associated discarding are difficult to estimate on the basis of logbook information because they are poorly reported by fishing masters and their importance varies with several interrelated factors. The purpose of this paper is to inform the commonly discarded fishes on the Indonesian tuna longline fishery in the Indian Ocean. The study was conducted during 2010–2011 following six commercial tuna longline vessels based in Port of Benoa. The results showed that discards composition reach almost 20% from total catch. Those discards composition was dominated by longnose lancetfish (32.73%) and pelagic stingrays (11.62%) which both species contribute almost half of total discards. Later followed by crocodile shark (6.07%), snake mackerel (0.41%), ocean sunfish (0.14%), olive ridley turtle (0.07%), with hammerhead shark, tappertail ribbonfish, false killer whale and leatherback sea turtle 0.02% each. Almost half of total catch are discards and half of discards are disposed dead or dying. These findings indicate the need for special management to reduce the discards for tuna longline in Indonesia.*"

222. The WPEB **NOTED** that the use of discards is an important issue to address as Indonesia's 50% discards could be utilised for protein in some manner.

223. The WPEB **NOTED** that the study demonstrates that different trophic levels more abundant over time and these sorts of studies are important to assess ecosystem approach to fisheries

***FAD fisheries impacts***

224. The WPEB **NOTED** paper IOTC–2013–WPEB09–34 which examines the impacts of the use of drifting FADs on pelagic marine ecosystems, including the following abstract provided by the authors:

"*The use of fish aggregating devices (FADs) by purse seine fisheries has come under increasing criticism for its potential deleterious impacts on tuna stocks, for high levels of by-catch and threats to the biodiversity of tropical pelagic ecosystems. Here, we review the current state of scientific knowledge of this fishing technique and current management strategies. Our intent is to encourage objective discussion of the topic and highlight areas worthy of future research. We show that catching juvenile tuna around FADs does not necessarily result in overfishing of stocks, although more selective fishing techniques would likely help obtain higher yield. Levels of non-tuna by-catch are comparable to or less than in other commercial tuna*

*fisheries and are primarily comprised of species that are not considered threatened. Accordingly, to minimize impacts on ecosystem balance, there is merit in considering that all species captured in purse seine fisheries (excluding vulnerable species such as turtles and sharks) should be retained, but the consequences of such a measure should be carefully examined before implementation.*" – (see paper for full abstract)

225. The WPEB **NOTED** that the issue of full retention of bycatch is important to deal with. The ecological and socio-economic consequences of such practices should be carefully investigated. The impact of the deployment of FADs on the ecology of species other than tunas should be examined given the possibility of both positive and negative impacts identified in the study.

***Malaysian bycatch***

226. The WPEB **NOTED** paper IOTC–2013–WPEB09–35 which examined the bycatch records of sharks, marine turtles and marine mammals by the Malaysian tuna longliners and the Malaysian coastal fisheries, including the following abstract provided by the authors:

"*From 2005 to 2010 total sharks caught by Malaysian tuna longliners targeting tropical tuna was from 10 – 134 tons. It made up between 06-1.2% of the total catches of the tuna vessels. The catch rates of sharks by these vessels greatly vary at the range of 30 – 600 kg/vessel. From 2012 to June 2013, Malaysian flag vessels shifted their target species to albacore tuna. However, the sharks catch data only available from Janaury – March 2012 as the rest of the period, the sharks caught by the longline were released immediately into the sea. The highest catch rate of sharks was recorded in January 2012 at 600 kg/vessel. No information on catch of turtle or marine mammal were recorded by the Malaysia tuna longliners. In the coastal waters, shark catch contributed only 0.2% of total annual landing and 80% were from trawlers with the major catch from over 30 nm from the shore. There are about 56 species of sharks that inhibit in Malaysian waters*." – (see paper for full abstract)

227. The WPEB **AGREED** that the Malaysian longline vessels are large enough to carry scientific observes. As such, Malaysia should expand the implementation of the regional observer scheme on board its longline fleet to monitor catch and bycatch.

***India bycatch***

228. The WPEB **NOTED** paper IOTC–2013–WPEB09–36 which examined the pelagic megafauna bycatch in the tuna longline fisheries off India, including the following abstract provided by the authors:

"*To assess the diversity and abundance of pelagic megafauna caught in the tuna longline survey in the seas around India, data was collected and analysed from survey voyages of four research longliners of the Fishery Survey of India (FSI) during 2004-2010. Study was conducted by operating 1.2 million hooks in three regions of seas around India, i.e., eastern Arabian Sea, western Bay of Bengal and Andaman and Nicobar waters. Significant variations in the diversity and abundance of large pelagics were observed among the three regions of the study area. Besides the target species (yellowfin tuna, Thunnus albacares), 60 species of large pelagics and sea turtles were incidentally caught. Indo-Pacific sailfish, Istiophorus platypterus, was the main bycatch species. In the order of abundance, pelagic stingray (Pteroplatytrygon violacea), common dolphinfish (Coryphaena hippurus), pelagic thresher (Alopias pelagicus), skipjack tuna (Katsuwonus pelamis), and long snouted lancetfish (Alepisaurus ferox), were the other important species recorded.*" – (see paper for full abstract)

229. The WPEB **NOTED** that the paper focussed on yellowfin tuna as a target species, even though other species such as swordfish have a high utility or value as a product.

230. The WPEB **REQUESTED** that India undertake a CPUE standardisation for these survey vessels as an independent index of abundance for yellowfin tuna, and possibly other species in the Indian Ocean.

231. The WPEB **RECALLED** the definition of bycatch adopted by the SC in 2012 as follows:

"***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. A bycatch species includes those non-IOTC species which are (a) retained (byproduct), (b) incidentally taken in a fishery and returned to the sea (discarded); or (c) incidentally affected by interacting with fishing equipment in the fishery, but not taken*."

***La Réunion bycatch***

232. The WPEB **NOTED** paper IOTC–2013–WPEB09–37 Rev_1 which outlined the commercial catch and discards of the pelagic longline fishery of Réunion Island based on the self-reporting data collection program, including the following abstract provided by the authors:

"*Pelagic longline fishery activities of Reunion Island are monitored since 2011 by the self-reporting data collection program (SRP) that covered 12% of the total fishing effort in 2011-2012. Fishermen report in SRP various informations on fishing locations, gear used, catch, discards and depredation. We used these data to assess the levels and distribution of commercial catch and discards between mid-2011 and mid-2013. We found that the catch per unit of effort (CPUE) of swordfish (target species) has decreased since 2011 as long as the overall profitability of this fishery including other commercial species and taxa: yellowfin tuna, bigeye tuna, albacore tuna, dolphinfish and billfish. Discards were mostly blue sharks (38%), pelagic stingrays (24%) and a generic group of very long fish usually called snooks by fishermen (20%). In this context of overall decrease of fishery profitability, fishing on the east coast of Madagascar between July and September still remains a profitable strategy while byctach rate of discards is reasonably low. Albacore tuna season occurring the last quarter of the year also remains profitable with high albacore CPUE levels near Reunion Island and below average rate of discarded bycatch.*"

233. The WPEB **NOTED** that profitability is important to account for in the effort distribution, and this is an important variable to describe fishing behaviour. The type of economic incentives used are important as it affects the bottom line for the fleet.

***FADs and the environment***

234. The WPEB **NOTED** paper IOTC–2013–WPEB09–38 which examined whether FADs modify the floating object environment in the ocean, including the following abstract provided by the authors:

"*Natural floating objects (e.g., logs) have always been a component of the habitat of tropical tunas. However, the introduction of fish aggregating devices (FADs) modifies this environment. To assess the changes due to the deployment of FADs, we compared the spatial distribution of natural and artificial floating objects (FADs), using data from observers onboard tuna purse seine vessels in the Indian Ocean from December 2006 to December 2008. Although natural objects occur more commonly in waters south of 7°S and FADs are more common in waters north of 7°S, all types of floating objects can be found everywhere. Using different spatial scales (quadrats of size 1° 9 1°, 2° 9 2°,5° 9 5°, and 10° 9 10°), we computed the proportion of FADs observed in quadrats without natural objects. The scale of 2° 9 2° quadrats represented a threshold: distributions of the two types of objects were different at scales smaller than this threshold. The strongest change that has occurred since the introduction of FADs (besides the increased catches) has been the dramatic increase in the total number of floating objects. Since the introduction of FADs, the number of objects has at least doubled everywhere.*"

235. The WPEB **AGREED** that FADs could possibly be used as an index of abundance looking at spatial density, probability on encounter of species (X) to estimate an overall species abundance over time.

***Capture depth of bycatch***

236. The WPEB **NOTED** paper IOTC–2013–WPEB09–39 which examined the capture depth of the dominate bycatch species and the relationship between their catch rates and the sea surface temperature, including the following abstract provided by the authors:

"*On the basis of the data collected on a pelagic longline vessel from November 18, 2012 through March 31, 2013 in the fishing area of the Indian Ocean (2°47'N~8°13'S, 62°18'E~67°49'E), the capture depth of the dominant bycatch species and the relationship between their catch rates and the sea surface temperature were analyzed. The results showed that (1) blue shark (Prionace glauca) mainly inhabited the water layer of 80~160m, the water layer with the highest catch rate was 120~160m, followed by 80~120m, the catch rate of remaining water layers was low; (2) swordfish (Xiphias gladius) mainly inhabited the water layer of 80~200m, the catch rate of this water layer increased at first then decreased, the catch rate in the water layer of 120~160m was the highest and much higher than that of other water layers; (3) blue marlin (Makaira nigricans) was mainly caught in the water layer of 80~200m, the catch rate of this water layer was high, and the catch rate peaked in the water layer of 160~200m.*" – (see paper for full abstract)

237. The WPEB **AGREED** that the paper could be improved by standardising the catch rates by effort across depth layers. The maximum fishing depth was 320 m.

238. The WPEB **NOTED** that this paper may not be representative of the behaviour to be applied across wider areas due to the narrow focus of this study.

***Swordfish buoy gear***

239. The WPEB **NOTED** paper IOTC–2013–WPEB09–41 which examined a potential for bycatch reduction in the small-scale swordfish fisheries: a Florida experience and Indian Ocean perspective, including the following abstract provided by the authors:

"*A swordfish buoy gear, an innovative fishing practice developed in USA in early 2000s, provide a possibility of direct swordfish targeting yielding high CPUE of target species and very low bycatch levels.*

*Here we present a summary of US experience and discuss potential application of this gear in the Indian Ocean region in the perspective of small-scale fisheries development and bycatch reduction.*"

240. The WPEB **NOTED** the adoption of the swordfish buoy gear may provide certain flexibility to the small-scale fleets in view of decrease of bycatch levels and conservation of non-retained species. In particular this gear might be used as a viable alternative of gillnet gear in small-scale fisheries, which often targeted shark or otherwise subjected to relatively high level of mortality among non-retained species. Similarly small longline boats might chose the buoy gear to reduce their bait consumption and decrease catch of non-target species. The deployment is highly dependent on currents.

***Self reporting – La Réunion longline fishery***

241. The WPEB **NOTED** paper IOTC–2013–WPEB09–42 which examined a self-reporting data collection project for the pelagic longline fishery based in La Reunion, including the following abstract provided by the authors:

"*Overexploitation of target and bycatch species in marine capture fisheries is the most widespread and direct driver of degradation of marine communities and loss of global marine biodiversity. Logbook data in general covered only the part of the catch landed to be commercialized. Observer programs can be difficult to implement depending on the size of fishing boats and present several constraints leading to inferences biases. In this context, IRD with the cooperation of the CAP RUN launched in 2011, a self-reporting of exhaustive catch and effort data for the pelagic longline fishery based in Reunion Island. The aim of this project is to increase the coverage level of the fishing activity of all longliners of the fleet in terms of fishing effort and spatial distribution. The project is undertaken with the financial support of the "Data Collection Framework" program of the European Union. It is based on financial motivations of collaborative fishermen.*" – (see paper for full abstract)

242. **NOTING** that the quality of information held in the IOTC databases on sharks and byctach species is limited, the WPEB **AGREED** that studies such as that outlined on this study could be conducted in other small scale fisheries to improve data deficiencies on target and bycatch species.

243. The WPEB **AGREED** that proving incentives to fishers to obtain data is not wise, but rather, that collaborative arrangements is more likely to yield robust data sets from the fishery. However, due to the current economic situation of the La Réunion longline fleet, such incentives are acceptable to motivate fishers to keep collecting catch data.

***Observer data vs video monitoring***

244. The WPEB **NOTED** paper IOTC–2013–WPEB09–43 which compared observer data with video monitoring on a French purse seiner in the Indian Ocean, including the following abstract provided by the authors:

"*Data collected through an Electonic Monitoring feasability study are presented. The study demonstrates that for for some variables, EM is able to provide reliable fisheries information from French tropical tuna purse seiners. Specifically, these variables are: i) location and time of all fishing events, ii) species composition of catch per event, and iii) total catch weight by species for main target species (yellowfin and skipjack). These results are encouraging and directly correspond with the compliance related objectives of the current observer program. These results also indicate that progress is still required to be made for EM to be considered as an equivalent or complementary option to the scientific observer programme. Set type and non-target species identification are the primary areas where further work is required to improve the data collection processes and outputs.*"

245. The WPEB **AGREED** that electronic monitoring systems, if calibrated and set up correctly, can be equally as accurate as onboard scientific observers to provide reliable fisheries information and could therefore represent an alternative to human observers when it is difficult to place them on fishing vessels. Similar pilot studied can be conducted on other fishing gears.

***Illegal fishing in the Chagos archipelago***

246. The WPEB **NOTED** paper IOTC–2013–WPEB09–46 Rev_1 which examined the catch and bycatch composition of illegal fishing in the Chagos Archipelago, including the following abstract provided by the authors:

"*In April 2010, the UK government declared the Chagos Archipelago a no-take MPA to commercial fishing. The MPA covers an area over 544,000 km2 and was created with aims of biodiversity conservation and creating a scientific reference site within the region (Mangi et al., 2010). Encompassing both coastal and pelagic areas, the MPA has doubled the area of ocean covered by MPAs worldwide and protects approximately half of the coral reefs in the Indian Ocean that are still classed as 'high quality'. There are about 10 Important Bird Areas, with some of the Indian Ocean's most dense populations of several seabird species. The area also includes undisturbed and recovering populations of Hawksbill and Green Turtles. Although commercial fishing within 200 nautical miles of the islands ceased in November 2010,*

*recreational fishing for pelagic and demersal species with hook and lines is still permitted in an MPA exclusion zone covering the territorial waters around the island of Diego Garcia.*" – (see paper for full abstract)

247. The WPEB **NOTED** that reporting of shark catches reported at sea was high compared to the reported landings specifically by gillnet and longline vessels.

248. The WPEB **NOTED** paper OTC–2013–WPEB09–INF18 which examined Pelagic diversity in the Indian Ocean from long-term data series of longline research data, including the following abstract provided by the authors:
"*Historical and recent research and observer data were combined in a dataset of 135 cruises and 3886 longline sets carried out from 1963 to 2011. The Indian Ocean was partitioned in three embedded panels of zones, taking into account the main pelagic habitat features such as distance from shelf breaks, presence of islands, shoals or seamounts, and Longhurst's biogeochemical provinces. Longline sets were assigned to panels of zones and analyzed in terms of species richness. We carefully dealt with the taxonomic identification of catches (70910 fish individuals among 113 species) and analyzed data at species level. Linear mixed-effect models were used to standardize fishing effort (hook number) and allowed us to predict species richness in the different panels. Our findings highlight regional differences with high species diversity areas (like Mozambique Channel/Madagascar and Saya de Malha) that might be used for future conservation issues. While we do not find strong drift in diversity indexes over the time, however we documented decreased abundance of several top predators as sharks and billfish and increased abundance of meso-predator: longnose lancetfish.*"

### *14.2. Development of technical advice for other bycatch and byproduct species*

*Nil.*

## 15. RESEARCH RECOMMENDATIONS AND PRIORITIES

### *15.1 Revision of the WPEB work plan*

249. The WPEB **NOTED** the urgent need to improve the collection of fisheries data and develop applied research to fill the major knowledge gaps for sharks that affect the provision of scientific advice to the Commission. Therefore, the WPEB prepared an outline and general objective for a Shark Year Program (SharkYP), which included the following aspects: a) the objectives of the program; b) general background of existing fishery and biological data for the main pelagic sharks in the Indian Ocean, highlighting major gaps of knowledge, as well as the main fisheries impacting sharks; c) priorities in fisheries data collection; d) research priorities on biological information; e) research priorities on mitigation measures; and f) other considerations for the SharkYP.

250. The WPEB **RECOMMENDED** that a small working group of shark experts and the IOTC Secretariat further develop the draft Shark Year Program (SharkYP) and to present the proposal at the next SC meeting to be held in December 2013. The overall objective is to:
"The Shark Year Program (SharkYP) represents a further step to align with the work of the WPEB with IOTC Conservation and Management Measures (CMMs), particularly to the recently adopted Resolution 13/06 *on a scientific and management framework on the conservation of shark species caught in association with IOTC managed fisheries*. Moreover, the SharkYP aims to provide guidance to WPEB researchers, by prioritising issues related to data collection and research on species biology/ecology, fisheries and mitigation measures. Finally, by promoting cooperation and coordination among WPEB researchers, the SharkYP aims to improve the quality of the scientific advice on sharks provided to the Commission, and to better assess the impact on these species of the current CMMs."

251. The WPEB **NOTED** the range of research projects on bycatch and byproduct species, currently underway, or in development within the IOTC area of competence, and reminded participants to ensure that the projects described are included in their National Reports to the SC, which are due on the 17th of November 2013.

252. The WPEB **RECOMMENDED** that the SC consider and endorse the workplan and assessment schedule for the WPEB for 2014, and tentatively for future years, as provided at Appendix XIX and Appendix XX, respectively.

### *15.2 Format of future WPEB Sessions*

253. The WPEB **RECOMMENDED** that the SC note the following:
- The WPEB **DISCUSSED** the future format in order to focus the efforts of scientists working on different groups of bycatch species to address more efficiently, the mandate of the group.
- The WPEB **CONSIDERED** a range of options which the SC is asked to consider:
    - **Option 1**: The current WPEB be split into two; A dedicated Working Party on Sharks (WPS) and a Working Party on Ecosystems and Bycatch (WPEB).

- **Option 2**: Retaining the WPEB in its current form, with alternating focus of sharks in one year, followed by other ecosystem and bycatch issues in the next year.
- **Option 3**: Maintaining the WPEB with clear guidelines to deal with sharks every year, as well as other issues and bycatch groups in alternate years or as required.

- The WPEB **AGREED** that shark issues were important to address on a yearly basis.

254. 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. Expertise in stock assessment from other IOTC working parties, e.g. the Working Party on Tropical Tunas or the Working Party on Billfish, may be of value for such analyses.

## 16. OTHER BUSINESS

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

255. The WPEB **NOTED** with thanks, the contributions of the Invited Expert for the meeting, Dr. Ronel Nel, from the Nelson Mandela Metropolitan University, Port Elizabeth, South Africa and encouraged her 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.

256. The WPEB **AGREED** to the following core areas of expertise and priority areas for contribution that need to be enhanced for the next meeting of the WPEB in 2014, by the Invited Experts:
    - **Expertise:** Sharks – stock assessment; including from regions other than the Indian Ocean; data poor assessment approaches for sharks.
    - **Priority areas for contribution:** Sharks – refining the information base, historical data series and indicators for shark species for stock assessment purposes (species focus: blue shark and oceanic whitetip shark).

257. The WPEB **RECOMMENDED** that two Invited Experts be brought to the WPEB in 2014 so as to further increase the capacity of the WPEB to undertake work on sharks at the next meeting, and for this to be included in the IOTC budget for 2014.

### *16.2 Date and place of the Tenth Session of the Working Party on Ecosystems and Bycatch*

258. The WPEB participants were unanimous in thanking La Réunion, France, for hosting the Ninth Session of the WPEB and commended La Réunion on the warm welcome, the excellent facilities and assistance provided to the IOTC Secretariat in the organisation and running of the Session.

259. 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 late July or September 2014, in conjunction with the Working Party on Billfish. The meeting location will be communicated by the IOTC Secretariat to the SC for its consideration at its next session to be held in December 2014.

### *16.3 Election of a Chairperson and Vice-Chairperson for the next biennium*

260. The WPEB participants were unanimous in **THANKING** the outgoing Chair Dr. Charles Anderson for his outstanding Chairpersonship over the past five years, including his dedication to the IOTC scientific process and in particular to Ecosystems and Bycatch matters. It was noted that he has tirelessly contributed to the advancement of the Commission's objective to ensure the sustainable interaction of IOTC fisheries with bycatch species in the Indian Ocean.

261. The WPEB **NOTED** that the Vice-Chairperson, Dr. Evgeny Romanov, had completed a first term of two years as Vice-Chairperson of the WPEB, and thus, the position was declared open.

262. Noting the rules of procedure of the IOTC: Rule X.6: The Scientific Committee [*and its Working Parties*] shall elect, preferably by consensus, a Chairperson and a Vice-Chairperson from among its members for two years, the WPEB **CALLED** for nominations for the newly vacated positions of Chairperson and Vice-Chairperson for the next biennium. Dr. Rui Coelho (EU,Portugal) was nominated and elected as Chairperson, and Dr. Evgeny Romanov (La Réunion) was nominated and elected as Vice-Chairperson of the WPEB for the next biennium.

263. The WPEB **RECOMMENDED** that the SC note the new Chairperson, Dr. Rui Coelho (EU,Portugal) and Vice-Chairperson, Dr. Evgeny Romanov (La Réunion), of the WPEB for the next biennium.

264. The WPEB **NOTED** the Chairman's Award for best presentation by a coastal country scientist was introduced in 2012. This year's award winners were Mr. Kiilu Benedict Kyalo (Kenya) and Mr. Sijo Varghese from India. A certificate was presented to the winners with warm congratulations from all participants.

### *16.4 Review of the draft, and adoption of the Report of the Ninth Session of the Working Party on Ecosystems and Bycatch*

265. The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB09, provided at Appendix XXI, as well as the management advice provided in the draft resource stock status summary for each of the seven shark species, as well of those for marine turtles and seabirds:

**Sharks**

- 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

**Other species/groups**

- Marine turtles – Appendix XVII
- Seabirds – Appendix XVIII

266. The report of the Ninth Session of the Working Party on Ecosystems and Bycatch (IOTC–2013–WPEB09–R) was **ADOPTED** on the 16 September 2013.

# APPENDIX I
# LIST OF PARTICIPANTS

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# APPENDIX II
# AGENDA FOR THE NINTH WORKING PARTY ON ECOSYSTEMS AND BYCATCH

**Date:** 12–16 September 2013
**Location: Espace TAMARUN**
**Reunion Island, France**
**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 FIFTENTH SESSION OF THE SCIENTIFIC COMMITTEE** (Secretariat)
4. **OUTCOMES OF SESSIONS OF THE COMMISSION**
   - 4.1. Outcomes of the Seventeenth Session of the Commission (Secretariat);
   - 4.2. Review of Conservation and Management Measures relevant to Ecosystems and Bycatch (Secretariat).
5. **PROGRESS ON THE RECOMMENDATIONS OF WPEB08** (Chair)
6. **REVIEW OF DATA AVAILABLE ON ECOSYSTEMS AND BYCATCH**
   - 6.1. Review of the statistical data available for ecosystems and bycatch species (Secretariat);
   - 6.2. Progress on reporting and outcomes from Compliance Committee (enforcement measures taken) (Secretariat);
   - 6.3. Regional Observer Scheme – Update (Secretariat).
7. **NEW INFORMATION ON BIOLOGY, ECOLOGY, FISHERIES AND ENVIRONMENTAL DATA RELATING TO ECOSYSTEMS AND BYCATCH SPECIES**
   - 7.1. Review new information on environment and ecosystem interactions, including climate change issues affecting pelagic ecosystems in the IOTC area of responsibility;
   - 7.2. Data from other sources (papers from CPCs).
8. **REVIEW OF NATIONAL BYCATCH ISSUES IN IOTC MANAGED FISHERIES AND NATIONAL PLANS OF ACTION** (in particular for sharks and seabirds)
9. **GILLNET FISHERIES: PROBLEMS AND NEEDS** (recommendations from the SC / decisions of the Commission)
   - 9.1. Regional review of the data available for gillnet fleets operating in the Indian Ocean in view of decision of SC14.91: "*The SC RECOMMENDED that the Commission considers allocating 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.*"
   - 9.2. Training for CPCs having gillnet fleets on species identification, bycatch mitigation and data collection methods and also to identify other potential sources of assistance – Development of plans of action.
10. **SHARKS AND RAYS**
    - 10.1. Review new information on the biology, stock structure, bycatch mitigation measures, fisheries and associated environmental data (all):
      - Shark bycatch mitigation in longline gear: effect of terminal gear on shark bycatch: leaders (wire vs. monofilament), hooks / hooks sizes (circle vs. tuna vs. J-hooks). Review of regional research results and/or open discussion / results from other oceans. Best practices of shark handling / live release: circle hooks, wire leaders, live release. Shark post-release mortality in the longline fisheries.
      - Shark bycatch mitigation in purse seine gear: sharks in nets (whale shark, other species); sharks and FADs. Review of regional research results and/or open discussion / results from other oceans. Best practices of shark handling / live release. Shark post-release mortality in the purse seine fisheries.
    - 10.2. Stock status indicators for sharks and rays (all)
      - Historical data series for sharks and rays (in particular for blue shark and oceanic whitetip shark);
      - Stock indicators for sharks and rays (in particular for blue shark and oceanic whitetip shark);
      - Ecological Risk Analysis: review of efforts taken in 2012, potential management implications and direction for further progress;

- Other indicators.

10.3. Review of data needs and way forward for the evaluation of shark stocks (all);
10.4. Development of technical advice on the status of the shark stocks (all);
10.5. Update of shark species Executive Summaries for the consideration of the Scientific Committee (all).

**11. MARINE TURTLES**

11.1. Review of data available at the Secretariat for marine turtles (Secretariat);
11.2. Review new information on marine turtle biology, ecology, fisheries interactions and bycatch mitigation measures (all);
11.3. Review of new information on the status of marine turtles (all)
- Ecological Risk Analysis: Analysis: review of efforts taken in 2012, potential management implications and direction for further progress;
- Other indicators.

11.4. Review of Resolution 12/04 *On the conservation of marine turtles* (all);
11.5. Development of technical advice for marine turtles (all);
11.6. Update of marine turtle species Executive Summary for the consideration of the Scientific Committee (all).

**12. SEABIRDS**

12.1. Review of data available at the Secretariat for seabirds (Secretariat);
12.2. Review new information on seabird biology, ecology, fisheries interactions and bycatch mitigation measures (all);
12.3. Review of new information on the status of seabirds (all);
12.4. Review of Resolution 12/06 *On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries* (all);
12.5. Development of technical advice for seabirds (all);
12.6. Update of seabird Executive Summary for the consideration of the Scientific Committee (all).

**13. MARINE MAMMALS**

13.1. Review new information on marine mammal biology, ecology, fisheries interactions and bycatch mitigation measures (all);
- Purse seine (bycatch/non-bycatch interactions);
- Gillnet (bycatch);
- Longline (bycatch and depredation):
  - Review of available data and new information on depredation;
  - Requirement for improvement of the data on depredation;
  - Possible consequences of depredation on stock assessment;

13.2. Review of Resolution 00/02 *On a survey of predation of longline caught fish*;
13.3. Development of technical advice for marine mammals (all).

**14. OTHER BYCATCH AND BYPRODUCT SPECIES INTERACTIONS**

14.1. Review new information on other bycatch and byproduct biology, ecology, fisheries interactions and bycatch mitigation measures (all);
14.2. Development of technical advice for other bycatch and byproduct species (all).

**15. RESEARCH RECOMMENDATIONS AND PRIORITIES**

15.1. Revision of the WPEB work plan (Chair);
15.2. Format of future WPEB Sessions.

**16. OTHER BUSINESS**

16.1. Development of priorities for an Invited Expert/s at the next Working Party on Ecosystems and Bycatch meeting (Chair);
16.2. Date and place of the Tenth Session of the Working Party on Ecosystems and Bycatch (Chair and Secretariat);
16.3. Election of a Chairperson and Vice-Chairperson for the next biennium;
16.4. Review of the draft, and adoption of the Report of the Ninth Session of the Working Party on Ecosystems and Bycatch (Chair).

# APPENDIX III
# LIST OF DOCUMENTS

| Document | Title | Availability |
|---|---|---|
| IOTC–2013–WPEB09–01a | Draft agenda of the Ninth Working Party on Ecosystems and Bycatch | ✓(26 June 2013) |
| IOTC–2013–WPEB09–01b | Draft annotated agenda of the Ninth Working Party on Ecosystems and Bycatch | ✓(7 September 2013) |
| IOTC–2013–WPEB09–02 | Draft list of documents | ✓(19 August 2013) |
| IOTC–2013–WPEB09–03 | Outcomes of the Fifteenth Session of the Scientific Committee (Secretariat) | ✓(9 August 2013) |
| IOTC–2013–WPEB09–04 | Outcomes of the Seventeenth Session of the Commission (Secretariat) | ✓(9 August 2013) |
| IOTC–2013–WPEB09–05 | Review of current Conservation and Management Measures relevant to ecosystems and bycatch (Secretariat) | ✓(9 August 2013) |
| IOTC–2013–WPEB09–06 | Progress made on the recommendations of WPEB08 (Secretariat) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–07 | Status of development and implementation of National Plans for Action for Seabirds and Sharks (Secretariat) | ✓(22 August 2013) |
| IOTC–2013–WPEB09–08 | Review of the statistical data available for bycatch species (Secretariat) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–09 | Progress on reporting and outcomes from Compliance Committee (Secretariat) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–10 | Update on the implementation of the IOTC Regional Observer Scheme (Secretariat) | ✓(22 August 2013) |
| IOTC–2013–WPEB09–11 | Revision of the WPEB work plan (Secretariat & Chair) | ✓(19 August 2013) |
| **Sharks** | | |
| IOTC–2013–WPEB09–12 | Size distribution and sex ratio of scalloped hammerhead sharks (*Sphyrna lewini*) in Indian Ocean at southern part of Java and Nusa Tenggara, Indonesia (D.D. Kembaren, U. Chodrijah & A. Suman) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–13 | Shark bycatch - small scale tuna fishery interactions along the Kenyan coast (K.B. Kyalo & S. Ndegwa) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–14 Rev_1 | Sharks caught by Malagasy longline in 2012 (D.M. Rahombanjanahary) | ✓(28 August 2013)<br>✓(12 September 2013) |
| IOTC–2013–WPEB09–15 | An update on shark bycatch of tuna gillnet fisheries of Pakistan (M. Khan, R. Nawaz, K. Mehmood, R. Narwaz & U. Shahid) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–16 Rev_1 | Summary of the transhipment of shark products by longliners in the Indian Ocean (S.M. Martin, J.C. Moir, J. Pearce & C.C. Mees) | ✓(2 September 2013)<br>✓(11 September 2013) |
| IOTC–2013–WPEB09–17 | Sharks: Bycatch in the tuna longline fishery in the Indian Ocean by Thai tuna longliners in 2012 (P. Luesrithawornsin & A. Wongkeaw) | ✓(3 September 2013) |
| IOTC–2013–WPEB09–18 | Status of shark fishery in Sri Lanka (H.L.N.S. Herath & R. Maldeniya) | ✓(2 September 2013) |
| IOTC–2013–WPEB09–19 Rev_1 | EU project for the provision of scientific advice for the purpose of the implementation of the EUPOA sharks: a brief overview of the results for Indian Ocean (H. Murua, M.N. Santos, P. Chavance, J. Amande, B. Seret, F. Poisson, J. Ariz, F.J. Abascal, P. Bach, R. Coelho & M. Korta) | ✓(24 July 2013)<br>✓(11 September 2013) |
| IOTC–2013–WPEB09–20 | Shark bycatch by dropline gear in the north coast of Mozambique: Results of the acoustic/dropline survey conducted from 25th October to 07th November 2012 (R.J. Mutombene) | ✓(4 September 2013) |
| IOTC–2013–WPEB09–21 | Looking behind the curtain: quantifying massive shark mortality in fish aggregating devices (J.D. Filmalter, M. Capello, J.-L. Deneubourg, P.D. Cowley & L. Dagorn) | ✓(28 June 2013) |
| IOTC–2013–WPEB09–22 | Standardized CPUE series for blue and shortfin mako sharks caught by the Portuguese pelagic longline fishery in the Indian Ocean, between 1999 and 2012 (R. Coelho, M.N. Santos & P.G. Lino) | ✓(28 August 2013) |
| **Marine Turtles** | | |
| IOTC–2013–WPEB09–23 | Ecological Risk Assessment and Productivity - Susceptibility Analysis of sea turtles overlapping with fisheries in the IOTC region (R. Nel, R.M. Wanless, A. Angel, B. Mellet & L. Harris) | ✓(27 June 2013) |

| Document | Title | Availability |
|---|---|---|
| IOTC–2013–WPEB09–24 | IOTC / IOSEA reports give insights into Indian Ocean fisheries-turtle interactions (D. Hykle & P. Migraine) | ✓(15 July 2013) |
| IOTC–2013–WPEB09–25 | Post nesting migration of green turtle (*Chelonia mydas*) in the western Indian Ocean (J. Bourjea, S. Ciccione, S. Behamou, & M. Dalleau) | ✓(13 August 2013) |
| IOTC–2013–WPEB09–26 | Movement and diving behaviour of late juvenile loggerhead sea turtles (*Caretta caretta*) in the western Indian Ocean (M. Dalleau, S. Behamou, J. Sudre, S. Ciccione & J. Bourjea) | ✓(13 August 2013) |
| **Seabirds** | | |
| IOTC–2013–WPEB09–27 | The incidental catch of seabirds in gillnet fisheries: A global review (R. Zydelis, C. Small & G. French) | ✓(13 August 2013) |
| **Marine Mammals and Depredation** | | |
| IOTC–2013–WPEB09–28 | An assessment of cetacean mortality in the gillnet fishery of the Northern Arabian Sea (M. Moazzam) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–29 | Proposal for species identification guide for cetaceans (whale and dolphins) occurring in the Indian Ocean (M. Moazzam) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–30 | Risso's Dolphins (*Gampus griseus*): impact of the Sri Lankan tuna gillnet fishery (R.C. Anderson) | ✓(28 August 2013) |
| **Bycatch and discards** | | |
| IOTC–2013–WPEB09–31 | 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) | ✓(28 June 2013) |
| IOTC–2013–WPEB09–32 | An overview of the bycatch landed by local and foreign tuna longliners in Mauritius for the period 2009 to 2012 (S. Beeharry, Z. Dhurmeea & T. Sooklall) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–33 | Commonly discarded fishes on Indonesian tuna longline fishery in Indian Ocean (I. Jatmiko, B. Setyadji & B. Nugraha) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–34 | 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 & G. Moreno) | ✓(28 June 2013) |
| IOTC–2013–WPEB09–35 | The bycatch records of sharks, marine turtles and marine mammals by the Malaysian tuna longliners and the Malaysian coastal fisheries (S. Basir, M.N. Nordin & N.A. Mokhtar) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–36 | Pelagic megafauna bycatch in the tuna longline fisheries off India (S.P. Varghese, K. Vijayakumaran & D.K. Gulati) | ✓(10 August 2013) |
| IOTC–2013–WPEB09–37 Rev_1 | Commercial catch and discards of pelagic longline fishery of Reunion Island based on the self-reporting data collection program (P.S. Sabarros, E. Romanov, L. Le Foulgoc, E. Richard, J.-P. Lamoureux & P. Bach) | ✓(4 & 12 September 2013) |
| IOTC–2013–WPEB09–38 | How much do fish aggregating devices (FADs) modify the floating object environment in the ocean? (L. Dagorn, N. Bez, T. Fauvel & E. Walker) | ✓(28 June 2013) |
| IOTC–2013–WPEB09–39 | The capture depth of the dominate bycatch species and the relationship between their catch rates and the sea surface temperature (J. Li, L. Song & D. Li) | ✓(28 June 2013) |
| IOTC–2013–WPEB09–40 | Estimation of bycatch and discard by Iranian fishing vessels (Gillnets) in IOTC area of competence in 2012 (R. Shahifar, H.R. Barghahi, R. Noori. & S. Khorshidi) | ✓(2 September 2013) |
| IOTC–2013–WPEB09–41 | Buoy gear – a potential for bycatch reduction in the small-scale swordfish fisheries: a Florida experience and Indian Ocean perspective (E.V. Romanov, D. Kerstetter, T. Moor & P. Bach) | ✓(4 September 2013) |
| IOTC–2013–WPEB09–42 | Self-reporting data collection project for the pelagic longline fishery based in La Reunion (P. Bach, P. Sabarros, L. Le Foulgoc, E. Richard, J.P. Lamoureux & E. Romanov) | ✓(4 September 2013) |
| IOTC–2013–WPEB09–43 | Comparing observer data with video monitoring on a French purse seiner in the Indian Ocean (P. Chavance, A. Batty, H. Mc Elderry, L. Dubroca, P. Dewals, P. Cauquil, V. Restrepo & L. Dagorn) | ✓(29 August 2013) |
| **Others** | | |

| Document | Title | Availability |
|---|---|---|
| IOTC–2013–WPEB09–44 | Consideration to improve tasks for CPUE standardisation and stock assessments of sharks in the IOTC-WPEB meetings (Anon) | ✓(30 August 2013) |
| IOTC–2013–WPEB09–45 | Provision of scientific advice for the purpose of the implementation of the EUPOA sharks. Final Report. European Commission, Studies for Carrying out the Common Fisheries Policy (MARE/2010/11 - LOT 2) (H. Murua, F.J. Abascal, J. Amande, J. Ariz, P. Bach, P. Chavance, R. Coelho, M. Korta, F. Poisson, M.N. Santos & B. Seret) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–46 Rev_1 | Catch and bycatch composition of illegal fishing in the British Indian Ocean Territory (BIOT) (S.M. Martin, J.M. Clark, J. Pearce & C.C. Mees) | ✓(2 September 2013)<br>✓(11 September 2013) |
| IOTC–2013–WPEB09–47 | Assessment of depredation level in Reunion Island pelagic longline fishery based on information from self-reporting data sampling programme (E.V. Romanov, P.S. Sabarros, L. Le Foulgoc, E. Richard, J.-P. Lamoureux & P. Bach) | ✓(4 September 2013) |
| **INFORMATION PAPERS/PRESENTATIONS** | | |
| IOTC–2013–WPEB09–INF01 | Guidelines for the presentation of stock assessment models (IOTC Scientific Committee) | ✓(26 June 2013) |
| IOTC–2013–WPEB09–INF02 | REGULATION (EU) No 605/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 June 2013 amending Council Regulation (EC) No 1185/2003 on the removal of fins of sharks on board vessels | ✓(20 August 2013) |
| IOTC–2013–WPEB09–INF03 | Brief presentation of the Portuguese research plan for the improvement of knowledge on pelagic sharks caught in the swordfish fishery in the Indian Ocean (M.N. Santos & R. Coelho) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF04 | A global review of species-specific shark-fin-to-body-mass ratios and relevant legislation (L. Biery & D. Pauly) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF05 | Population trends in Pacific Oceanic sharks and the utility of regulations on shark Finning (S.C. Clarke, S.J. Harley, S.D. Hoyle, & J.S. Rice) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF06 | Application of Generalized Linear Models and Generalized Estimation Equations to model at-haulback mortality of blue sharks captured in a pelagic longline fishery in the Atlantic Ocean (R. Coelho, P. Infante & M.N. Santosa) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF07 | Turtle lights for gillnets | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF08 | Developing ultraviolet illumination of gillnets as a method to reduce sea turtle bycatch (J. Wang, J. Barkan, S. Fisler, C. Godinez-Reyes & Y. Swimmer) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF09 | Marine turtles along the Indian coast: Distribution, status, threats and management implications (A. Kurian) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF10 | Canadian fishery closures provide a large scale test of the impact of gillnet bycatch on seabird populations (P. Regular, W. Montevecchi, A. Hedd, G. Robertson & S. Wilhelm) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF11 | Arctic Terns *Sterna paradisaea* from The Netherlands migrate record distances across three oceans to Wilkes Land, East Antarctica (R.C. Fijn, D. Hiemstra, R.A. Phillips & J. van der Winden) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF12 | Non-lethal strategies for mitigating odontocete bycatch and depredation in longline fisheries: physical and psychological deterrence at the hook (D. Hamer & S. Childerhouse) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF13 | Seasonal distribution, movements and taxonomic status of blue whales (*Balaenoptera musculus*) in the northern Indian Ocean (R.C Anderson, T.A. Branch, A. Agiyawadu, R. Baldwin & F. Marsac) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF14 | A critique of the ecosystem impacts of drifting and anchored FADs use by purse-seine tuna fisheries in the Western and Central Pacific Ocean (B. Leroy, J.S. Phillips, S. Nicol, G.M. Pilling, S. Harley, D. Bromhead, S. Hoyle, S. Caillot, V. Allain & J. Hampton) | ✓(28 August 2013) |

| Document | Title | Availability |
|---|---|---|
| IOTC–2013–WPEB09–INF15 | Global spatio-temporal patterns in tropical tuna purse seine fisheries on drifting fish aggregating devices (DFADs): Taking a historical perspective to inform current challenges (A. Fonteneau, E. Chassot & N. Bodin) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF16 | Towards an Integrated Shark Conservation and Management Measure for the Western and Central Pacific Ocean (S. Clarke) | ✓(28 August 2013) |
| IOTC–2013–WPEB09–INF17 | Glossary of scientific terms, acronyms and abbreviations, and report terminology | ✓(13 September 2013) |

# APPENDIX IV
## THE STANDING OF A RANGE OF INFORMATION RECEIVED BY THE IOTC SECRETARIAT FOR BYCATCH (INCLUDING BYPRODUCT) SPECIES

IOTC CPCs are 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 | **o** | **o** | **o** | | | |
| Crocodile shark | *Pseudocarcharias kamoharai* | PSK | | v | v | | | |
| Silky shark | *Carcharhinus falciformis* | FAL | v | | | | | |
| Oceanic whitetip shark | *Carcharhinus longimanus* | OCS | **o** | **o** | **o** | | | |
| 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 2013, are defined in **Table 1**, by type of fishery. Species of sharks that are known to occur in Indian Ocean fisheries directed at IOTC species or pelagic sharks are shown in **Appendix 1**. Species of seabirds and marine turtles are presented in **Tables 5** and **6**, respectively.

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
- 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.

## SHARKS

**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; Comoros ; 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; Comoros ; 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; EU(Portugal)
- 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
- 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

**SHARKS**

*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; EU-Portugal; 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 3.** 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*: 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*: 2013
*Deadline*: June (December) 30th of year following that for which data are due; first report due for 2014
*Binding status*: Obligatory
*Parties having provided data for industrial fleets*: Several parties have provided data concerning this requirement.
*Remarks*: For the sake of clarity it would be better to clarify which species or species groups are the focus of this requirement.

**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 V
# 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.
   - **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 **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 and oceanic whitetip shark.
   - **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.
   - **Coastal** fisheries of **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.

# APPENDIX VI
## IMPLEMENTATION OF THE REGIONAL OBSERVER SCHEME
(Updated16 September 2013)

| CPCs | Active Vessels LOA≥24m or High Seas vessels[2] | | | | Progress | List of accredited observers submitted | Number of observer reports provided (format of reports)[3] | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | LL | PS | GN | BB | | | 2010 | 2011 | 2012 | 2013[4] |
| **MEMBERS** | | | | | | | | | | |
| Australia | 6 | 5 | | | Australia has implemented an observer programme that complies with the IOTC Regional Observer Scheme. | **YES: 21** | **2(O)** | **1(O)** | **2(O)** | **No** |
| Belize | 6 | | | | No information received by the Secretariat. | **No** | **No** | **No** | **No** | **No** |
| China<br>–Taiwan,China | 36<br>370 | | | | China has an observer programme.<br>No observer reports provided. | **YES: 2**<br>**YES: 54** | **1(O)**<br>**No** | **No**<br>**No** | **No**<br>**No** | **No**<br>**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: 7** | N/A | N/A | N/A | N/A |
| Eritrea | No information received | | | | No information received by the Secretariat. | **No** | **No** | **No** | **No** | **No** |
| European Union | 44 | 22 | | | EU has an observer programme on-board its purse seine and longline fleets, however the programme is limited due to the piracy activity in the western Indian Ocean.<br>To date, no information has been received from EU,Spain and EU,UK | **EU,France: 25**<br>**EU,Portugal: 4**<br>**EU,Spain : No**<br>**EU,UK : No** | **No** | EU, France: 12**(O)**<br>EU, Portugal: 1**(O)** | EU, France: 13**(O)**<br>EU, Portugal: 1**(O)** | **No** |
| France (OT) | | 5 | | | France has an observer programme on board it purse seine fleet. | **YES: 23** | **No** | **9(O)** | **7(O)** | **No** |
| Guinea | | | | | No information received by the Secretariat. | **No** | **No** | **No** | **No** | **No** |
| India | 20 | | | | India has not developed any observer programme so far. | **No** | **No** | **No** | **No** | **No** |
| Indonesia | 1278 | | | | 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** | **No** |
| Iran, I R. of | | 4 | 1229 | | No information received by the Secretariat. | **No** | **No** | **No** | **No** | **No** |
| Japan | 72 | | | | Japan has started its observer programme on the 1st of July 2010, and 19 observers are currently being deployed in the Indian Ocean. | **YES: 19** | **6(E)** | **8(E)** | **No** | **No** |
| Kenya | 2 | | | | Kenya is developing an observer programme and 5 observers have been trained under the SWIOFP training. | **YES: 5** | **No** | **No** | **No** | **No** |
| Korea, Rep. of | 7 | 3 | | | Korea has an observer programme since 2002 with 3 observers being deployed in the Indian Ocean giving a14.5% coverage of the fishing operation in 2009. | **YES: 20** | **2(O)** | **No** | **2(O)** | **No** |

[2] The number of active vessels is given for 2012.
[3] Year in which the observed trip has started (E: Electronic; O: Other)
[4] 2013 data covers only the first quarter. Will be updated for the SC.

| CPCs | Active Vessels LOA≥24m or High Seas vessels[2] | | | | Progress | List of accredited observers submitted | Number of observer reports provided (format of reports)[3] | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | LL | PS | GN | BB | | | 2010 | 2011 | 2012 | 2013[4] |
| Madagascar | 8 | | | | Madagascar is developing an observer programme. Five and three observers have been trained respectively under the SWIOFP and the IOC projects. Although Madagascar reported observer coverage for the last quarter of 2012, no observer reports have been provided to date. | YES: 7 | No | No | No | No |
| Malaysia | 5 | | | | No information received by the Secretariat. | No | No | No | No | No |
| Maldives | | | | 249 | Maldives vessels are monitored by field samplers at landing sites. | No | No | No | No | No |
| Mauritius | 5 | | | | Mauritius is developing an observer programme, and, 5 and 3 observers have been trained respectively under the SWIOFP and the IOC projects. | YES: 8 | No | No | No | No |
| Mozambique | 1 | | | | No information received by the Secretariat. | YES: 11 | No | No | No | No |
| Oman | 8 | | | | No information received by the Secretariat. | No | No | No | | |
| Pakistan | | | 10 | | No information received by the Secretariat. | No | No | No | No | No |
| Philippines | 14 | | | | No information received by the Secretariat. | No | No | No | No | No |
| Seychelles | 28 | 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 | No |
| Sierra Leone | No information received | | | | No information received by the Secretariat. | No | No | No | No | No |
| Sri Lanka | | | 2482 | | Sri Lanka has not started the implementation of an observer programme. The fleet is multipurpose, using mainly gillnets and longlines. | No | No | No | No | No |
| Sudan | No information received | | | | No information received by the Secretariat. | No | No | No | No | No |
| Tanzania, United Rep.of | 7 | | | | No information received by the Secretariat. | No | No | No | No | No |
| Thailand | 2 | | | | Thailand has not developed an observer programme so far. | No | No | No | No | No |
| United Kingdom | | | | | UK does not have any active vessels in the Indian Ocean. | N/A | N/A | N/A | N/A | N/A |
| Vanuatu | 2 | | | | No information received by the Secretariat. | No | No | No | No | No |
| Yemen | No information received | | | | No information received by the Secretariat. | No | No | No | No | No |
| **COOPERATING NON-CONTRACTING PARTIES** | | | | | | | | | | |
| Senegal | | | | | Since 2007 Senegal does not have any active vessels in the Indian Ocean. | N/A | N/A | N/A | N/A | N/A |
| South Africa | 13 | | | | South Africa has only an observer programme for foreign vessels operating in the EEZ of South Africa at the moment. | YES: 16 | No | 13[5] | 13[6] | No |

[5] Reports from South African observers onboard foreign vessels operating in the EEZ of South Africa.
[6] *Ibid.* 3.

# APPENDIX VII

## PROGRESS ON THE DEVELOPMENT AND IMPLEMENTATION OF NPOAS FOR SHARKS AND SEABIRDS

(Updated16 September 2013)

| CPC | Sharks | Date of Implementation | Seabirds | Date of implementation | Comments |
|---|---|---|---|---|---|
| **MEMBERS** | | | | | |
| **Australia** | | 14-Apr-2004 | | 2006 | Sharks: 2nd NPOA-Sharks (Shark-plan 2) was released in July 2012, along with an operational strategy for implementation: http://www.daff.gov.au/fisheries/environment/sharks/sharkplan2 Seabirds: Has implemented a Threat Abatement Plan [TAP] for the Incidental Catch (or Bycatch) of Seabirds During Oceanic Longline Fishing Operations since 1998. The present TAP took effect from 2006 and largely fulfills the role of an NPOA in terms of longline fisheries. The 2006 TAP is currently under review. Also currently undertaking an assessment of seabird bycatch in trawl, gillnet and purse seine fisheries, and will develop an NPOA to bring together fisheries plans and actions to reduce the incidental catch of seabirds in longline, trawl and gillnet fisheries. |
| **Belize** | | | | | Sharks: No information received by the Secretariat.<br>Seabirds: No information received by the Secretariat. |
| **China** | | – | | – | Sharks: Development has not begun.<br>Seabirds: Development has not begun. |
| **–Taiwan,China** | | May 2006 | | May 2006 | Sharks: No revision currently planned.<br>Seabirds: No revision currently planned. |
| **Comoros** | | – | | – | Sharks: Development has not begun.<br>Seabirds: Development has not begun. |
| **Eritrea** | | | | | Sharks: No information received by the Secretariat.<br>Seabirds: No information received by the Secretariat. |
| **European Union** | | 5 Feb 2009 | | 16-Nov-2012 | Sharks: Approved on 05-Feb-2009 and it is currently being implemented.<br>Seabirds: The EU adopted on Friday 16 November an Action Plan to address the problem of incidental catches of seabirds in fishing gears. |
| **France (territories)** | | | | | Sharks: Approved on 05-Feb-2009 but not yet implemented.<br>Seabirds: No information received by the Secretariat. |
| **Guinea** | | | | | Sharks: No information received by the Secretariat.<br>Seabirds: No information received by the Secretariat. |
| **India** | | | | | Sharks: Currently being drafted with the assistance of BOBP-IGO<br>Seabirds: India has determined that seabird interactions are not a problem for their fleets. |
| **Indonesia** | | – | | – | Sharks: NPOA guidelines developed and released for public comment among stakeholders in 2010 (funded by ACIAR Australia—DGCF). Training to occur in 2011, including data collection for sharks based on forms of statistical data to national standards (by DGCF (supported by ACIAR Australia). Implementation expected late 2011/early 2012.<br>Seabirds: Development has not begun. |
| **Iran, Islamic Republic of** | | – | | – | Sharks: Have communicated to all fishing cooperatives the IOTC resolutions on sharks. Have in place a ban on the retention of live sharks.<br>Seabirds: I.R. Iran determined that seabird interactions are not a problem for their fleet as |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | they consist of gillnet vessels only. |
| **Japan** | | 03-Dec-2009 | | 03-Dec-2009 | Sharks: NPOA–Shark assessment implementation report submitted to COFI in July 2012<br>Seabirds: NPOA–Seabird implementation report submitted to COFI in July 2012. |
| **Kenya** | | | n.a. | – | Sharks: Due to paucity of the most basic information on shark stocks in Kenyan waters, it was decided the NPOA-Sharks be developed in the planning year 2014/ 2015. This will enable the country to carry out some baseline surveys on the shark fishery in the 2013/ 2014 planning year.<br>Seabirds: Kenya does not have any flagged longline vessels on its registry. There is no evidence of any gear seabird interaction with the current fishing fleet. Kenya does not therefore consider developing NPOA seabirds as necessary for the time being. |
| **Korea, Republic of** | | – | | – | Sharks: Approved on 18/08/2011 and is currently being implemented.<br>Seabirds: Early stages of development. |
| **Madagascar** | | – | | – | Sharks: Development has not begun.<br>Seabirds: Development has not begun.<br>Note: A fisheries monitoring system is in place in order to ensure compliance by vessels with the IOTC's shark and seabird conservation and management measures. |
| **Malaysia** | | 2006 | n.a. | – | Sharks: A review of the NPOA-Shark (2006) is in the final stages, with stakeholder consultation due to be completed in September 2013. A revised NPOA-Sharks is expected to be published by the end of 2013.<br>Seabirds: Malaysia has carried out a review and determined that an NPOA-Seabirds is not necessary as no longline vessels flagged to Malaysia fish south of 20 degrees south. |
| **Maldives, Republic of** | | – | n.a. | – | Sharks: An earlier draft of the NOPA is available: Gaps/issues that arose following the total shark ban have been identified through support from the Bay of Bengal Large Marine Ecosystem (BOBLME) Project. Presently Maldives is seeking further support from BOBLME Project to finalize the plan and associated regulation to be published in Government Gazette.<br>Seabirds: Article 12 of IPOA states that if a 'problem exists' CPCs adopt an NPOA. IOTC Resolution 05/09 suggests CPCs to report on seabirds to the IOTC Scientific Committee if the issue is appropriate'. Maldives considers that seabirds are not an issue in Maldives fisheries, both in the pole-and-line fishery and in the longline fishery. The new longline fishing regulations has provision on mitigation measures on seabird bycatch. Maldives will be reporting on seabirds to the appropriate technical Working Party meetings of IOTC. |
| **Mauritius** | | | | | Sharks: Currently being drafted.<br>Seabirds: Drafting will commence upon completion of NPOA–Sharks. In the meantime fishing companies have been requested to implement all mitigation measures as provided in the IOTC Resolutions. |
| **Mozambique** | | – | | – | Sharks: Development has not begun.<br>Seabirds: Development has not begun. |
| **Oman, Sultinate of** | | | | | Sharks: No information received by the Secretariat.<br>Seabirds: No information received by the Secretariat. |
| **Pakistan** | | | | | Sharks: No information received by the Secretariat.<br>Seabirds: No information received by the Secretariat. |
| **Philippines** | | Sept. 2009 | | – | Sharks: Under periodic review. Shark catches for 2010 provided to the Secretariat.<br>Seabirds: Development has not begun. No seabird interactions recorded. |
| **Seychelles, Republic of** | | Apr-2007 | | – | Sharks: NPOA-sharks to be reviewed in 2012.<br>Seabirds: Development has not begun. |

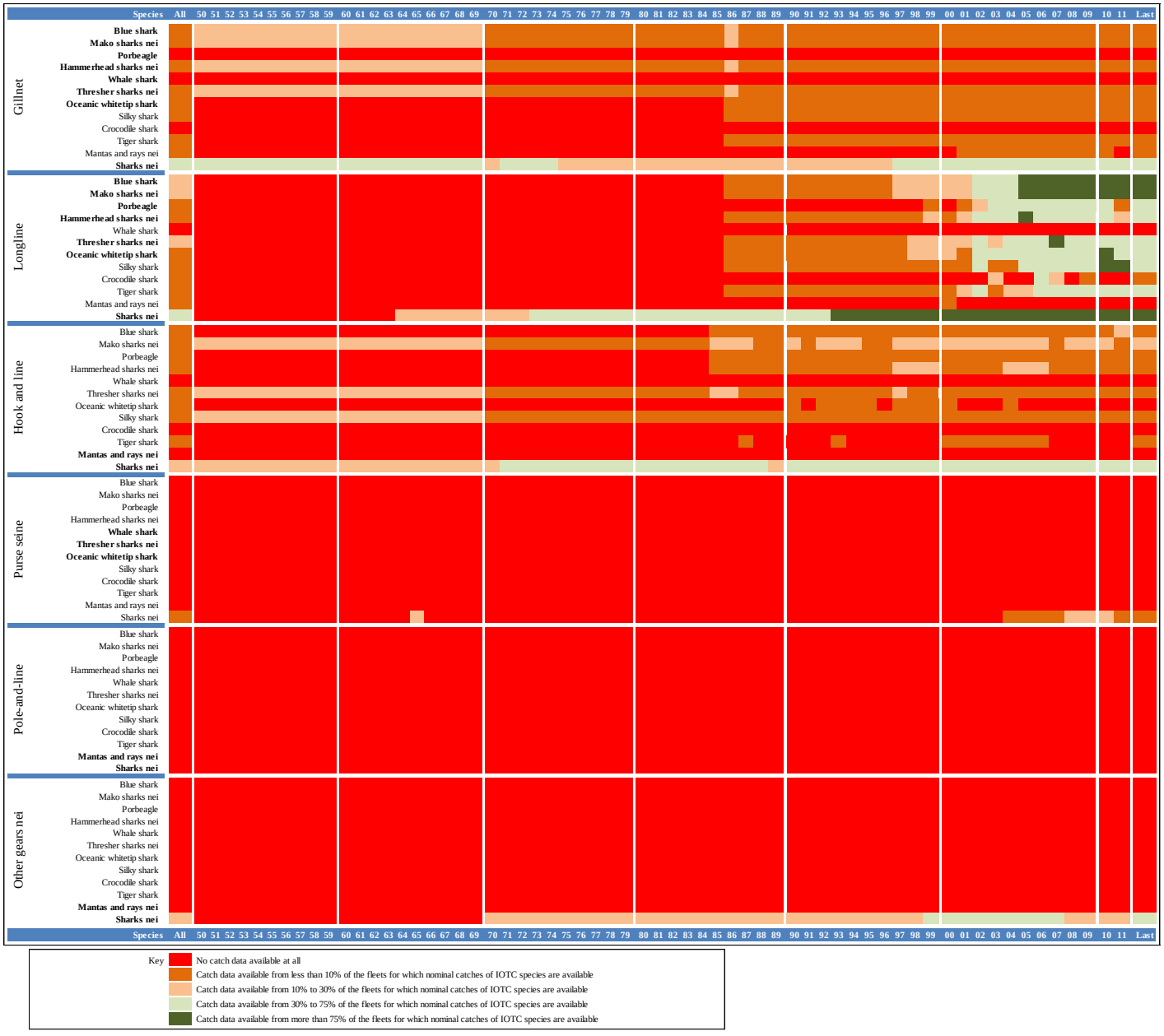
| | | | | | |
|---|---|---|---|---|---|
| **Sierra Leone** | | | | | Sharks: No information received by the Secretariat.<br>Seabirds: No information received by the Secretariat. |
| **Sri Lanka** | | | | | Sharks: An NPOA-sharks is currently being finalized and is expected to be completed prior to the SC meeting in 2013.<br>Seabirds: Sri Lanka has determined that seabird interactions are not a problem for their fleets. |
| **Sudan** | | | | | Sharks: No information received by the Secretariat.<br>Seabirds: No information received by the Secretariat. |
| **Tanzania, United Republic of** | | – | | – | Sharks: Initial discussions have commenced.<br>Seabirds: Initial discussions have commenced.<br>Note: Terms and conditions related to protected sharks and seabirds contained within fishing licenses. |
| **Thailand** | | 23-Nov-2005 | | – | Sharks: Second NPOA-sharks currently being drafted.<br>Seabirds: Development has not begun. |
| **United Kingdom** | n.a. | – | n.a. | – | Not applicable: British Indian Ocean Territory (Chagos Archipelago) waters are a Marine Protected Area closed to fishing except recreational fishing around Diego Garcia. For sharks, UK is the 24th signatory to the Convention on Migratory Species 'Memorandum of Understanding on the Conservation of Migratory Sharks' which extends the agreement to UK Overseas Territories including British Indian Ocean Territories; Section 7 (10) (e) of the *Fisheries (Conservation and Management) Ordinance* refers to recreational fishing and requires sharks to be released alive. No seabirds are caught in the recreational fishery. |
| **Vanuatu** | | | | | Sharks: No information received by the Secretariat.<br>Seabirds: No information received by the Secretariat. |
| **Yemen** | | | | | Sharks: No information received by the Secretariat.<br>Seabirds: No information received by the Secretariat. |
| **COOPERATING NON-CONTRACTING PARTIES** | | | | | |
| **Senegal** | | 25-Sept-2006 | | – | Sharks: The Sub-Regional Fisheries Commission supported the development of a NPOA-sharks for Senegal in 2005. Other activities conducted include the organization of consultations with industry, the investigation of shark biology and social -economics of shark fisheries). The NPOA is currently being revised. Consideration is being made to the inclusion of minimum mesh size, minimum shark size, and a ban on shark finning.<br>Seabirds: The need for a NPOA-seabirds has not yet been assessed. |
| **South Africa, Republic of** | | – | | 2008 | Sharks: The gazetting of the draft NPOA-sharks for public comment has been approved by the Minister of the Department of Agriculture, Forestry and Fisheries (6 July 2012).<br>Seabirds: Published in August 2008 and fully implemented. The NPOA-seabirds has been earmarked for review. |

| Colour key | |
|---|---|
| NPOA Completed | |
| Drafting being finalised | |
| Drafting commenced | |
| Not begun | |

# APPENDIX VIII
## 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 1950–2011

Shark species in bold are those identified by the Commission in 2013, 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 1950–2011 and 2007–11 are shown column ***All*** and ***Last***, respectively.



# APPENDIX IX
# STATUS OF FISHERIES STATISTICS FOR SHARKS

*Extract from IOTC–2013–WPEB09–08*

*(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 2013, through the adoption of IOTC Resolution 13/03 *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 [IOTC–2013–WPEB09–08 ]**.

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

The availability of shark nominal catch data over the period 1950–2011 for those shark species identified by the Commission (**Table 1**), by species, gear type, and year, is presented in **Appendix 2 [IOTC–2013–WPEB09–08]**. 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 [IOTC–2013–WPEB09–08])**, 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.

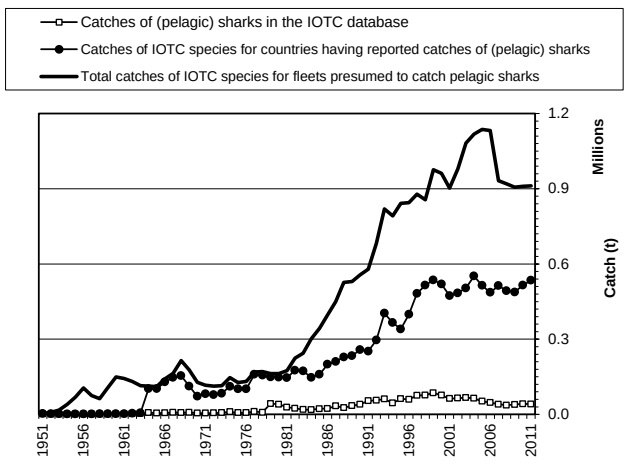



**Fig. 1.** Catches of pelagic sharks recorded in the IOTC

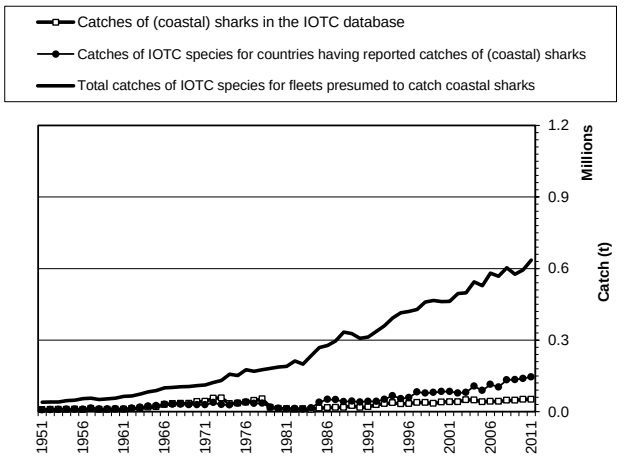



**Fig. 2.** Catches of coastal sharks recorded in the IOTC

| | |
|---|---|
| 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 (1950–2011). | nominal catches database versus the total catches of tuna 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 (1950–2011). |
| 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 (**Fig. 3**). 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). **Fig. 4** shows the proportion that the catches of sharks that are recorded in the IOTC database at the species level (green shading in **Fig. 3**, or between 5–35% of the total catches of sharks recorded) made over the total combined catches of those sharks, by species and year, for the period 1950–2012.

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.

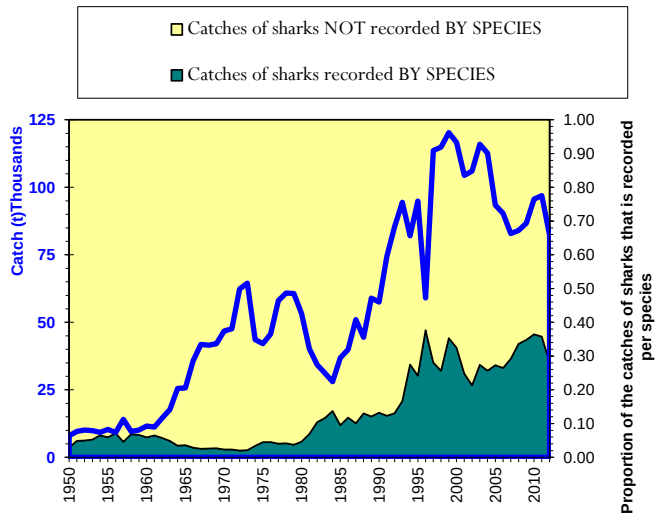



**Fig. 3.** Proportion of the catches of sharks that are recorded by species in the IOTC nominal catches database *versus* those recorded in aggregated form (1950–2012) (The total catches of sharks recorded per year are also shown (blue line, left axis)).

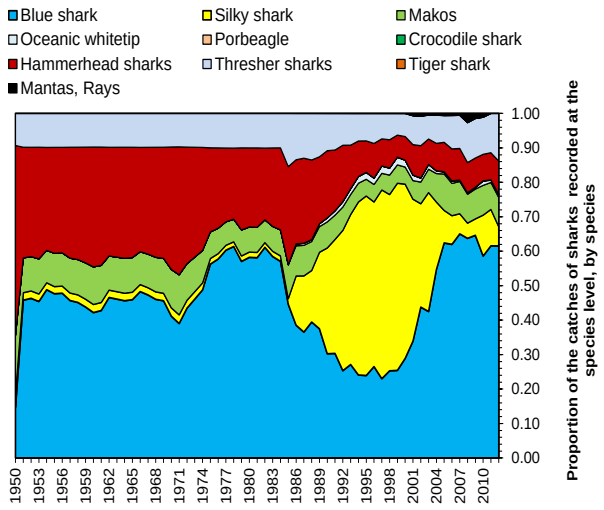



**Fig. 4.** Proportion that the catches of sharks reported by species make out of the total combined catches of those sharks, by year and species (1950–2012).

**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 (**Fig. 5**).

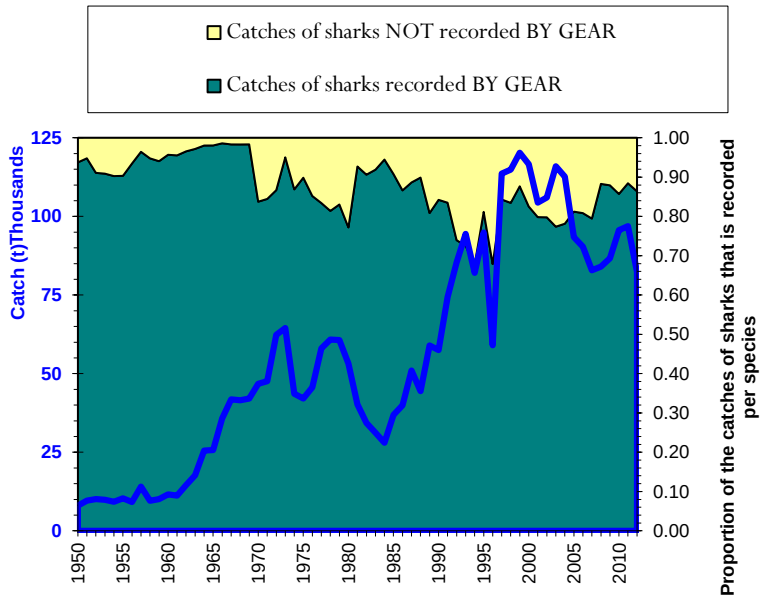



**Fig. 5.** Proportion of the catches of sharks that are recorded by gear in the IOTC nominal catches database versus those recorded in aggregated form (1950–2012) (The total catches of sharks recorded per year are also shown (white line, left axis)).

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[7], 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.
- **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**).

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

- **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, have in the past (Sri Lanka, Indonesia, Yemen) or are likely to catch significant amounts of pelagic sharks (Indonesia, Yemen).
    - In recent years Sri Lanka has reported lower catches of sharks with catches in 2012 only representing <4% of the total catches of all species combined.
    - 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. 6**), 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.

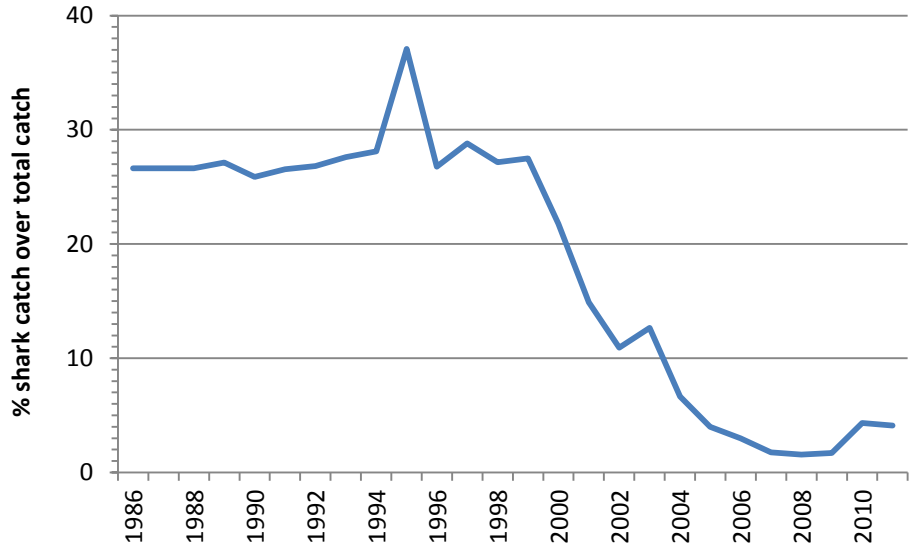



**Fig. 6.** Proportion that the combined catches of sharks made out of the total combined catches of sharks and IOTC species for the gillnet and longline fishery of Sri Lanka, by year, for the period 1986–2011.

- **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**: **Fig. 7** 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. 8** presents total numbers of sharks by grid for major shark species, by species, and combined for other species, for the period 2007–12.

Finally, **Figure 9** present numbers of shark reported for the longline fleet of Japan, by species for the years 2009–12.

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 following years. In addition, the catches available are considered to be incomplete, as they are likely to not include discards.

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

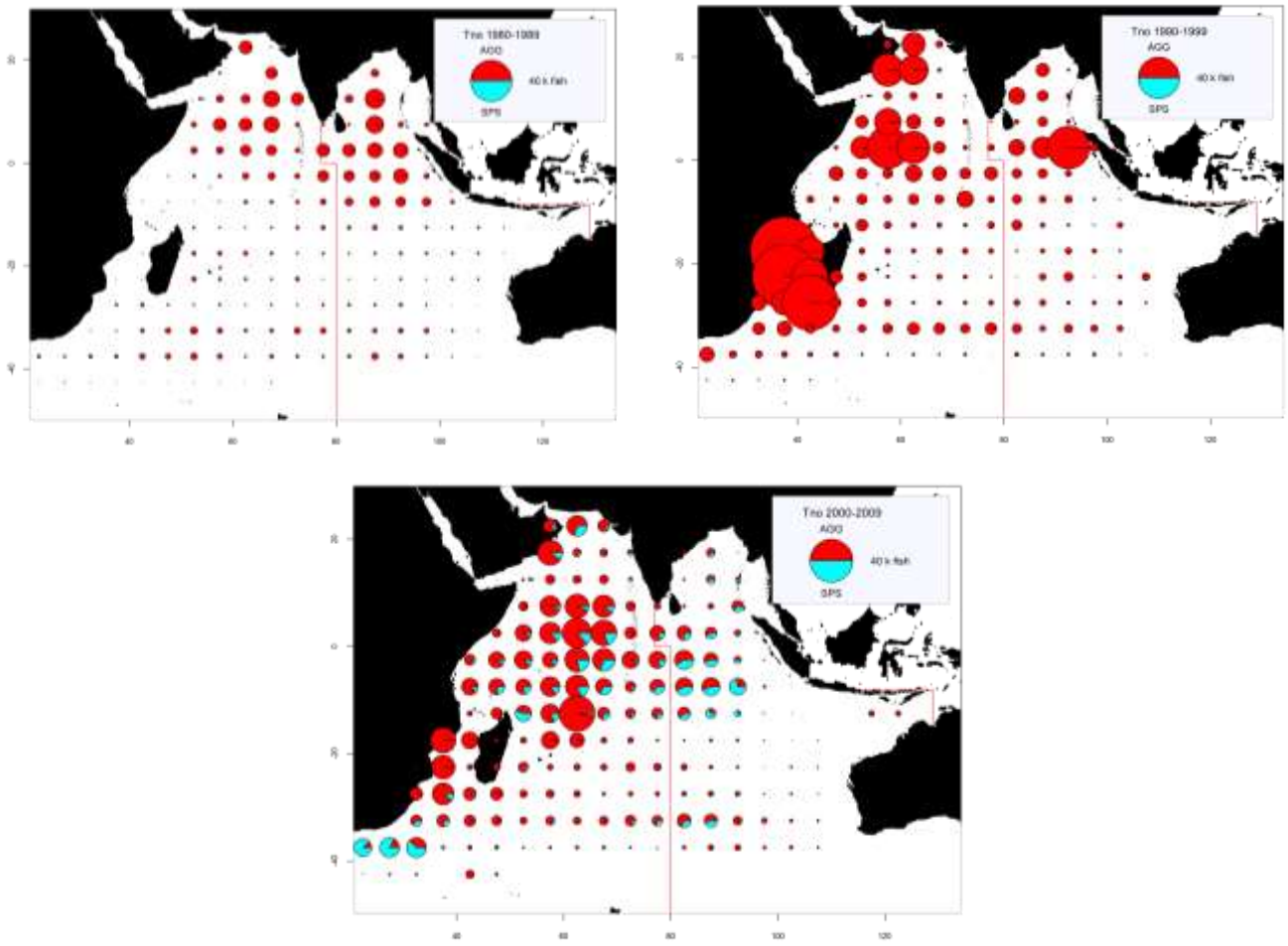



**Fig. 7a–c.** Time-area catches (total combined in number) of sharks available for the period 1980–2009 for deep-freezing longliners flagged in Taiwan,China, by decade and type of catch reported. Catch reported by species (**SPS**, Blue), Catch reported aggregated (**AGG,** Red).

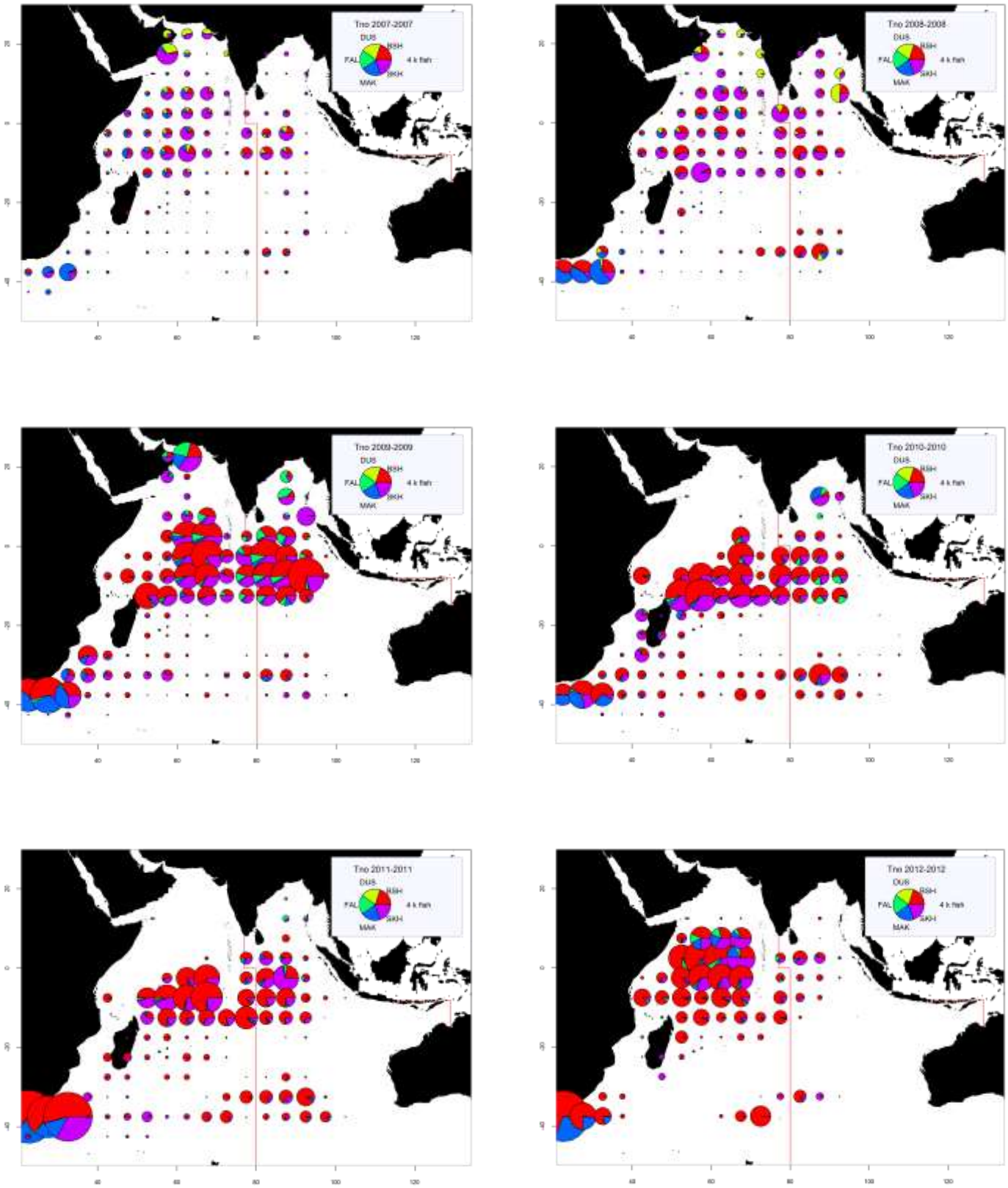



**Fig. 8a–f.** Time-area catches (total combined in number) of sharks available for the period 2007–2012 for deep-freezing longliners flagged in Taiwan,China, by year and species. Blue shark (**BSH**, red); Dusky shark (**DUS,** green); Mako sharks (**MAK**, blue); Other shark species (**SKH**, purple).

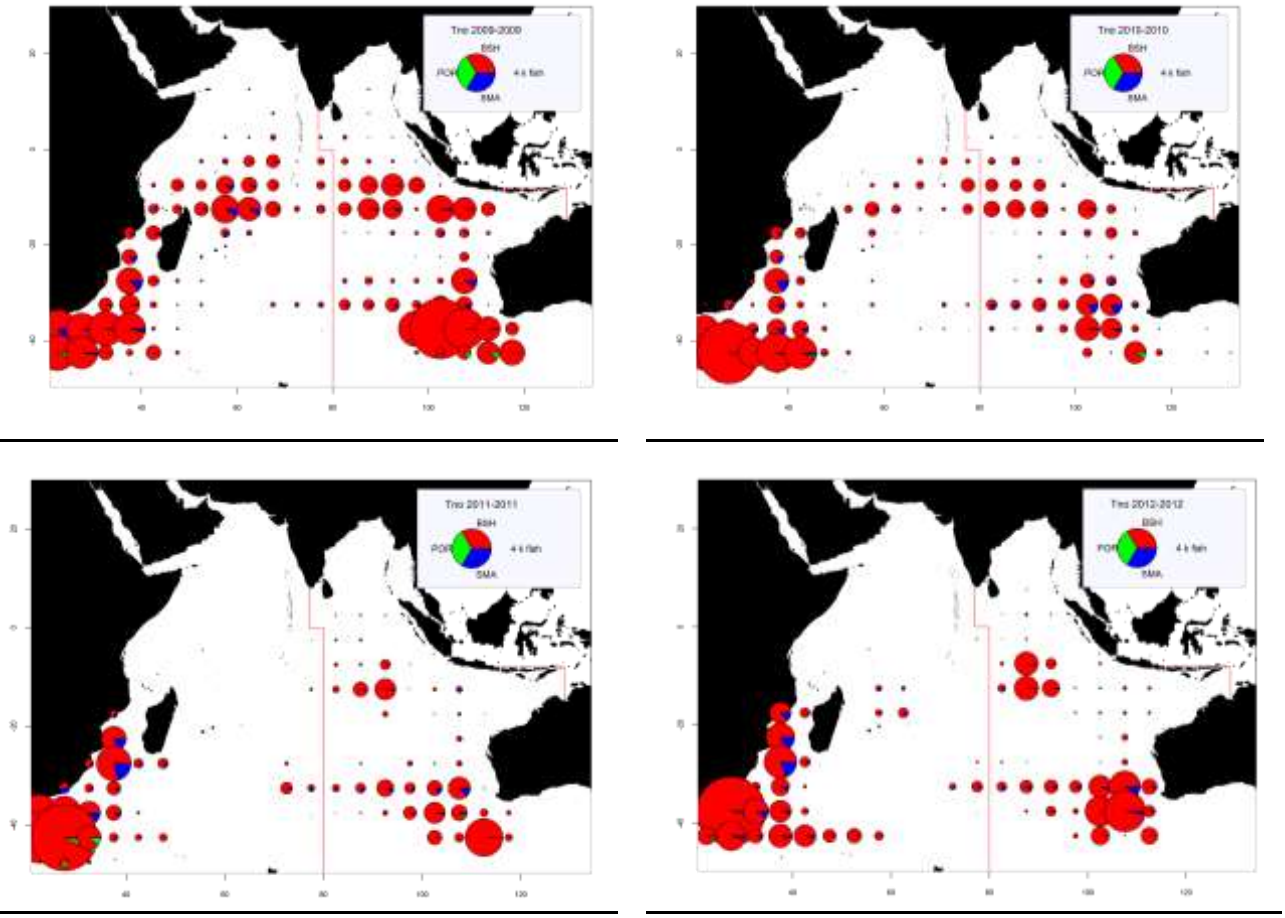


**Fig. 9a–d.** Time-area catches (total combined in number) of sharks available for the period 2009–2012 for deep-freezing longliners flagged to Japan, by year and species. Blue shark (**BSH**, red); Porbeagle (**POR,** green); Shortfin mako (**MAK**, blue).

**Length frequency data**: **Fig. 10** 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. **Fig. 11** 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**. To date no countries have reported shark length data for 2011 and 2012.


**Fig. 10.** 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.

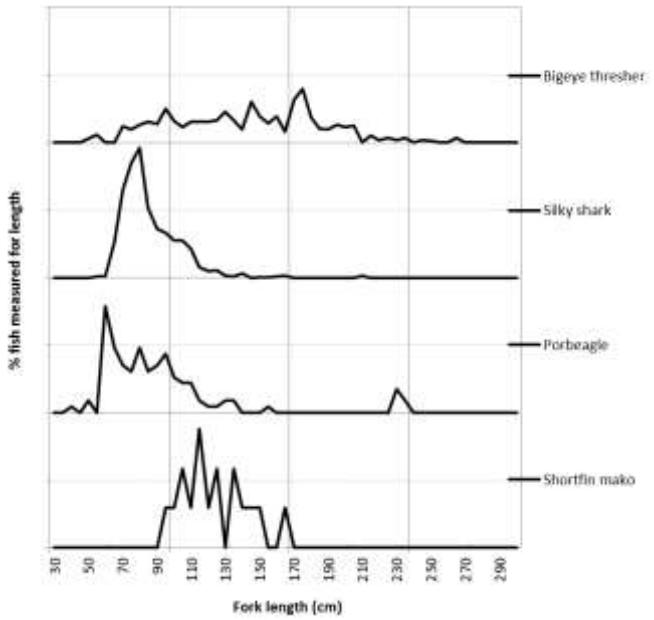



**Fig. 11.** Length frequency distributions (%) of bigeye thresher, silky shark, porbeagle, and shortfin mako, as derived from the samples available from longline fleets (2005–10). Broken horizontal gridlines refer to 10% of the fish.

# APPENDIX 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 (BSH: *Prionace glauca*)

**TABLE 1**. Blue shark: Status of blue shark (*Prionace glauca*) in the Indian Ocean

| Area[1] | Indicators | | 2013 stock status determination |
|---|---|---|---|
| Indian Ocean | Reported catch 2011:<br>Not elsewhere included (nei) sharks:<br>Average reported catch 2007–2011:<br>Not elsewhere included (nei) sharks: | 9,540 t<br>55,135 t<br>9,452 t<br>63,783 t | Uncertain |
| | MSY:<br>$F_{2012}/F_{MSY}$:<br>$SB_{2012}/SB_{MSY}$:<br>$SB_{2012}/SB_0$: | unknown<br>unknown<br>unknown<br>unknown | |

[1]Boundaries for the Indian Ocean = IOTC area of competence

| 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 | | |

**TABLE 2.** Blue shark: 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, Stevens 2009

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** 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 (Table 1). The current IUCN threat status of 'Near Threatened' applies to blue sharks globally (Table 2). 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 following should be noted:

- 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.

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

- Noting that current reported catches (probably largely underestimated) are estimated at an average ~ 9,452 t over the last five years, ~ 9,540 t in 2011, maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE.
- Mechanisms need to be developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

# 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 (OCS: *Carcharhinus longimanus*)

**TABLE 1**. Oceanic whitetip shark: Status of oceanic whitetip shark (*Carcharhinus longimanus*) in the Indian Ocean

| Area[1] | Indicators | | 2013 stock status determination |
|---|---|---|---|
| Indian Ocean | Reported catch 2011:<br>Not elsewhere included (nei) sharks:<br>Average reported catch 2007–2011:<br>Not elsewhere included (nei) sharks: | 388 t<br>55,135 t<br>347 t<br>63,783 t | Uncertain |
| | MSY:<br>$F_{2012}/F_{MSY}$:<br>$SB_{2012}/SB_{MSY}$:<br>$SB_{2012}/SB_0$: | unknown<br>unknown<br>unknown<br>unknown | |

[1]Boundaries for the Indian Ocean = IOTC area of competence

| 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 | | |

**NOTE:** IOTC Resolution 13/06 *on a scientific and management framework on the conservation of shark species caught in association with IOTC managed fisheries*, prohibits retention onboard, transhipping, landing or storing any part or whole carcass of oceanic whitetip sharks.

**TABLE 2.** Oceanic whitetip shark: 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, Baum et al. 2006
CITES - In March 2013, CITES agreed to include oceanic whitetip shark to Appendix II to provide further protections prohibiting the international trade; which will become effective on September 14, 2014.

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** 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 (Table 1). The current IUCN threat status of 'Vulnerable' applies to oceanic whitetip sharks globally (Table 2). 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 (Table 1). 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.

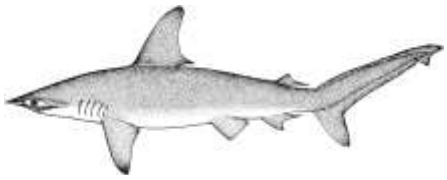
[9] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

***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 following should be noted:

- 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 ~347 t over the last five years, ~388 t in 2011, maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE.
- Mechanisms need to be developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

# 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 (SPL: *Sphyrna lewini*)

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

| Area[1] | Indicators | | 2013 stock status determination |
|---|---|---|---|
| Indian Ocean | Reported catch 2011:<br>Not elsewhere included (nei) sharks:<br>Average reported catch 2007–2011:<br>Not elsewhere included (nei) sharks: | 120 t<br>55,135 t<br>36 t<br>63,783 t | Uncertain |
| | MSY:<br>$F_{2012}/F_{MSY}$:<br>$SB_{2012}/SB_{MSY}$:<br>$SB_{2012}/SB_0$: | unknown<br>unknown<br>unknown<br>unknown | |

[1]Boundaries for the Indian Ocean = IOTC area of competence

| 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 | | |

**TABLE 2.** 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 | – |

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean
Sources: IUCN 2007, Baum 2007

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** The current IUCN threat status of 'Endangered' applies to scalloped hammerhead 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 following should be noted:

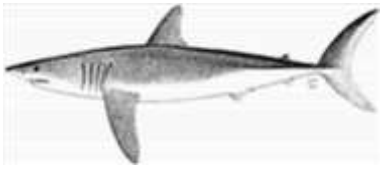
- The available evidence indicates considerable risk to the stock status at current effort levels.

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

- 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 ~36 t over the last five years, ~120 t in 2011, maintaining or increasing effort will probably result in further declines in biomass and productivity.
- Mechanisms need to be developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

# 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 (SMA: *Isurus oxyrinchus*)

**TABLE 1**. Shortfin mako shark: Status of shortfin mako shark (*Isurus oxyrinchus*) in the Indian Ocean

| Area[1] | Indicators | | 2013 stock status determination |
|---|---|---|---|
| Indian Ocean | Reported catch 2011:<br>Not elsewhere included (nei) sharks:<br>Average reported catch 2007–2011:<br>Not elsewhere included (nei) sharks: | 1,361 t<br>55,135 t<br>1,207 t<br>63,783 t | Uncertain |
| | MSY:<br>$F_{2012}/F_{MSY}$:<br>$SB_{2012}/SB_{MSY}$:<br>$SB_{2012}/SB_0$: | unknown<br>unknown<br>unknown<br>unknown | |

[1]Boundaries for the Indian Ocean = IOTC area of competence

| 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 | | |

**TABLE 2.** Shortfin mako shark: 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, Cailliet 2009

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** 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 (Table 1). The current IUCN threat status of 'Vulnerable' applies to shortfin mako sharks globally (Table 2). 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 following should be noted:

- The available evidence indicates considerable risk to the stock status at current effort levels.

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

- 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 ~1207 t over the last five years, ~1361 t in 2011, maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE.
- Mechanisms need to be developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

# 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 (FAL: *Carcharhinus falciformis*)

**TABLE 1**. Silky shark: Status of silky shark (*Carcharhinus falciformis*) in the Indian Ocean

| Area[1] | Indicators | | 2013 stock status determination |
|---|---|---|---|
| Indian Ocean | Reported catch 2011:<br>Not elsewhere included (nei) sharks:<br>Average reported catch 2007–2011:<br>Not elsewhere included (nei) sharks: | 3,353 t<br>55,135 t<br>1,396 t<br>63,783 t | Uncertain |
| | MSY:<br>$F_{2012}/F_{MSY}$:<br>$SB_{2012}/SB_{MSY}$:<br>$SB_{2012}/SB_0$: | unknown<br>unknown<br>unknown<br>unknown | |

[1]Boundaries for the Indian Ocean = IOTC area of competence

| 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 | | |

**TABLE 2.** Silky shark: 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, 2012

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** There remains considerable uncertainty about the relationship between abundance and the nominal CPUE series from the main longline fleets, and about the total catches over the past decade (Table 1). The current IUCN threat status of 'Near Threatened' applies to silky sharks in the western and eastern Indian Ocean and globally (Table 2). 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 following should be noted:

- 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.

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

- Noting that current reported catches (probably largely underestimated) are estimated at an average ~1,396 t over the last five years, ~ 3,353 t in 2011, maintaining or increasing effort will probably result in further declines in biomass.
- Mechanisms need to be developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

# 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 (BTH: *Alopias superciliosus*)

**TABLE 1**. Bigeye thresher shark: Status bigeye thresher shark (*Alopias superciliosus*) in the Indian Ocean

| **Area**[1] | **Indicators** | | **2013 stock status determination** |
|---|---|---|---|
| Indian Ocean | Reported catch 2011:<br>Not elsewhere included (nei) sharks:<br>Average reported catch 2007–2011:<br>Not elsewhere included (nei) sharks: | 330 t<br>55,135 t<br>68 t<br>63,783 t | Uncertain |
| | MSY:<br>$F_{2012}/F_{MSY}$:<br>$SB_{2012}/SB_{MSY}$:<br>$SB_{2012}/SB_0$: | unknown<br>unknown<br>unknown<br>unknown | |

[1]Boundaries for the Indian Ocean = IOTC area of competence

| **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 | | |

**TABLE 2.** Bigeye thresher shark: 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, Amorim et al. 2009

**NOTE:** IOTC Resolution 12/09 *On the conservation of thresher sharks (family Alopiidae) caught in association with fisheries in the IOTC area of competence*, prohibits retention onboard, transhipping, landing, storing, selling or offering for sale any part or whole carcaess of thresher sharks of all the species of the family Alopiidae[14].

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** 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 (Table 1). The current IUCN threat status of 'Vulnerable' applies to bigeye thresher shark globally (Table 2). 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 9–3 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

[13] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only
[14] Scientific observers shall be allowed to collect biological samples from thresher sharks that are dead at haulback, provided that the samples are part of the research project approved by the Scientific Committee (or the Working Party on Ecosystems and Bycatch).

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 Resolution 12/09 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 following should be noted:

- 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 ~68 t over the last five years, ~330 t in 2011, maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE.
- Mechanisms need to be developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

# 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 (PTH: *Alopias pelagicus*)

**TABLE 1.** Pelagic thresher shark: Status pelagic thresher shark (*Alopias pelagicus*) in the Indian Ocean

| Area[1] | Indicators | | 2013 stock status determination |
|---|---|---|---|
| Indian Ocean | Reported catch 2011: | 10 t | Uncertain |
| | Not elsewhere included (nei) sharks: | 55,135 t | |
| | Average reported catch 2007–2011: | 4 t | |
| | Not elsewhere included (nei) sharks: | 63,783 t | |
| | MSY: | unknown | |
| | $F_{2012}/F_{MSY}$: | unknown | |
| | $SB_{2012}/SB_{MSY}$: | unknown | |
| | $SB_{2012}/SB_0$: | unknown | |

[1]Boundaries for the Indian Ocean = IOTC area of competence

| 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 | | |

**TABLE 2.** Pelagic thresher shark: IUCN threat status of pelagic thresher shark (*Alopias pelagicus*) in the Indian Ocean

| Common name | Scientific name | IUCN threat status[15] | | |
|---|---|---|---|---|
| | | 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, Reardon et al. 2009

**NOTE:** IOTC Resolution 12/09 *On the conservation of thresher sharks (family Alopiidae) caught in association with fisheries in the IOTC area of competence*, prohibits retention onboard, transhipping, landing, storing, selling or offering for sale any part or whole carcaess of thresher sharks of all the species of the family Alopiidae[16].

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** 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 (Table 1). The current IUCN threat status of 'Vulnerable' applies to pelagic thresher shark globally (Table 2). 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.

[15] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only
[16] Scientific observers shall be allowed to collect biological samples from thresher sharks that are dead at haulback, provided that the samples are part of the research project approved by the Scientific Committee (or the Working Party on Ecosystems and Bycatch).

***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 following should be noted:

- 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 ~10 t in 2011, maintaining or increasing effort will probably result in further declines in biomass, productivity and CPUE.
- Mechanisms need to be developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks.

# APPENDIX XVII
# DRAFT RESOURCE STOCK STATUS SUMMARY – MARINE TURTLES

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

## Status of marine turtles in the Indian Ocean

**TABLE 1.** Marine turtles: 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[17] |
|---|---|---|
| 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 |

Sources: Marine Turtle Specialist Group 1996, Red List Standards & Petitions Subcommittee 1996, Sarti Martinez (Marine Turtle Specialist Group) 2000, Seminoff 2004, Abreu-Grobois & Plotkin 2008, Mortimer et al. 2008, IUCN 2012

### 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 is likely to be substantial as shown by the Ecological Risk Assessment undertaken in 2012/13, and an order of magnitude higher than longline and purse seine gears for which mitigation measures are in place.

***Outlook.*** Resolution 12/04 *On the conservation of marine turtles* includes an annual evaluation requirement (para. 17) by the Scientific Committee. However, given the lack of reporting of marine turtle interactions by CPCs to date, such an evaluation cannot not be undertaken. Unless IOTC CPCs become compliant with the data collection and reporting requirements for marine turtles, the WPEB and the SC 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 following should be noted:

- The available evidence indicates considerable risk to 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 interactions are known to be a severe underestimate: 39 interactions reported in 2010 by 3 CPCs.
- The Ecological Risk Assessment conducted by Nel et al. (2013) concluded that, from the limited data received on longlining and purse seining, the former posed the greater apparent risk to marine turtles. The ERA estimated that ~3,500 marine turtles are caught by longliners annually, followed by ~250 turtles p.a. in purse seine operations. Two separate approaches to estimate gillnet impacts on sea turtles, based on

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

very limited data, calculated that ~ 52,425 turtles p.a. or 11,400 – 47,500 turtles p.a. are caught in gillnets (with a mean of the two methods being 29,488 turtles p.a.) Anecdotal/published studies reported values of >5000 – 16 000 turtles p.a. for each of just India, Sri Lanka and Madagascar. Of these reports, green turtles are under the greatest pressure from gillnet fishing, constituting 50–88% of catches. Loggerhead, hawksbill and olive ridley turtles are caught in varying proportions depending on the region.

- Maintaining or increasing fishing 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.

# 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[18] |
|---|---|---|
| **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* (to be superseded by Resolution 12/06 on 1 July, 2014) 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 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

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

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 following should be noted:

- 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.

# APPENDIX XIX
# WORKPLAN: WORKING PARTY ON ECOSYSTEMS AND BYCATCH (2014–2018)

***Requests from the Commission***

At Sessions of the Commission, Conservation and Management Measures adopted contained elements which call on the Scientific Committee, via the WPEB, to undertake specific tasks.

**Resolution 13/04** ***On the conservation of cetaceans***

(para. 6) The Commission requests that the IOTC Scientific Committee develop best practice guidelines for the safe release and handling of encircled cetaceans, taking into account those developed in other Regional Fisheries Management Organisations, including the Western and Central Pacific Fisheries Commission, and that these guidelines be submitted to the 2014 Commission meeting for endorsement.

**Resolution 13/05** ***On the conservation of whale sharks (Rhincodon typus)***

(para. 6) The Commission requests that the IOTC Scientific Committee develop best practice guidelines for the safe release and handling of encircled whale sharks, taking into account those developed in other regional fisheries management organisations including the Western and Central Pacific Fisheries Commission, and that these guidelines be submitted to the 2014 Commission meeting for endorsement.

**Resolution 13/06** ***On a scientific and management framework on the Conservation of sharks species caught in association with IOTC managed fisheries***

(para. 2) The SC recommendation or advice shall be conducted taking account of:

a) full stock assessments on sharks, stock assessment and Ecological Risk Assessments (ERAs) by fishing gears, using available best scientific data/information;
b) trend of fishing effort by fishing gear on each shark species;
c) effective IOTC Conservation and Management Measures for certain fishing gears with high risk by shark species;
d) priority in shark species with high risk;
e) review of practical implementation of prohibition to retain on board of shark species;
f) feasibility of implementation of prohibition to retain on board including identification of shark species;
g) impact and bias of IOTC Conservation and Management Measures of sharks on fishing operations and sharks data/information collected and reported by CPCs;
h) further improvement of level for sharks data/information submitted by CPCs, particularly developing CPCs

(para. 7) Scientific observers shall be allowed to collect biological samples (vertebrae, tissues, reproductive tracts, stomachs, skin samples, spiral valves, jaws, whole and skeletonised specimens for taxonomic works and museum collections) from oceanic whitetip sharks taken in the IOTC area of competence that are dead at haulback, provided that the samples are a part of a research project approved by the IOTC Scientific Committee (SC)/the IOTC Working Party on Ecosystems and Bycatch (WPEB). In order to obtain the approval, a detailed document outlining the purpose of the work, number of samples intended to be collected and the spatio-temporal distribution of the sampling effect must be included in the proposal. Annual progress of the work and a final report on completion shall be presented to the SC/WPEB.

(para. 9) The provisional measures stipulated in this Resolution shall be evaluated in 2016 by the IOTC Scientific Committee to deliver more appropriate advice on the conservation and management of the stocks for the consideration of the Commission.

**Resolution 13/08** ***Procedures on a fish aggregating devices (FADs) management plan, including more detailed specification of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species***

(para. 7) The IOTC Scientific Committee will analyse the information, when available, and provide scientific advice on additional FAD management options for consideration by the Commission in 2016, including recommendations on the use of biodegradable materials in new and improved FADs and the phasing out of FAD designs that do not prevent the entanglement of sharks, marine turtles and other species. When assessing the impact of FADs on the dynamic and distribution of targeted fish stocks and associated

species and on the ecosystem, the IOTC Scientific Committee will, where relevant, use all available data on abandoned FADs (i.e. FADs without a beacon).

**Resolution 12/04** ***On the conservation of marine turtles***

(para. 11) The IOTC Scientific Committee shall request the IOTC Working Party on Ecosystems and Bycatch to:

a) Develop recommendations on appropriate mitigation measures for gillnet, longline and purse seine fisheries in the IOTC area;
b) Develop regional standards covering data collection, data exchange and training;
c) Develop improved FAD designs to reduce the incidence of entanglement of marine turtles, including the use of biodegradable materials.

The recommendations of the IOTC Working Party on Ecosystems and Bycatch shall be provided to the IOTC Scientific Committee for consideration at its annual session in 2012. In developing its recommendations, the IOTC Working Party on Ecosystems and Bycatch shall examine and take into account the information provided by CPCs in accordance with paragraph 10 of this measure, 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 IOTC Working Party on Ecosystems and Bycatch will specifically consider the effects of circle hooks on target species catch rates, marine turtle mortalities and other bycatch species.

(para. 17) The IOTC Scientific Committee shall annually review the information reported by CPCs pursuant to this measure and, as necessary, provide recommendations to the Commission on ways to strengthen efforts to reduce marine turtle interactions with IOTC fisheries.

**Resolution 12/06** ***On reducing the incidental bycatch of seabirds in longline fisheries***

(para. 8) The IOTC Scientific Committee, based notably on the work of the WPEB and information from CPCs, will analyse the impact of this Resolution on seabird bycatch no later than for the 2016 meeting of the Commission. It shall advise the Commission on any modifications that are required, based on experience to date of the operation of the Resolution and/or further international studies, research or advice on best practice on the issue, in order to make the Resolution more effective.

**Resolution 12/09** ***On the conservation of thresher sharks (Family Alopiidae) caught in association with fisheries in the IOTC area of competence***

(para. 7) Scientific observers shall be allowed to collect biological samples (vertebrae, tissues, reproductive tracts, stomachs, skin samples, spiral valves, jaws, whole and skeletonised specimens for taxonomic works and museum collections) from thresher sharks that are dead at haulback, provided that the samples are part of the research project approved by the IOTC Scientific Committee (or IOTC Working Party on Ecosystems and Bycatch (WPEB)). In order to obtain the approval, a detailed document outlining the purpose of the work, number and type of samples intended to be collected and the spatio-temporal distribution of the sampling work must be included in the proposal. Annual progress of the work and a final report on completion of the project shall be presented to the IOTC WPEB and the IOTC Scientific Committee.

**Resolution 11/04** ***On a regional observer scheme***

(para. 15) The elements of the Observer Scheme, notably those regarding its coverage, are subject to review and revision, as appropriate, for application in 2012 and subsequent years. Basing on the experience of other Tuna RFMOs, the IOTC Scientific Committee will elaborate an observer working manual, a template to be used for reporting (including minimum data fields) and a training program.

**Resolution 05/05** ***Concerning the conservation of sharks caught in association with fisheries managed by IOTC***

(para. 2) In 2006 the IOTC Scientific Committee (in collaboration with the IOTC Working Party on Ecosystems and Bycatch) provide preliminary advice on the stock status of key shark species and propose a research plan and timeline for a comprehensive assessment of these stocks.

(para. 5) The ratio of fin-to-body weight of sharks described in paragraph 4 shall be reviewed by the IOTC Scientific Committee and reported back to the Commission in 2006 for revision, if necessary.

***Core topics for research***

The WPEB **RECOMMENDED** that the following core topic areas as priorities for research over the coming years, taking into account data gaps, capacity among CPCs, and areas for implementation:

***High Priority:***

- ***Shark stock status analyses (development of abundance indices)***
    i. Develop/improve accurate standardised CPUE indices for each shark species for the Indian Ocean as a whole or by sub-region as appropriate, once stock structure and management units have been determined.
    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).
- ***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).
- ***Stock assessment***
    i. There is a clear request from the Commission to carry out stock status determinations for sharks in the Indian Ocean, and that at present the data held at the IOTC Secretariat would be insufficient to undertake integrated stock assessments for any stock.
    ii. Alternative approaches should be explored as options to determine stock status, by building layers of partial evidence, such as CPUE indices combined with catch data, life-history parameters and yield-per recruit metrics, as well as the use of data poor assessment approaches.
- ***Bycatch mitigation***
    i. Sharks
    ii. Seabirds – line weighting
    iii. Marine turtles
    iv. Marine mammals

***Medium Priority***

- ***Depredation***
    i. Longline fishery depredation
- ***Stock structure***
    i. genetic research to determine the connectivity of species throughout their distributions: such studies should be developed at the sub-regional level.
    ii. tagging research to better understand and estimate exploitation rates, the movement dynamics, possible spawning locations, natural mortality, fishing mortality and post-release mortality of stocks from various fisheries in the Indian Ocean.
- ***Biological information***
    i. Quantitative biological studies are necessary for all species throughout their range to determine key biological parameters including age-at-maturity and fecundity-at-age/length relationships, age-length keys, age and growth, which will be fed into future stock assessments.

# APPENDIX XX
# ASSESSMENT SCHEDULE FOR THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH

| Species | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|
| ***Working Party on Ecosystems and Bycatch*** | | | | | |
| Blue sharks | Indicators & data poor approaches | | | Indicators & data poor approaches | Revisit ERA |
| Oceanic whitetip sharks | Indicators & data poor approaches | | | | Revisit ERA |
| Scalloped hammerhead sharks | | Indicators & data poor approaches | | | Revisit ERA |
| Shortfin mako sharks | | | Indicators & data poor approaches | | Revisit ERA |
| Silky sharks | | Indicators (data poor approaches) | | | Revisit ERA |
| Bigeye thresher sharks | | | | Indicators & data poor approaches | Revisit ERA |
| Pelagic thresher sharks | | | Indicators & data poor approaches | | Revisit ERA |
| Marine turtles | | Review of mitigation measures in 12/04 | | Revisit ERA | |
| Seabirds | | Review of mitigation measures in 12/06 | | Review of mitigation measures in 12/06 | |
| Marine Mammals | | | | | |

Note: the assessment schedule may be changed dependant on the annual review of fishery indicators, or SC and Commission requests.

# APPENDIX XXI
# CONSOLIDATED RECOMMENDATIONS OF THE NINTH SESSION OF THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH

***Note: Appendix references refer to the Report of the Ninth Session of the Working Party on Ecosystems and Bycatch (IOTC–2013–WPEB09–R)***

**Meeting participation fund**

WPEB09.01 (para.3) **NOTING** that the IOTC Meeting Participation Fund (MPF), adopted by the Commission in 2010 (Resolution 10/05 *On the establishment of a Meeting Participation Fund for developing IOTC Members and non-Contracting Cooperating Parties*), was used to fund the participation of 11 national scientists to the WPEB09 meeting (7 in 2012), all of which were required to submit and present a working paper at the meeting, the WPEB **RECOMMENDED** that this fund be maintained into the future.

WPEB09.02 (para.5) **NOTING** that the Commission had directed the Secretariat (via Resolution 10/05) to ensure that the MPF be utilised, as a first priority, to support the participation of scientists from developing CPCs in scientific meetings of the IOTC, including Working Parties, rather than non-science meetings, the WPEB **RECOMMENDED** that the Secretariat strictly adhere to the directives of the Commission contained in Resolution 10/05, including paragraph 8 which states that '*The Fund will be allocated in such a way that no more than 25% of the expenditures of the Fund in one year is used to fund attendance to non-scientific meetings*.' Thus, 75% of the annual MPF shall be allocated to facilitating the attendance of developing CPC scientists to the Scientific Committee and its Working Parties.

**Employment of a Fisheries Officer**

WPEB09.03 (para.12) **NOTING** the rapidly increasing scientific workload at the IOTC Secretariat, including a wide range of additional duties on ecosystems and bycatch assigned to it by the SC and the Commission, and that the new Fishery Officer (Science) supporting the IOTC scientific activities has not been given a mandate by the Commission to work on ecosystems and bycatch matters, the WPEB strongly **RECOMMENDED** that the Commission approve the hiring of a Fishery Officer (Bycatch) to work on bycatch matters in support of the scientific process.

**Regional observer scheme**

WPEB09.04 (para.35) The WPEB **RECOMMENDED** that the Compliance Committee and Commission consider how to address the lack of implementation of regional observer schemes by CPCs for their fleets and reporting to the IOTC Secretariat as per the provision of Resolution 11/04 *on a Regional Observer Scheme*, noting the update provided in Appendix VI.

WPEB09.05 (para.37) The WPEB **RECOMMENDED** that as a priority, the IOTC Secretariat should immediately commence work with CPCs that are yet to develop and implement a Regional Observer Scheme that would meet the requirements contained in Resolution 11/04, and provide an update at the next session of the WPEB.

**Identification cards for shark, seabirds and marine turtles**

WPEB09.06 (para.38) The WPEB **EXPRESSED** its thanks to the IOTC Secretariat and other experts involved in the development of the identification cards for marine turtles, seabirds and sharks and **RECOMMENDED** that the cards be translated into the following languages, in priority order: Farsi, Arabic, Spanish and Portuguese, and that the Commission allocate funds for this purpose.

WPEB09.07 (para.39) The WPEB **RECOMMENDED** that the Commission allocate additional funds in 2014 to translate and print further sets of the shark, seabird and marine turtle identification cards (budget estimate: Table 2).

**TABLE 2**. Estimated translation, production and printing costs for 1000 sets of identification guides for marine turtles, seabirds and sharks.

| Description | Unit price | Units required | Total |
|---|---|---|---|
| Translation (per language) | $1000 | 3 | 3,000 |
| Typesetting | $1000 | 3 | 3,000 |
| Marine turtles ID cards | $5 | 1000 | 5,000 |
| Seabird ID cards | $7 | 1000 | 7,000 |
| Shark ID cards | $7 | 1000 | 7,000 |
| Total estimate (US$) | | | **24,000** |

**Regional review of the current and historical data available for gillnet fleets operating in the Indian Ocean**

WPEB09.08 (para.52) The WPEB reiterated its previous **RECOMMENDATION** that the Commission considers allocating funds to support a regional review of the current and historical data available for gillnet fleets operating in the Indian Ocean. As an essential contribution to this review, scientists from all CPCs having gillnet fleets in the Indian Ocean, in particular those from I.R. Iran, Oman, Pakistan and Sri Lanka, should collate the known information on bycatch in their gillnet fisheries, including sharks, marine turtles and marine mammals, with estimates of the likely order of magnitude where more detailed data are not available. A consultant should be hired for 30 days to assist CPCs with this task (budget estimate: Table 3).

**TABLE 3**. Estimated costs for the hiring of a consultant to undertake a regional review of gillnet fleets.

| Description | Unit price | Units required | Total |
|---|---|---|---|
| Contract days | $350 | 30 | 10,500 |
| Travel costs (field) | $3,000 | 3 | 9,000 |
| Travel costs to attend WPEB | $5,000 | 1 | 5,000 |
| Total estimate (US$) | | | **24,500** |

**Training for CPCs having gillnet fleets on species identification, bycatch mitigation and data collection methods and also to identify other potential sources of assistance – Development of plans of action**

WPEB09.09 (para.64) The WPEB **RECOMMENDED** that the Commission allocate funds in its 2014 and 2015 budgets for the IOTC Secretariat to carry out training for CPCs having gillnet fleets on bycatch mitigation methods, species identification, and data collection methods (budget estimate: Table 4).

**TABLE 4**. Estimated costs for CPCs with large gillnet fleets on bycatch mitigation methods, species identification and data collection methods. Two training workshops: I.R. Iran/Oman and Sri Lanka.

| Description | Unit price | Units required | Total |
|---|---|---|---|
| Production of training material | $1,000 | 1 | 1,000 |
| Travel costs (IOTC Staff) (I.R.Iran/Oman, Sri Lanka) | $4,000 | 3 | 12,000 |
| Travel costs (Experts) (I.R.Iran/Oman, Sri Lanka) | $4,000 | 3 | 12,000 |
| Workshop venue – to be paid by hosts | $0 | 2 | $0 |
| Total estimate (US$) | | | **25,000** |

**Sharks and rays**

**Review of new information on the status of sharks and rays**

WPEB09.10 (para.68) **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 length frequency data on sharks, as per IOTC Resolutions, so that more detailed analysis can be undertaken for the next WPEB meeting.

WPEB09.11 (para.69) **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 Commission allocates funds for this activity, in the 2014 and 2015 IOTC budgets (budget estimate: Table 5).

**TABLE 5**. Estimated costs for the hiring of a consultant to undertake a literature review of shark interactions.

| Description | Unit price | Units required | Total |
|---|---|---|---|
| Contract days | $350 | 30 | 10,500 |
| Travel costs (field) | $3,000 | 3 | 9,000 |
| Travel costs to attend WPEB | $5,000 | 1 | 5,000 |
| Total estimate (US$) | | | **24,500** |

**Review new information on the biology, stock structure, bycatch mitigation measures, fisheries and associated environmental data**

WPEB09.12 (para.117) 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 **RECOMMENDED** that the Commission allocate funds in the 2014 IOTC Budge to develop an identification guide for fishing hooks and pelagic fishing gears used in IOTC fisheries. The total estimated production and printing costs for the first 1000 sets of the identification cards is around a maximum of US$16,500 (Table 6). The IOTC Secretariat shall seek funds from potential donors to print additional sets of the identification cards at US$5,500 per 1000 sets of cards.

**TABLE 6**. Estimated production and printing costs for 1000 sets of identification guide for fishing hooks and pelagic fishing gears used in IOTC fisheries.

| Description | Unit price | Units required | Total |
|---|---|---|---|
| Purchase images | US$100 | 25 | 2,500 |
| Contract days | US$350 | 20 | 7,000 |
| Printing plates / plate | US$100 | 15 | 1,500 |
| Printing /1000 sets | US$5500 | 1 | 5,500 |
| Total estimate (US$) | | | **16,500** |

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

WPEB09.13 (para.123) The WPEB **RECOMMENDED** that the Commission note the list of the 10 most vulnerable shark species to longline gear (Table 7) and purse seine gear (Table 8) in the Indian Ocean, as determined by a productivity susceptibility analysis, compared to the list of shark species/groups required to be recorded for each gear, contained in Resolution 13/03 o*n the recording of catch and effort by fishing vessels in the IOTC area of competence*. At the next revision to Resolution 13/03, the Commission may wish to add the missing species/groups of sharks and rays.

**TABLE 7**. 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 | | |

**TABLE 8**. List of the 10 most vulnerable shark species to purse seine 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 purse seine gear | FAO Code | Shark species listed in IOTC Resolution 12/03 for purse seine gear | FAO Code |
|---|---|---|---|---|
| 1 | Oceanic whitetip shark (*Carcharhinus longimanus*) | OCS | Whale sharks (*Rhincodon typus*) | RHN |
| 2 | Silky shark (*Carcharhinus falciformis*) | FAL | | |
| 3 | Shortfin mako (*Isurus oxyrinchus*) | SMA | | |
| 4 | Great hammerhead (*Sphyrna mokarran*) | SPM | | |
| 5 | Pelagic stingray (*Pteroplatytrygon violacea)* | PLS | | |
| 6 | Scalloped hammerhead (*Sphyrna lewini*) | SPL | | |
| 7 | Smooth hammerhead (*Sphyrna zygaena*) | SPZ | | |
| 8 | Longfin mako (*Isurus paucus*) | LMA | | |
| 9 | Dusky shark (*Carcharhinus obscurus*) | DUS | | |
| 10 | Tiger shark (*Galeocerdo cuvier*) | GAC | | |

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

WPEB09.14 (para.138) **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 10) for which nominal catch data shall be reported as part of the statistical requirement for IOTC CPCs.

**TABLE 10.** 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 |

**Best practice guidelines for the safe release and handling of encircled whale sharks**

WPEB09.15 (para.141) The WPEB **RECOMMENDED** the following *Guidelines for the safe release and handling of encircled whale* sharks, that should be added as an additional page in the IOTC shark identification guides:

- The methods listed below depend on the condition of the particular purse seine set, e.g. the size and orientation of the encircled animal, size of fish in the purse seine set and operation style.
  - Cutting the net when the whale shark is at the surface and separated from the tuna and when the operation presents no danger for the crew;
  - Standing the animal on the net and rolling it outside the bunt. A rope placed under the animal and attached to the float line could help rolling the whale shark out of the net;
  - Brailing sharks (only for small individual less than 2–3 meters).
- The crew should never:
  - Pull up the shark by its tail;
  - Tow the shark by its tail.

**Marine Turtles**

**Review of data available at the Secretariat for marine turtles**

WPEB09.16 (para.148) 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.

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

WPEB09.17 (para.166) The WPEB **RECOMMENDED** that the ERA for marine turtles be kept under review, and that consideration be given to updating it periodically in light of newly received data and other information.

**Review of Resolution 12/04 on the conservation of marine turtles**

WPEB09.18 (para.168) The WPEB **RECOMMENDED** that at the next revision of IOTC Resolution 12/04 *on the conservation of marine turtles*, the measure is strengthened to ensure that where possible, CPCs report annually on the total estimated level of incidental catches of marine turtles, by species, as provided at Table 12.

**TABLE 12.** 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* |

**Resolution 10/02 Mandatory statistical [reporting] requirements for IOTC Members and Cooperating Non-Contracting Parties (CPCs)**

WPEB09.19 (para.169) **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* and Resolution 13/03 on *On the recording of catch and effort by fishing vessels in the IOTC area of competence*.

**Requests contained in IOTC Conservation and Management Measures**

WPEB09.20 (para.171) The WPEB **RECALLED** and updated its previous **RECOMMENDATION** 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, fishing 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, soak times, light deterrents) 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 *Marine turtle identification cards for Indian Ocean fisheries*).

**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 ecological FADs[19] based on the principles outlined in Annex III of Resolution 13/08 *Procedures on a fish aggregating devices (FADs) management plan, including more detailed specification of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species*.

**Marine mammals**

**Review of Resolution 00/02 On a survey of predation of longline caught fish**

WPEB09.21 (para.207) **NOTING** that the requirements contained in Resolution 00/02 o*n a survey of predation of longline caught fish* was completed by the WPEB and SC in past years, the WPEB **RECOMMENDED** that Resolution 00/02 be revoked by the Commission.

**Development of technical advice for marine mammals**

WPEB09.22 (para.213) The WPEB **RECOMMENDED** that depredation events be incorporated into Resolution 13/03 at its next revision, so that interactions may be quantified at a range of spatial scales. Depredation events should also be quantified by the regional observer scheme.

**Revision of the WPEB work plan**

WPEB09.23 (para.250) The WPEB **RECOMMENDED** that a small working group of shark experts and the IOTC Secretariat further develop the draft Shark Year Program (SharkYP) and to present the proposal at the next SC meeting to be held in December 2013. The overall objective is to:
"The Shark Year Program (SharkYP) represents a further step to align with the work of the WPEB with IOTC Conservation and Management Measures (CMMs), particularly to the recently adopted Resolution 13/06 *on a scientific and management framework on the conservation of shark species caught in association with IOTC managed fisheries*. Moreover, the SharkYP aims to provide guidance to WPEB researchers, by prioritising issues related to data collection and research on species biology/ecology, fisheries and mitigation measures. Finally, by promoting cooperation and coordination among WPEB researchers, the SharkYP aims to improve the quality of the scientific advice on sharks provided to the Commission, and to better assess the impact on these species of the current CMMs."

WPEB09.24 (para.252) The WPEB **RECOMMENDED** that the SC consider and endorse the workplan and assessment schedule for the WPEB for 2014, and tentatively for future years, as provided at Appendix XIX and Appendix XX, respectively.

**Format of future WPEB Sessions**

WPEB09.25 (para.253) The WPEB **RECOMMENDED** that the SC note the following:

- The WPEB **DISCUSSED** the future format in order to focus the efforts of scientists working on different groups of bycatch species to address more efficiently, the mandate of the group.
- The WPEB **CONSIDERED** a range of options which the SC is asked to consider:
    - **Option 1**: The current WPEB be split into two; A dedicated Working Party on Sharks (WPS) and a Working Party on Ecosystems and Bycatch (WPEB).

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

- **Option 2**: Retaining the WPEB in its current form, with alternating focus of sharks in one year, followed by other ecosystem and bycatch issues in the next year.
- **Option 3**: Maintaining the WPEB with clear guidelines to deal with sharks every year, as well as other issues and bycatch groups in alternate years or as required.

- The WPEB **AGREED** that shark issues were important to address on a yearly basis.

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

WPEB09.26 (para.257) The WPEB **RECOMMENDED** that two Invited Experts be brought to the WPEB in 2014 so as to further increase the capacity of the WPEB to undertake work on sharks at the next meeting, and for this to be included in the IOTC budget for 2014.

**Election of a Chairperson and Vice-Chairperson for the next biennium**

WPEB09.27 (para.263) The WPEB **RECOMMENDED** that the SC note the new Chairperson, Dr. Rui Coelho (EU,Portugal) and Vice-Chairperson, Dr. Evgeny Romanov (La Réunion), of the WPEB for the next biennium.

**Report of the Ninth Session of the Working Party on Ecosystems and Bycatch**

WPEB09.28 (para.265) The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB09, provided at Appendix XXI, as well as the management advice provided in the draft resource stock status summary for each of the seven shark species, as well of those for marine turtles and seabirds:

**Sharks**

- 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

**Other species/groups**

- Marine turtles – Appendix XVII
- Seabirds – Appendix XVIII