Report of the 12th Session of the IOTC Working Party on Ecosystems and Bycatch

Victoria, Seychelles 12 - 16September 2016

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ACRONYMS

ABNJ	Areas Beyond National Jurisdiction
ACAP	Agreement on the Conservation of Albatrosses and Petrels
BSH	Blue shark
CITES	Convention on International Trade in Endangered Species
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_{2015} is the fishing mortality estimated in the year 2015
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
IO-ShYP	Indian Ocean Shark multi-Year Plan
IPOA	International Plan of Action
IUU	Illegal, Unreported and Unregulated, fishing
LL	Longline
LSTLV	Large-scale tuna longline vessel
MoU	Memorandum of Understanding
MPF	Meeting Participation Fund
MSY	Maximum sustainable yield
n.a.	Not applicable
NDF	Non Detriment Finding
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
WPDCS	Working Party on Data Collection and Statistics, of the IOTC
WPEB	Working Party on Ecosystems and Bycatch, of the IOTC

KEY 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 kilometres in length whose purpose is to enmesh, entrap, or entangle fish by drifting on the surface of, or in, the water column.

STANDARDISATION OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE REPORT TERMINOLOGY

SC16.07 (para. 23) The SC **ADOPTED** the reporting terminology contained in Appendix IV and **RECOMMENDED** that the Commission considers adopting the standardised IOTC Report terminology, to further improve the clarity of information sharing from, and among its subsidiary bodies.

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

Level 1: ***From a subsidiary body of the Commission to the next level in the structure of the Commission:***
RECOMMENDED, RECOMMENDATION: Any conclusion or request for an action to be undertaken, from a subsidiary body of the Commission (Committee or Working Party), 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; from a Committee to the Commission). The intention is that the higher body will consider the recommended action for endorsement under its own mandate, if the subsidiary body does not already have the required mandate. Ideally this should be task specific and contain a timeframe for completion.

Level 2: ***From a subsidiary body of the Commission to a CPC, the IOTC Secretariat, or other body (not the Commission) to carry out a specified task:***
REQUESTED: This term should only be used by a subsidiary body of the Commission if it does not wish to have the request formally adopted/endorsed by the next level in the structure of the Commission. For example, if a Committee wishes to seek additional input from a CPC on a particular topic, but does not wish to formalise the request beyond the mandate of the Committee, it may request that a set action be undertaken. Ideally this should be task specific and contain a timeframe for the completion.

Level 3: ***General terms to be used for consistency:***
AGREED: Any point of discussion from a meeting which the IOTC body considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 or level 2 above; a general point of agreement among delegations/participants of a meeting which does not need to be considered/adopted by the next level in the Commission's structure.
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 future reference.

Any other term: Any other term may be used in addition to the Level 3 terms to highlight to the reader of and IOTC report, the importance of the relevant paragraph. However, other terms used are considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3, described above (e.g. **CONSIDERED**; **URGED**; **ACKNOWLEDGED**).

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EXECUTIVE SUMMARY

The 12thSession of the Indian Ocean Tuna Commission's (IOTC) Working Party on Ecosystems and Bycatch (WPEB) was held in Victoria, Seychelles from 12 - 16 September 2016. A total of 34 participants (37 in 2015, 37 in 2014) attended the Session. The list of participants is provided at Appendix I. The meeting was opened by the Chairperson, Dr Rui Coelho from IPMA, EU-Portugal, who welcomed participants and formally opened the 12thSession of the IOTC Working Party on Ecosystems and Bycatch (WPEB12). The Chairperson also welcomed the Invited Expert for the meeting, Dr Malcolm Francis (New Zealand) and the data preparation consultant Dr Joel Rice (USA).

Identification guides for fishing gear

WPEB12.01 (Para. 21)The WPEB **RECALLED** the recommendation made by the WPEB in 2013 and 2014: 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 (WPEB09, para.117).

Regional observer scheme

WPEB12.02 (Para. 54) **RECALLING** the SC18 (para. 134) ***"NOTING*** *that many CPCs report Regional Observer data in .pdf format, or as data embedded within documents, and also in hard-copy format, the SC* ***ENCOURAGED*** *CPCs to report Regional Observer data in any non-proprietary electronic format (e.g. csv, xml, txt, etc.) or in an electronic format that can be easily exported and processed into standard spreadsheet, database or statistical software (e.g. xls, dbase, mdb, etc.). This may be in any electronically readable format as long as all of the agreed minimum data reporting requirements have been fulfilled",* the WPEB **RECOMMENDED** that observer data are submitted in electronic format that could be automatically exported and processed into a standard spreadsheet-like format (e.g. csv, xml, txt, xls, dbase, mdb etc.), avoiding formats whose processing could be time consuming and unnecessarily complex (e.g. pdf, Microsoft Word documents etc.), at the same time ensuring that all of the agreed minimum data reporting requirements have been fulfilled.

Bycatch data exchange protocol (BDEP)

WPEB12.03 (Para. 62) The WPEB **RECOMMENDED** that, on completion of the development of the ROS database and the input of all of the historical data, the IOTC Secretariat continue to populate the BDEP template, adapting it where necessary, and present this to the WPDCS and SC for further review.

Tuna gillnet fisheries

WPEB12.04 (Para. 105) **RECALLING** the previous recommendation from the Scientific Committee, the WPEB **RECOMMENDED** that this is reiterated: *"**NOTING** that gillnets are regularly being used with lengths in excess of 4,000 m (and up to 7,000 m) within and occasionally beyond the EEZ of Pakistan and other IOTC CPCs in the region, and that those used within the EEZ may sometimes drift onto the high seas in contravention of Resolution 12/12, the SC **RECOMMENDED** that the Commission should consider if a ban on large scale gillnets should also apply within IOTC CPC EEZ. This would be especially important given the negative ecological impacts of large scale drifting gillnets in areas frequented by marine mammals and turtles" (SC18 para. 39).*

ACAP best practice advice: update

WPEB12.05 (Para. 216) The WPEB **RECOMMENDED** that Resolution 12/06 be reviewed and **ENCOURAGED** the line weighting specifications to be updated to conform with the latest ACAP advice: (a) 40 g or greater attached within 0.5 m of the hook; or (b) 60 g or greater attached within 1 m of the hook; or (c) 80 g or greater attached within 2 m of the hook. CPCs are **ENCOURAGED** to test the safety and practicality of the above mentioned measure as well as sliding lead devices for line weighting, and to report the results back to the WPEB or SC.

WPEB12.06 (Para. 219) The WPEB **RECOMMENDED** that when Resolution 12/06 is reviewed, the two hook-shielding devices recommended by ACAP as best practice mitigation measures be incorporated as additional, stand-alone mitigation options for use in IOTC fisheries operating south of 25°S, and that these measures should conform with the technical specifications and performance attributes detailed in the ACAP advice. The WPEB **CLARIFIED** that if used, the hook-shielding devices would not need to

be combined with any other mitigation measure. In relation to the Smart Tuna Hook, the WPEB **NOTED** that on the basis of information provided, after release from the hook the shield sinks to the seafloor where it corrodes within 12 months, the byproduct of which is iron oxide and carbon. However, the WPEB **NOTED** concerns regarding pollution associated with the discarded shields of the Smart Tuna Hooks, and **REQUESTED** that further information be made available to clarify the potential effects.

Data collection opportunities

WPEB12.07 (Para. 225) The WPEB **RECOGNISED** that although the IOTC Regional Observer Programme (ROP) for transhipment is primarily a mechanism for compliance monitoring, it does provide potential opportunities for gathering photographs and information for scientific purposes, including on seabird bycatch mitigation measures. Therefore, the WPEB **RECOMMENDED** that the collection of seabird bycatch mitigation photographs through the ROP is trialled as a pilot.

Revision of the WPEB Program of Work 2017–2021

WPEB12.08 (Para. 245) The WPEB **RECOMMENDED** that the SC consider and endorse the WPEB Program of Work (2017–2021), as provided at Appendix XVIII.

Review of the draft, and adoption of the Report of the 12th Session of the Working Party on Ecosystems and Bycatch

WPEB12.09 (Para. 254)The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB12, provided at Appendix XIX, 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 IX
- Oceanic whitetip sharks (*Carcharhinus longimanus*)– Appendix X
- Scalloped hammerhead sharks (*Sphyrna lewini*) – Appendix XI
- Shortfin mako sharks (*Isurus oxyrinchus*) – Appendix XII
- Silky sharks (*Carcharhinus falciformis*) – Appendix XIII
- Bigeye thresher sharks(*Alopias superciliosus*) – Appendix XIV
- Pelagic thresher sharks(*Alopias pelagicus*) – Appendix XV

Other species/groups

- Marine turtles – Appendix XVI
- Seabirds – Appendix XVII

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

Stock	Indicators	Prev[1]	2010	2011	2012	2013	2014	2015	2016	Advice to the Commission
Sharks: Although sharks are not part of the 16 species directly under the IOTC mandate, sharks are frequently caught in association with fisheries targeting IOTC species. Some fleets are known to actively target both sharks and IOTC species simultaneously. As such, IOTC Contracting Parties 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 IOTC fisheries, although the list is not exhaustive.										
Blue shark *Prionace glauca*	Reported catch 2015: 30,054 t Not elsewhere included (nei) sharks[2]: 57,125 t Average reported catch 2011–2015: 29,535 t Not elsewhere included (nei) sharks[2]: 49,785 t									A precautionary approach to the management of blue shark should be considered by the Commission, by ensuring that future catches do not exceed current catches. The stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirement on sharks, so as to better inform scientific advice. Click below for a full stock status summary: o Blue sharks – Appendix IX
	MSY (1,000 t) (80% CI): Unknown F_{MSY} (80% CI): Unknown SB_{MSY} (1,000 t) (80% CI): Unknown F_{2014}/F_{MSY} (80% CI): (0.44–4.84) SB_{2014}/SB_{MSY} (80% CI): (0.83–1.75) SB_{2014}/SB_0 (80% CI): Unknown									
Oceanic whitetip shark *Carcharhinus longimanus*	Reported catch 2015: 211 t Not elsewhere included (nei) sharks[2]: 57,125 t Average reported catch 2011–2015: 248 t Not elsewhere included (nei) sharks[2]: 49,785 t									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. Click below for a full stock status summary: o Oceanic whitetip sharks – Appendix X o Scalloped hammerhead sharks – Appendix XI o Shortfin mako sharks – Appendix XII o Silky sharks– Appendix XIII o Bigeye thresher sharks– Appendix XIV o Pelagic thresher sharks– Appendix XV
Scalloped hammerhead shark *Sphyrna lewini*	Reported catch 2015: 52 t Not elsewhere included (nei) sharks[2]: 57,125t Average reported catch 2011–2015: 75 t Not elsewhere included (nei) sharks[2]: 49,785 t									
Shortfin mako *Isurus oxyrinchus*	Reported catch 2015: 1,268 t Not elsewhere included (nei) sharks[2]: 57,125t Average reported catch 2011–2015: 1,447 t Not elsewhere included (nei) sharks[2]: 49,785 t									
Silky shark *Carcharhinus falciformis*	Reported catch 2015: 3,232 t Not elsewhere included (nei) sharks[2]: 57,125t Average reported catch 2011–2015: 3,707 t Not elsewhere included (nei) sharks[2]: 49,785 t									
Bigeye thresher shark *Alopias superciliosus*	Reported catch 2015: 0 t Not elsewhere included (nei) sharks[2]: 57,125 t Average reported catch 2011–2015: 94 t Not elsewhere included (nei) sharks[2]: 49,785 t									
Pelagic thresher shark *Alopias pelagicus*	Reported catch 2015: 0 t Not elsewhere included (nei) sharks[2]: 57,125 t Average reported catch 2011–2015: 69 t Not elsewhere included (nei) sharks[2]: 49,785 t									

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 12th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Ecosystems and Bycatch (WPEB) was held in Victoria, Seychelles from 12 - 16 September 2016. A total of 34 participants (37 in 2015, 37 in 2014) attended the Session. The list of participants is provided at Appendix I. The meeting was opened by the Chairperson, Dr Rui Coelho from IPMA, EU-Portugal, who welcomed participants and formally opened the 12th Session of the IOTC Working Party on Ecosystems and Bycatch (WPEB12). The Chairperson also welcomed the Invited Expert for the meeting, Dr Malcolm Francis (New Zealand) and the data preparation consultant Dr Joel Rice (USA).

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

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

3. THE IOTC PROCESS: OUTCOMES, UPDATES AND PROGRESS

3.1 Outcomes of the 18th Session of the Scientific Committee

3. The WPEB **NOTED** paper IOTC–2016–WPEB12–03 which outlined the main outcomes of the 18th Session of the Scientific Committee (SC18),specifically related to the work of the WPEB and **AGREED** to consider how best to progress these issues at the present meeting.

4. The WPEB **NOTED** that in 2016, the SC made a number of requests in relation to the WPEB11 report. Those requests and the associated responses from the WPEB11are provided below for reference.

Review of the statistical data available for ecosystems and bycatch species

NOTING *the high level of uncertainty in the nominal catches of blue sharks and high proportion caught by Indonesia, the SC* ***AGREED*** *that the IOTC consultancy work that is currently taking place to improve the Indonesian nominal catch data series is extended in order to provide sufficient attention to sharks, and for this to be included in the Program of Work as a high priority (para. 38 of the SC18 report).*

IOTC species Identification guides – general

NOTING *that the Commission has approved US$30,000 for the printing of the species identification cards in 2016, as confirmed by the IOTC Secretariat at the 19th Session of the Commission, the SC* ***REQUESTED*** *that the species identification cards already translated into languages other than English and French, be printed in the first quarter of 2016 for dissemination(para 103 of the SC18 report).*

The SC ***REQUESTED*** *that the IOTC Secretariat should ensure that hard copies of the identification cards continue to be printed as many CPCs scientific observers, both on board and port, still do not have smart phone technology/hardware access and need to have hard copies. At this point in time, electronic formats, including 'applications or apps' are only suitable for larger scale vessels, and even in the case of EU purse seine vessels, the use of hard copies is relied upon due to on board fish processing and handling conditions, as well as weather conditions. Electronic versions may be developed as complementary tools(para. 104 of the SC18 report).*

The SC ***AGREED*** *that IOTC CPCs should disseminate the identification cards to their observers and field samplers (Resolution 11/04), and as feasible, to their fishing fleets targeting tuna, tuna-like and shark species. This would allow accurate observer, sampling and logbook data on tuna and tuna-like species to be recorded and reported to the IOTC Secretariat as per IOTC requirements (para. 104 of the SC18 report).*

3.2 Outcomes of the 20th Session of the Commission

5. The WPEB **NOTED** paper IOTC–2016–WPEB12–04 which outlined the main outcomes of the 20th Session of the Commission, specifically related to the work of the WPEB and **AGREED** to consider how best to provide the Scientific Committee with the information it needs, in order to satisfy the Commission's requests, throughout the course of the current WPEB meeting.

6. The WPB **NOTED** the 12 Conservation and Management Measures (CMMs) adopted at the 20th Session of the Commission (consisting of 12 Resolutions and 0 Recommendations) as listed below:

IOTC Resolutions

- Resolution 16/01 *On an interim plan for rebuilding the Indian Ocean yellowfin tuna stock*
- Resolution 16/02 *On harvest control rules for skipjack tuna in the IOTC area of competence*
- Resolution 16/03 *On the second performance review follow-up*
- Resolution 16/04 *On the implementation of a Pilot Project in view of Promoting the Regional Observer Scheme of IOTC*
- Resolution 16/05 *On vessels without nationality*
- Resolution 16/06 *On measures applicable in case of non-fulfilment of reporting obligations in the IOTC*
- Resolution 16/07 *On the use of artificial lights to attract fish*
- Resolution 16/08 *On the prohibition of the use of aircrafts and unmanned aerial vehicles as fishing aids*
- Resolution 16/09 *On establishing a Technical Committee on Management Procedures*
- Resolution 16/10 *To promote the implementation of IOTC Conservation and Management Measures*
- Resolution 16/11 *On port state measures to prevent, deter and eliminate illegal, unreported and unregulated fishing*
- Resolution 16/12 *Working Party on the Implementation of Conservation and Management Measures (WPICMM)*

7. The WPB **NOTED** that pursuant to Article IX.4 of the IOTC Agreement, the above mentioned Conservation and Management Measures shall become binding on Members, 120 days from the date of the notification communicated by the IOTC Secretariat in IOTC Circular 2016–054 (i.e. 27 September 2016).

8. **NOTING** that the Commission also made a number of general comments and requests on the recommendations made by the Scientific Committee in 2015, which have relevance for the WPEB (details as follows: paragraph numbers refer to the *[provisional subject to adoption by correspondence]*report of the Commission (IOTC–2016–S20–R): the WPEB **AGREED** that any advice to the Commission would be provided in the Management Advice section of each stock status summary for the bycatch species detailed in the relevant species sections of this report.

   The Commission **CONSIDERED** the list of recommendations made by the SC18 in 2015 (IOTC–2015–SC18–R) that related specifically to the Commission. The Commission *[provisionally, subject to adoption]* **ENDORSED** the list of recommendations as its own, while taking into account the range of issues outlined in this Report (IOTC-2016-S20-R) and incorporated within Conservation and Management Measures adopted during the Session and as adopted for implementation as detailed in the approved annual budget and Program of Work *(para. 14 of the S20 report).*

   On the implementation of a pilot project in view of promoting the Regional Observer Scheme of IOTC

   *Para. 113. The Commission **ADOPTED** Resolution 16/04 On the implementation of a pilot project in view of promoting the Regional Observer Scheme of IOTC. This Resolution creates a pilot project aiming to enhance the implementation of the Resolution 11/04 on a Regional Observer Scheme and to raise the level of compliance to the implementation of Resolutions 15/01 and 15/02, respectively on the recording of catch and effort data by fishing vessels in the IOTC area of competence and on mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating non-Contracting parties (CPCs).*

3.2.1 Meeting Participation Fund (MPF)

9. The WPEB **RECALLED** the recommendation by the SC18:*"The WPB RECOMMENDED that the IOTC Rules of Procedure (2014), for the administration of the Meeting Participation Fund be modified so that applications are due not later than 60 days (current deadline is 45 days), and that the full Draft paper be submitted no later than 45 days (current deadline is 15 days) before the start of the relevant meeting, so that the Selection Panel may review the full paper rather than just the abstract, and provide guidance on areas for improvement, as well as the suitability of the application to receive funding using the IOTC MPF. The earlier submission dates would also assist with Visa application procedures for candidates (para.98)."* and **REQUESTED** that the Rules of Procedure are updated to include the revised deadlines so that a draft can be presented to the S21 for approval in 2017.

3.3 Review of Conservation and Management Measures relevant to Ecosystems and Bycatch

10. The WPEB **NOTED** paper IOTC–2016–WPEB12–05 which aimed to encourage participants at the WPEB12 to review some of the existing Conservation and Management Measures (CMM) relevant to relevant to ecosystems and bycatch, noting the CMMs contained in document IOTC–2016–WPEB12–04; and as necessary to 1) provide recommendations to the Scientific Committee on whether modifications may be required; and 2) recommend whether other CMMs may be required.

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

3.4 Progress on the recommendations of WPEB12

12. The WPEB **NOTED** paper IOTC–2016–WPEB12–06 which provided an update on the progress made in implementing the recommendations from the previous WPEB meeting which were endorsed by the Scientific Committee, and **AGREED** to provide alternative recommendations for the consideration and potential endorsement by participants as appropriate given any progress.

13. The WPEB **RECALLED** 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 IOTC 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);
    - if appropriate an approximate budget for the activity, so that the IOTC Secretariat may be able to use it as a starting point for developing a proposal for the Commission's consideration.

14. The WPEB **REQUESTED** that the IOTC Secretariat continue to 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, as well as any updates and requests.

15. The WPEB **NOTED** that while sampling in Indonesia has continued, there has been very limited information collected on sharks, mostly due to the small number of gears and landing sites (i.e., 8 sites) selected for the pilot sampling in North and West Sumatra. The Secretariat will continue to monitor the results of the sampling, and report to the WPEB any information collected on sharks – although it is unlikely the pilot sampling results can be used to inform or review the current nominal catches of sharks in Indonesia due to the limited data available from sampling for shark species.

3.4.1 Species identification cards

16. The WPEB **NOTED** the progress made in translations and printing of the IOTC species identification cards, including the Persian and Arabic guides produced by WWF-Pakistan and yet to be distributed, and **ENCOURAGED** CPCs to continue to work with the IOTC Secretariat to complete these in the priority languages identified by the SC.

17. The WPEB reiterated the **RECOMMENDATION** that the IOTC Secretariat ensure that hard copies of the identification cards continue to be printed as many CPCs scientific observers, both on board and port, still do not have smart phone technology/hardware access and need to have hard copies on board.

18. The WPEB **NOTED** that the Seabird Bycatch Identification guide prepared by ACAP in collaboration with the Japanese Fisheries Research Agency has been published, and can be downloaded from the ACAP website: http://www.acap.aq/en/bycatch-mitigation. The guide is intended for use at sea by fisheries observers to assist in the identification of albatrosses and some commonly caught petrels and shearwaters brought aboard after being killed in longline operations. The guide also outlines protocols for taking photographs of dead seabirds, and the collection of feather samples for DNA analysis.

19. **NOTING** the difficulties with the identification of dead seabirds, the WPEB **REQUESTED** that the guides developed by ACAP and JFRA are made available via the IOTC website in the languages of relevance to IOTC CPCs.

20. **NOTING** the recommendation of the SC18 *"The SC RECOMMENDED that the Commission allocate funds in its 2016/2017 budget, to produce and print the IOTC best practice guidelines for the safe release and handling of encircled cetaceans. The guidelines could be incorporated into a set of IOTC cetacean identification cards: Cetacean identification for Indian Ocean fisheries"(para.102),* the WPEB **REQUESTED** that the IOTC Secretariat works with the authors of paper IOTC–2014–WPEB10–32 to develop the project further.

The WPEB **NOTED** that many shark species which occur in the Indian Ocean are not represented in the IOTC shark ID guide, and thus it would be useful to update the IOTC ID guides to include other wildlife in the northern Indian Ocean. The WPEB **NOTED** that many shark species occur in the northern Indian Ocean and that it may not be possible to include all in the guide and **SUGGESTED** that only those species which are known to interact with pelagic fisheries be included.

3.4.2 Identification guides for fishing gear

21. The WPEB **RECALLED** the recommendation made by the WPEB in 2013 and 2014: 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 Budget 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 (WPEB09, para.117).

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

23. The WPEB **NOTED** that the SPC guides are currently available on the IOTC website.

24. WPEB **ENCOURAGED** all participants to bring examples of the types of hooks used by their domestic longline fisheries to the next WPEB to begin the process of collecting terminal gear information.

3.4.3 Shark tagging programs: Indian Ocean

25. The WPEB **RECALLED** paper IOTC–2015–WPEB11–INF11, which provided a concept note on an IOTC shark tagging program with pop-up satellite archival tags (PSAT) in response to Indian Ocean Shark Year Programme (ShYP) priorities, and those endorsed by the Scientific Committee and Commission.

26. The WPEB **ACKNOWLEDGED** the importance of PSAT tagging for sharks to study post-release mortality of species currently banned for retention in IOTC area of competence, and collect information on habitat use and migratory behaviour.

27. **ACKNOWLEDGING** that partial funding has been identified for this project, the WPEB **REQUESTED** that the authors develop a revised concept note for the remaining activities for consideration by other potential funding bodies.

4. REVIEW OF DATA AVAILABLE ON ECOSYSTEMS AND BYCATCH

4.1 Review of the statistical data available for ecosystems and bycatch species

4.1.1 IOTC database

28. The WPEB **NOTED** paper IOTC–2016–WPEB12–07 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 15/02 *Mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPC's)*, for the period 1950–2014. A summary for sharks is provided at Appendix IV.

29. The WPEB **NOTED** the main data issues that are considered to negatively affect the quality of the statistics for bycatch species available at the IOTC Secretariat, by species group, 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.

30. The WPEB **NOTED** the standing of catch statistics for the main species of sharks, by major fisheries (gears), for the period 1950–2015 (Appendix VI) 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 important for assessing the status of shark stocks.

31. The WPEB **NOTED** the encouraging improvements in the quality of data reported to the IOTC.

32. The WPEB **RECALLED** Resolution 15/02 (para.2) which requires CPCs to report all discards, not just those that are dead on release: *"Estimates of the total catch by species and gear, if possible quarterly, that shall be*

submitted annually as referred in paragraph 7 (separated, whenever possible, by retained catches in live weight and by discards in live weight or numbers) for all species under the IOTC mandate as well as the most commonly caught elasmobranch species according to records of catches and incidents as established in Resolution 15/01 on the recording of catch and effort data by fishing vessels in the IOTC area of competence (or any subsequent superseding Resolution). "

33. The WPEB **SUGGESTED** that information from logbooks could be used to establish when the reporting of particular species within each CPC began which will facilitate the reconstruction of catch series for the different species from aggregate shark catches.

34. The WPEB**NOTED** the high blue shark catches by Indonesia, mostly taken by gillnets prior to 1983, after which the majority of catches were taken by coastal longlines. The WPEB **ACKNOWLEDGED** that these are the current best estimates, based on a consultancy project undertaken in 2012, the results of which were reviewed and endorsed by the SC and have since been used as a methodology to estimate the blue catches of Indonesia, detailed in paper IOTC-2016-WPEB12-INF04 for reference.

35. The WPEB **RECALLED** that presenting data at a working party meeting does not constitute a formal submission to the IOTC Secretariat and **URGED** all CPCs to submit data to the IOTC Secretariat formally as required according to IOTC reporting procedures based on the requested fisheries statistics and data submission forms that can be found on the IOTC website: www.iotc.org/data/requested-statistics-and-submission-forms

36. The WPEB **NOTED** paper IOTC–2016–WPEB12–08 which provided an overview of the improvements that are currently being made to the IOTC database, including the following abstract provided by the authors:

"The current state of the art related to the internal IOTC core data management processes is described, depicting benefits and shortcomings as they emerged after more than one decade of adoption. Reasons for a radical change in the process implementation are listed, together with the improvements that the envisaged changes will bring to the internal data flow – as part of the Secretariat's daily operations – and outside its boundaries (targeting mostly scientists, data analysts, policy makers, country-level focal points as well as national and regional management bodies). The proposed changes aim at rationalizing the entire data management chain, all the way up from the data ingestion to the data dissemination steps, at the same time enabling data consumers to have a simpler and more effective way to get access to the data while still enforcing the confidentiality policies currently adopted by the Commission. The most ambitious goal of this exercise is to increase the overall value of the data, transforming raw information into a valuable asset from the very first stages of the process, at the same time reducing the time-to-market prior to the final dissemination of regular information updates."– (see paper for full abstract).

37. The WPEB **NOTED** that this paper describes the automation of the disaggregation procedures used for the main IOTC species and the potential for applying these methods to sharks to improve estimates of historical catches.

38. The WPEB **CONGRATULATED** the IOTC Secretariat on the excellent work led by the new IOTC Data Coordinator particularly proposals to disaggregate catches reported as 'Sharks' (which currently account for around half of total estimates of catches of sharks) by species, using systematic and automated procedures within the IOTC database.

39. The WPEB **NOTED** that the new IOTC database aims to consolidate the range of datasets collated by the IOTC Secretariat, including the Regional Observer Scheme, that can be used to improve the quality and quantity of data available – particularly for species of sharks, and seabird interactions.

40. The WPEB**NOTED** the very high proportion of historic catches of aggregate shark species allocated to silky sharks and **ENCOURAGED** the use of historical research vessel data from the Soviet Union and Japan to improve the historical estimates further.

41. The WPEB **NOTED** that the current disaggregation processes used are heavily dependent on the availability of shark species composition data for certain fleets. This information is used as a basis for disaggregating catches reported as aggregates by species for similar fleets. The same process is used for catches that are not reported by gear type. Nevertheless, it may not be appropriate to use these estimation where there are very little data.

42. The WPEB **CONSIDERED** additional database functionality that would be useful to improve the quality of the catch estimates, including changes to the (automated) disaggregation procedure to enable changes in the selection of proxy fleet/gears/time periods to assess ranges in possible catch levels by species, as a proxy for uncertainty in the catch estimates

43. The WPEB **NOTED** that disaggregating the aggregate shark catches is an important first step which needs to be followed by addressing the catches of non-reporting fleets.

4.2 Regional observer scheme – Update (Resolution 11/04 On a regional observer scheme)

44. The WPEB **NOTED** paper IOTC–2016–WPEB11–09which 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:

"As of 9th August 2016, fifteen CPCs (Australia, China (including Taiwan,China), Comoros, EU (France[1], Spain and Portugal), Indonesia, Japan, Kenya, Rep. of Korea, Madagascar, Maldives, Mauritius, Mozambique, Seychelles, South Africa and Thailand) have submitted a list of observers and have been allocated an IOTC observer registration number. This makes a total of 348 currently registered observers."– (see paper for full abstract).

45. **NOTING** the update of the implementation of the Regional Observer Scheme (Appendix VII), 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. 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.

46. The WPEB **NOTED** the upcoming observer training workshop organised by WWF-Pakistan as a follow-up to the regional observer workshop held in Oman in 2015.

47. **NOTING** that EU,France reports effort for some vessels under 24m which fish within the EEZ, the WPEB **REQUESTED** EU,France submit these data to the IOTC Secretariat so that their observer coverage rate can be calculated accurately.

48. The WPEB **NOTED** the 100% observer coverage in the EU-Spain tuna purse seine fleet since December 2014 and **REQUESTED** that the observer trip reports and observer data are submitted to IOTC prior to the Working Party on Data Collection and Statistics and Scientific Committee as soon as the data is processed and validated.

49. The WPEB **NOTED** that some EU-Spain purse seiners have replaced onboard observers with Electronic Monitoring Systems. The total number of EU-Spain purse seiners with onboard observers is currently around ten while the rest are monitored through EMS.

50. **ACKNOWLEDGING** that the ROS came into force in July 2010, the WPEB **REQUESTED** that Appendix B in paper IOTC-2016-WPEB12-09 is revised so that the total effort from the Japanese fleet is also only included from July 2010.

51. The WPEB **NOTED** the data that has been collected by the crew-observer or self-sampling scheme led by WWF-Pakistan and **ENCOURAGED** WWF-Pakistan to continue with the good work the has been started and **REQUESTED** that these are submitted formally to IOTC through the appropriate government channels.

52. The WPEB **NOTED** the electronic monitoring trials planned for longline fisheries in the southern Indian Ocean through the Common Oceans programme and **AGREED** that BirdLife should also contribute to the IOTC observer pilot project proposal to share lessons learned.

53. The WPEB **AGREED** that a range of alternative solutions are necessary to begin making progress in data collection in developing country fleets such as electronic monitoring, extended port based sampling and fisher self-sampling/self-reporting (as is already being trialled in Pakistan).

54. **RECALLING** the SC18 (para. 134) ***"NOTING** that many CPCs report Regional Observer data in .pdf format, or as data embedded within documents, and also in hard-copy format, the SC **ENCOURAGED** CPCs to report Regional Observer data in any non-proprietary electronic format (e.g. csv, xml, txt, etc.) or in an electronic format that can be easily exported and processed into standard spreadsheet, database or statistical software (e.g. xls, dbase, mdb, etc.). This may be in any electronically readable format as long as all of the agreed minimum data reporting requirements have been fulfilled",* the WPEB **RECOMMENDED** that observer data are submitted in electronic format that could be automatically exported and processed into a standard spreadsheet-like format (e.g. csv, xml, txt, xls, dbase, mdb etc.), avoiding formats whose processing could be time consuming and unnecessarily complex (e.g. pdf, Microsoft Word documents etc.), at the same time ensuring that all of the agreed minimum data reporting requirements have been fulfilled.

[1] Including Mayotte due to its status as a French outermost region since January 2014

55. **NOTING** that many CPCs already have established observer data management systems in place, the WPEB **REQUESTED** the IOTC Secretariat provide a template for observer data to be submitted as flat files extracted from national databases, according to the data reporting requirements agreed by the SC17.

4.2.1 Revision of Resolution 11/04 on a regional observer scheme

56. **RECALLING** the objectives of Resolution 11/04 on a regional observer scheme as follows:
"Para 1: *The objective of the IOTC Observer Scheme shall be to collect verified catch data and other scientific data related to the fisheries for tuna and tuna-like species in the IOTC area of competence*"
and **NOTING** that the objective of the ROS contained in Resolution 11/04, and the rules contained in Resolution 12/02 *On data confidentiality policy and procedures* makes no reference to the data collected not being used for compliance purposes, the WPEB reiterated its **RECOMMENDATION** that at the next revision of Resolution 11/04, it be clearly stated that the data collected shall not be used for compliance purposes.

4.2.2 Bycatch data exchange protocol (BDEP)

57. The WPEB **RECALLED** paper IOTC–2015–WPEB11–41 which proposed a format for the collation and harmonisation of global datasets for bycatch species and **NOTED** paper IOTC–2016-WPEB12-INF03 that detailed the WCPFC progress with using the template.

58. The WPEB further **RECALLED** the subsequent request by WPEB11 to the IOTC Secretariat: *"The WPEB **REQUESTED** the IOTC Secretariat collate the observer data available, using the BDEP template as a trial format and aggregating data according to the guidelines in Resolution 12/02 Data confidentiality policy and procedures and present this for review at the next WPEB meeting".*

59. The WPEB **NOTED** the trial presented by the IOTC Secretariat for a set of example observer data and **ACKNOWLEDGED** the issues with collating the historical observer data into this format, most of which were overcome when using the data reported according to the new interim reporting requirements.

60. The WPEB **AGREED** that the usefulness of the summaries presented in the BDEP template is dependent on the quality and timelines of submission of CPC observer programme data to the Secretariat. Consequently, the WPEB **URGED** all CPCs to submit their observer data according to the minimum data reporting requirements agreed at SC17 detailed on the IOTC website [www.iotc.org/science/regional-observer-scheme-science].

61. **ACKNOWLEDGING** the benefits of producing globally compatible datasets among the tRFMOs, the WPEB **AGREED** to continue to trial the BDEP template to support harmonisation initiatives.

62. The WPEB **RECOMMENDED** that, on completion of the development of the ROS database and the input of all of the historical data, the IOTC Secretariat continue to populate the BDEP template, adapting it where necessary, and present this to the WPDCS and SC for further review.

4.2.3 Pilot projects under Resolution 16/04

63. The WPEB **NOTED** Resolution 16/04 (*On the implementation of a pilot project in view of promoting the Regional Observer Scheme of IOTC)* and **ACKNOWLEDGED** the importance of this new CMM for the working party.

64. **ACKNOWLEDGING** the difficulties in implementing onboard observers on small gillnet vessels, the WPEB A**GREED** on the importance of implementing pilot projects to promote the Regional Observer Scheme, including the development of electronic monitoring and port sampling in accordance with Resolution 16/04 for countries with gillnet fisheries.

65. The WPEB **NOTED** that Resolution 16/04 states that the project will *"explore the possibilities offered by electronic observation and observation in port"* (para. 6) and that *"the IOTC Scientific Committee will draft guidelines regarding the ToR and work of observers, and an indicative budget for approval by the Commission in 2017"* (para. 3).

66. The WPEB **REQUESTED** the IOTC Secretariat liaise with the WPEB Chair and Vice Chair as well as the SC Chair to develop the ToRs, guidelines, work of observers and indicative budget intersessionally, and submit it for the WPDCS and SC19 to review.

5. REVIEW OF NATIONAL BYCATCH ISSUES IN IOTC MANAGED FISHERIES AND NATIONAL PLANS OF ACTION (SHARKS; SEABIRDS; MARINE TURTLES)

5.1 Review of applications for 'not applicable' NPOA status

67. The WPEB **RECALLED** that the IPOA-SHARKS is a voluntary instrument that applies to all States engaged in shark fisheries. The text sets out a set of activities which implementing States are expected to carry out, including an assessment of whether a problem exists with respect to sharks, adopting a National Plan of Action for the conservation and management of sharks (NPOA-SHARKS), as well as procedures for national reviews and reporting requirements. The calendar years by when these actions preferably should have been taken, are indicated.

68. The WPEB **RECALLED** that the IPOA-SEABIRDS is a voluntary instrument that applies to all States engaged in fisheries. The text sets out a set of activities which implementing States are expected to carry out, including an assessment of whether a problem exists with respect to the incidental catch of seabirds in its longline fishery, adopting a National Plan of Action for reducing the incidental catch of seabirds in longline fisheries (NPOA-SEABIRDS) as well as procedures for national reviews and reporting requirements. The calendar years by when these actions preferably should have been taken, are indicated.

69. The WPEB **NOTED** the process for assessing the need for an NPOA by CPCs, as adopted by the SC in 2014, detailed in Appendix VII of the SC17 Report. All CPCs are now required to follow that process when requesting the IOTC Secretariat to apply a status of 'Not applicable (n.a.)' for an NPOA, in the 'Table of progress in implementing NPOA-sharks, NPOA-seabirds and the FAO guidelines to reduce sea turtle mortality in fishing operations'.

70. The WPEB **NOTED** that no requests were received by the IOTC Secretariat since the last SC meeting to apply a status of 'Not applicable (n.a.)' for an NPOA, in the 'Table of progress in implementing NPOA-sharks, NPOA-seabirds and the FAO guidelines to reduce sea turtle mortality in fishing operations'.

5.2 Updated status of development and implementation of National Plans of Action for seabirds and sharks, and the implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations (CPCs)

5.2.1 NPOA implementation overview

71. The WPEB **NOTED** paper IOTC–2016–WPEB12–10 Rev_1 which provided an update on the current 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, by IOTC CPCs, including the following abstract provided by the authors:

> *"At its 18th Session, the Scientific Committee **RECOMMENDED** that the Commission note the current status of development and implementation of National Plans of Action (NPOAs) for sharks and seabirds, and the implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations, by each CPC as provided at Appendix V, recalling that the IPOA-Seabirds and IPOA-Sharks were adopted by the FAO in 1999 and 2000, respectively, and required the development of NPOAs."*

72. The WPEB **NOTED** the current status of development and implementation of National Plans of Action (NPOAs) 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 NPOAs, or even carried out assessments to ascertain if the development of a Plan is warranted. Currently only 16 of the 37 IOTC CPCs have an NPOA-Sharks (8 more in development), while only 6 CPCs have an NPOA-Seabirds (2 in development). A single CPC has determined than an NPOA-Sharks is not needed, and 5 have similarly determined than an NPOA-Seabirds is not needed.

73. The WPEB **NOTED** the current status of development and implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations. Currently only 9 of the 37 IOTC CPCs have implemented the FAO guidelines to reduce marine turtle mortality in fishing operations (2 more in progress), and two CPCs (European Union, France (OT)) have implement a full NPOA in 2015.The IOTC and IOSEA Secretariats should continue to work collaboratively with any CPC requesting assistance to develop their national management plans for the reduction of marine turtle bycatch in tuna fisheries.

74. 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 WPEB and SC in 2016, **NOTING** that NPOAs are a framework that should facilitate estimation of shark catches, seabird interactions, and development and implementation of appropriate management measures, which should also enhance the collection of bycatch data and compliance with IOTC Resolutions.

75. The WPEB **REQUESTED** that the IOTC Secretariat continue to periodically revise the table summarising progress towards the development of NPOA-Sharks, NPOA-Seabirds, and the implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations, by each CPC for the consideration at each WPEB and the SC meeting. The current version is provided at Appendix VIII.

76. The WPEB **NOTED** that, following a stakeholder workshop earlier this year, the final version of the NPOA - Sharks for Pakistan has been submitted to the provincial fisheries departments for endorsement.

5.2.2 NPOA IOTC website portal

77. The WPEB **NOTED** that the NPOA portal on the IOTC website (http://iotc.org/science/status-of-national-plans-of-action-and-fao-guidelines) provides details of the most recent updated table of progress in implementing NPOA-Sharks, NPOA-Seabirds and the FAO Guidelines to Reduce Sea Turtle Mortality in Fishing Operations. It also provides other information in support of CPCs wishing to develop their own NPOAs, such as the guidelines and NPOA documents from all CPCs who have submitted their NPOAs.

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

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

6.1.1 Trace elements in oceanic pelagic communities

78. The WPEB **NOTED** paper IOTC–2016–WPEB12–13Rev_1 which provided a preliminary study of trace elements in oceanic pelagic communities in the western-central Indian Ocean, including the following abstract provided by the authors:

"*Catch of non-target pelagic fish by industrial and semi-industrial tuna fisheries represent around 5% of total catch in the western Indian Ocean. Fish is one of the main sources of animal protein for many regional countries including Seychelles, and also bring essential nutrients for human health. Instead of being discarded, these bycatch could thus constitute an additional and valuable food resource for populations which has to be investigated. Here, we aimed to determine the mineral composition of 13 oceanic pelagic species caught by purse-seiners and longliners in the western-central Indian Ocean and landed in Seychelles. From the ten essential trace elements analysed, selenium and zinc showed the highest concentrations in swordfish and blue marlin while Indian mackerel appeared as a good source of copper, iron and chrome. All catch had levels of lead and cadmium, two toxic elements, below the maximum legal sanitary limits. Regarding mercury, the largest pelagic species showed some concerns with 60% of wahoo and 30% of swordfish and blue marlin above the maximum sanitary limit of 1 ppm. However, it is largely recommended to take into account interactions between selenium and mercury for risk assessment study. Molar ratios of mercury and selenium in all oceanic pelagic fish from the western-central Indian Ocean indicate that these species are safe for human consumption. This study also gives insights on the relationships between the levels of essential and toxic elements in fish muscle and the size, trophic position and diet sources of the studied pelagic species."*

79. **NOTING** the size range of individuals in the study, the WPEB **SUGGESTED** that the size of the individuals might be an important factor to account in the analysis of toxic elements. The author clarified that size information was also being analysed and did have an effect on the concentration levels of mercury and other elements due to changes in feeding habitats.

80. The WPEB also **NOTED** the high mercury concentration in three species (Swordfish, Blue marlin and Wahoo), but also noted that Selenium concentrations are high which counterbalanced naturally the high mercury levels.

81. The WPEB also **NOTED** the surprisingly higher concentrations of mercury in Wahoo than blue marlin and swordfish, given its relatively lower trophic level and **SUGGESTED** the authors continue to investigate this.

82. The WPEB **NOTED** that sharks usually accumulate more mercury than selenium due to the difference in their metabolic processes.

6.1.2 Ecosystem based fisheries management: tRFMO progress

83. The WPEB **NOTED** paper IOTC–2016–WPEB12–14 which provided an evaluation of progress of tuna regional fisheries management organizations in applying ecosystem-based fisheries management, including the following abstract provided by the authors:

"Highly migratory fish species such as tunas, billfishes and sharks and associated ecosystems sustain important function and services for human wellbeing. Over the last decades international instruments of

fisheries governance have set the core principles and minimum standards for the management of highly migratory fishes. Concomitantly the expectations and roles of Regional Fisheries Management Organizations (RFMOs) have changed. In response, RFMOs have been slowly incorporating ecosystem principles when managing the tuna and those tuna-like species under their juristiction. Here, our main objective is to evaluate the progress of tuna RFMOs (tRFMO) in implementing Ecosystem-Based Fisheries Management (EBFM), and specifically we focus on reviewing the ecological component, rather than the socio-economic and governance components of an EBFM approach. We first develop a benchmark Conceptual Ecological Model for what could be considered a "role model" of EBFM implementation in a tRFMO. Second, we develop a criteria to evaluate progress in applying EBFM against this benchmark role model. In our evaluation, we assess progress of the following four ecological components: targeted species, bycatch species, ecosystem properties and trophic relationships, and habitats, and review 20 elements that ideally would make EBFM more operational." – (see paper for full abstract)

84. The WPEB **NOTED** that while only the Ecological Component of an EBFM approach was reviewed here, it would be also valuable to start discussing the socio-economic and governance components of the application in the IOTC region.

85. The WPEB **NOTED** the paper suggested steps in advancing the practical implementation of EBFM including the development of an Ecosystem Report Card, an Ecosystem Consideration Report, and an Ecosystem Risk Assessment.

86. **ACKNOWLEDGING** the importance of developing a template for an Ecosystem Report Card for the Indian Ocean as a starting point to foster the discussion of EBFM within IOTC, the WPEB **REQUESTED** the authors develop a preliminary template, including a conceptual framework of EBFM, its main components and potential indicators to track the status of the different components for presentation at the next IOTC Scientific Committee meeting with the aim of integrating ecosystem research within management.

87. The WPEB **NOTED** that the paper presented would also be useful to inform discussions at the upcoming joint tRFMO meeting on EBFM as it establishes a baseline of progress in implementation of the ecological component of EBFM across the five tRFMOS and identifies the main gaps and elements currently hindering progress. This joint tRFMO meeting is organised by ABNJ Common Ocean project and will be held next December (see section 12.3).

6.1.3 Bycatch composition: China

88. The WPEB **NOTED** paper IOTC–2016–WPEB12–16 which provided estimates of the composition and capture status of bycatch using Chinese longline observer data in the Indian Ocean, including the following abstract provided by the authors:

"From 2012 to 2015, five Chinese tuna longline observer trips were conducted in the Indian Ocean (N10°35' - S33°20' , E40°58' - E89°54'). Bycatch and capture status from these trips were analyzed in this report. A total of 4,463 individuals among 52 bycatch species were captured from 911,718 hooks deployed, including tunas (39.4%), billfishes (12.0%), sharks (12.4%), rays(2.4%), sea turtles and seabirds (0.09%), and miscellaneous species (33.8%). The dominant bycatch species were yellowfin tuna (Thunnus albacores), swordfish (Xiphias gladius), Indo-pacific blue marlin (Makaira mazara), blue shark (Prionace glauca), pelagic stingray(Dasyatis violacea), longnose lancetfish (Alepisaurus ferox), escolar (Lepidocybium flavobrunneum), and opah (Lampris guttatus)." – (see paper for full abstract)

89. The WPEB **NOTED** the reporting of Atlantic white marlin, a species that is not located in the Indian Ocean and **ENCOURAGED** the continuation of observer training in items such as species identification to overcome these issues.

90. The WPEB **NOTED** that billfish are considered bycatch in this fishery and are sometimes discarded.

91. **NOTING** the two unidentified seabirds, the WPEB **ENCOURAGED** the use of photographs that can be sent to experts for assistance with identification and the ACAP seabird bycatch identification guide which is available in a number of languages, including Chinese and will be made available via the IOTC website.

92. **NOTING** the lack of size information included in the current study, the WPEB **REQUESTED** the authors continue analysing the size data and present this at the next WPEB meeting.

93. The WPEB **ACKNOWLEDGED** the importance of the observer data and **ENCOURAGED** China to continue with the implementation of the programme and provide further results and analysis for future WPEB meetings, including results on the use of bycatch mitigation measures when presenting information on bycatch.

7. GILLNET FISHERIES: PROBLEMS AND NEEDS (*INCLUDING CAPACITY BUILDING*)

7.1 Regional review of the data available for gillnet fleets operating in the Indian Ocean

7.1.1 Drifting gillnet fisheries: Indonesia

94. The WPEB **NOTED** paper IOTC–2016–WPEB12–17 which detailed the composition and abundance of pelagic sharks caught by Indonesian drifting gillnet fisheries in the Indian Ocean, including the following abstract provided by the authors:

"Drift gillnet fleets in the South of Java part of Indian Ocean were multi-species fisheries. The target of this fleet was tuna and skipjack tuna. Our studies on shark fisheries had been conducted since 2014-2015 and focused on drift gillnets fleets in eastern Indian Ocean, south Java waters around 80 – 100 S and 1060 – 1100 E. The aims of this paper were to presents the information about sharks composition, size distribution and nominal catch-per-unit-effort. A total 244 ton catch of sharks was recorded, consisted of 13 species, with an average catch of 9.5 tonnes/month and average CPUE (Vessel Catch/Day) were 12.87kg/days. The greatest number of species caught with drift gillnet was from Family Alopidae (pelagic and bigeye thresher). Length frequency distribution of Alopias pelagicus from 55to 185 cm FL (SD± 15.33) and for Alopias superciliosus ranged from 90 to 268 cm FL (SD±27.05)."

95. The WPEB **THANKED** the authors for the study which aimed to quantify shark bycatch from the gillnet fisheries and **NOTED** the high impact of these fisheries on thresher sharks.

96. **AKNOWLEDGING** that this study was based on a limited number of trips (three) which may not be very representative of the total catches by the fleet, the WPEB **NOTED** the particularly high level of bycatch (48%) in these drifting gillnet fisheries which may be due to the long soak time of the nets.

97. The WPEB **NOTED** that fishers often use handlines in combination with gillnets while the net is soaking.

7.1.2 Tuna gillnet fisheries: Pakistan

98. The WPEB **NOTED** paper IOTC–2016–WPEB12–40 which detailed bycatch of the commercially important species of the tuna gillnet fisheries of Pakistan, including the following abstract provided by the authors:

"Gillnet operations in the offshore waters of Pakistan including Exclusive Economic Zone (EEZ) and the Area Beyond National Jurisdiction (ABNJ) contribute substantially to landings of tuna as well as a variety of non-target species. In addition to ecologically important species such as cetaceans (whales and dolphins), turtles and elasmobranchs (sharks, mobulid rays and whale sharks), a number of commercially important finfish species are also caught. Among these bycatch species billfishes, Spanish mackerels, queenfishes and dolphinfishes are dominating. Among billfishes, Indo-Pacific sailfish (Istiophorus platypterus) and black Marlin (Makaira indica) are dominating in the bycatch almost throughout the year especially during winter months. Common dolphinfish (Coryphaena hippurus) is another species which is caught throughout the year and contributing substantially to total landings of pelagic fisheries of Pakistan. Unprecedented increase in the bycatches of unicorn leatherjacket filefish (Alutrea monoceros), rough triggerfish (Canthidermis maculata) and largescale triggerfish (Canthidermis macrolepis) is of great interest, as these species were not reported in landings of tuna gillnetters during last decades."

99. The WPEB **NOTED** that the estimates of bycatch rates reported through the WWF-Pakistan crew-based observer scheme (45%) are consistently higher than official figures.

100. The WPEB **NOTED** the difference in definitions of bycatch among the papers presented (e.g. Spanish mackerel in this study), as in the wider literature, resulting in bycatch rates that are not comparable among studies.

101. **RECALLING** that the IOTC has already agreed on a definition of 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",* it was **AGREED** that this definition would be used by the Working Party when making comparisons, however, definitions specific to the fishery can be used in individual studies where appropriate.

102. The WPEB **NOTED** paper IOTC–2016–WPEB12-INF11 which provided an analysis of bycatch of the tuna gillnet fisheries of Pakistan from2013-2015,including the following abstract provided by the authors:

"There are around 700 gillnet vessels engaged in fishing in the continental shelf and offshore waters of Pakistan. These not only operate in the high seas within the exclusive economic zone, but also in the areas beyond national jurisdiction. A large number of sharks, sea turtles, cetaceans have been recorded to be caught in the tuna gillnet fisheries, but the species-wise composition data was not available. The study revealed that the dominating shark species includes Isurus oxyrinchus, Alopias pelagicus and Carcharhinus spp., whereas among the sea turtles, the olive ridley turtle (Lepidochelys olivacea) is the dominating species and constitutes to about 86% of the total sea turtle bycatch, followed by the green turtle (Chelonia mydas,) comprising of 14% of the total sea turtle bycatch and Indo-pacific bottlenose dolphin (Tursiops aduncus),

common bottlenose dolphin (Tursiops truncates) and spinner dolphin (Stenella longirostris) have been recorded as dominant cetacean species entangled. WWF-Pakistan has initiated a program of safe release of enmeshed animals and so far 32 whale sharks, 14 mobulids, 1 beaked whale, 1 guitarfish, 2 bottlenose dolphins and thousands of sea turtles have been released safely".

103. The WPEB **NOTED** the use of gillnets of 4 – 7km average length presented in the study on crew-based observer data.

104. **RECALLING** the previous recommendation from the Scientific Committee, the WPEB **RECOMMENDED** that this is reiterated: *"**NOTING** that gillnets are regularly being used with lengths in excess of 4,000 m (and up to 7,000 m) within and occasionally beyond the EEZ of Pakistan and other IOTC CPCs in the region, and that those used within the EEZ may sometimes drift onto the high seas in contravention of Resolution 12/12, the SC **RECOMMENDED** that the Commission should consider if a ban on large scale gillnets should also apply within IOTC CPC EEZ. This would be especially important given the negative ecological impacts of large scale drifting gillnets in areas frequented by marine mammals and turtles" (SC18 para. 39).*

105. The WPEB**NOTED** that although there is a retention ban on thresher sharks (*Resolution 12/09 On the conservation of thresher sharks* (Family Alopiidae) *caught in association with fisheries in the IOTC area of competence),* they make up a high proportion of the catches reported for these fleets by the crew-based observers.

106. The WPEB **NOTED** that the mortality rate for entangled marine turtles is approximately 6%.

107. The WPEB **NOTED** the data quality controls that are currently in place which include the use of the IOTC species identification guides (in Urdu) and the use of cameras by skippers.

108. The WPEB **NOTED** that AIS has been piloted on four vessels so far, and there are plans to use technologies such as CCTV footage and **REQUESTED** that these data are analysed and results are presented at the next meeting.

7.1.3 Tuna vessel bycatch: I.R. Iran

109. The WPEB **NOTED** paper IOTC–2016–WPEB12–12 which detailed Iranian fishing vessels bycatch in IOTC area of competence in 2015, including the following abstract provided by the author:

"In order to assess the level of Iranian tuna fishing vessels by-catch in the IOTC competence of area in 2015, the data which they are collected through the Iran Fishery Organization (IFO) data Collection system were used. Base on the system outputs, more than 24 different of Tuna, Tuna-like and some other species are caught by Iranian fishermen through the Tuna fishing activities. Based on 2015 information in total, 251551 tons of different species including, 212497 tons Tuna and Tuna-like species (target species 84.5%), 19532 tons Billfish (7.8%), 7135 tons of different Sharks species (2.8%) and 12388 tons of the other species (4.9%) were caught by Iranian fishing vessels in the IOTC competence of area in 2015."- (see paper for full abstract)

110. The WPEB **NOTED** that data presented are from port sampling, as the small size of the vessels prevents the accommodation of onboard observers.

111. The WPEB **NOTED** that a satellite-based monitoring system, covering ~ 60 vessels which started 15 years ago ended following the introduction of international sanctions 10 years ago as there is currently a lack of satellite access.

112. The WPEB **NOTED** the high proportion of milk sharks in the data set caught in the coastal area by the pelagic fisheries.

113. The WPEB **NOTED** the lack of spatial catch and efforts data, CPUE information and size frequency samples from gillnet fisheries and **ENCOURAGED** the tuna-targeting gillnet fishing nations to improve their current data management systems, and report data according to the IOTC Resolutions to support the sustainable management of tuna fisheries in the IOTC area of competence.

7.2 Training on species identification, bycatch mitigation and data collection for gillnet fleets – updates, plans of action and identification of other potential sources of assistance

114. The WPEB **NOTED** that Item 7.2 is now covered under the Regional Observer Scheme section of the WPEB Report, and as such, is not detailed here.

8. BLUE SHARK

8.1 Review new information on blue shark biology, stock structure, bycatch mitigation measures, fisheries and associated environmental data

8.1.1 Blue shark: intrinsic growth rates and steepness

115. The WPEB **NOTED** paper IOTC–2016–WPEB12–18 provided estimates of intrinsic rate of population change and steepness for blue shark (*Prionace glauca*) in the Indian Ocean, including the following abstract provided by the authors:

"*Maximum population growth rates and steepness values were computed for the Indian Ocean blue shark (Prionace glauca) based on biological information available for that Ocean. Uncertainty in the estimates of life history parameters was incorporated through Monte Carlo simulation by assigning statistical distributions to the biological parameters in a Leslie matrix approach. Estimated productivity was high, specifically with λ=1.37-1.42 yr-1 and rmax=0.32-0.35 yr-1, depending on the biological parameters and scenario considered. This is in line with what has been previously found for other populations of blue shark on other Oceans. Consequently, analytically derived values of steepness were also high, with h=0.80-0.87. These estimates can be used as inputs into both Bayesian surplus production (rmax) and age-structured (steepness) stock assessment models."*

116. The WPEB **THANKED** the authors for this is preliminary work conducted in anticipation of the 2017 blue shark stock assessment and **REQUESTED** that this is further developed for next year.

117. The WPEB **NOTED** that the estimates of steepness (0.80-0.87) appear implausibly high, as it implies an ability for sharks to have capacity to increase recruits per female four-fold as a density-dependent response.

118. The WPEB **SUGGESTED** that the author checks whether the Myers equation used to estimate steepness is appropriate for elasmobranchs, and to determine what is driving the response (e.g. does the 0-age juvenile survivorship increase rapidly?).

119. The WPEB also **NOTED** the low longevity (16) and **SUGGESTED** exploring options of increasing those values in the Leslie matrix modelling.

8.2 Review of new information on the status of blue shark

8.2.1 Nominal and standardised CPUE indices

Indonesia blue shark longline standardised CPUE

120. The WPEB **NOTED** paper IOTC–2016–WPEB12–19 which detailed preliminary standardized CPUE of blue shark in the Indonesian tuna longline fishery estimated from scientific observer data, for the period 2005 – 2014 including the following abstract provided by the authors:

"*The blue shark (Prionace glauca) is one of the dominant caught and most important bycatch shark species for Indonesian tuna longline fishery in the Indian Ocean. The number of Indonesian tuna longline fleets in Indian Ocean are 1,282 units. There are two types of tuna longline fleet in Indonesia, based on the product destinations, namely fresh and frozen tuna. This working document analyses the catch, effort, nominal and standardized CPUE trends for blue shark captured by this fishery, for the period between 2005-2014. Nominal annual CPUEs were calculated as number (N)/1000 hook. Standardized CPUEs were estimated with Generalized Linear Models (GLMs) using year, quarter, area, and operational characteristics of the gear. Model goodness-of-fit and model comparison was carried out with the Akaike Information Criteria (AIC) and the pseudo coefficient of determination (R2) and model validation with a residual analysis. The final estimated indexes of abundance were calculated by least square means (LSMeans). Preliminary results showed the factors that contributed most for the deviance were the area, followed by year, quarter, number of hooks between floats (NHBF), and then the other effects and the interactions. The trends of the standardized CPUEs were relatively similar to the nominal series, but with smoother peaks. In general there were no noticeable trends, with the series varying along the period."*

121. The WPEB**NOTED** that the standardisation only partly removed the high CPUE peaks in 2007 and 2012 (especially 2012), likely driven by the frozen fleet which fishes further south and therefore targets different individuals, due to the way that blue sharks aggregate by size and sex.

122. The WPEB **SUGGESTED** exploring the removal of the frozen vessels from the model to remove this effect, particularly given that there was only one frozen vessel fishing in 2012

123. **ACKNOWLEDGING** the surprising lack of significance of shark lines as an explanatory variable in the model, the WPEB **NOTED** that this may be due to its correlation with another variable.

124. **NOTING** the effect of latitude on the size of blue sharks, the WPEB **SUGGESTED** the authors further explore standardising the CPUE in biomass as well as numbers as a comparison.

125. The WPEB also **SUGGESTED** the authors consider investigating NHBF as categorical rather than continuous variable.

8.2.2 Stock assessments (including data poor approaches): preparation for 2017 assessment

126. The WPEB **NOTED** paper IOTC–2016–WPEB12–36which provided preliminary analysis and data development for blue shark (*Prionace glauca*) catch reconstruction, including the following abstract provided by the authors:

"Preliminary catch estimates using the IOTC nominal catch data were calculated via ratios, disaggregation and generalized additive models. This paper outlines three estimates based on the nominal catch data, ratio based, GAM estimated and disaggregated reports of 'shark' catch. These estimates reflect the initial avenues pursued to estimate blue shark catch possible next steps include the revision of the disaggregated data."

127. The WPEB **NOTED** that the estimates are currently substantially lower than the trade based estimates, although caution is required in interpreting the last three years (2013-2015) of the trade data as these values were extrapolated based on proportions and may not be reliable. The WPEB further **RECALLED** that there are three other trade-based methods (other than tuna ratio) available which should be considered.

128. The WPEB **NOTED** that the IOTC database estimates are likely to be underestimates and, thus the IOTC Secretariat and the consultant, in collaboration with the WPEB Chair, will investigate these issues further using other data sources (observer) and filtering methods.

129. The WPEB **NOTED** that this work will be ongoing until next year ahead of the stock assessment.

8.2.3 Selection of Stock Status indicators for blue shark

130. **NOTING** that no assessment was carried out in 2016, the WPEB **AGREED** that the stock status indicators from previous years should be carried over.

8.3 Development of management advice for blue shark and update of the Executive Summary for the consideration of the Scientific Committee

8.3.1 Consideration of options for alternative management measures for blue shark in the IOTC area of competence

131. The WPEB **ADOPTED** the management advice developed for blue shark in IOTC fisheries for tuna and tuna-like species, as provided in the draft resource stock status summary and **REQUESTED** that the IOTC Secretariat update the draft stock status summary for blue shark with the latest 2015 catch data (if applicable), and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration:
    - Blue sharks (*Prionace glauca*) – Appendix IX

9. OTHERS SHARKS AND RAYS

9.1 Review new information on other shark and ray biology, stock structure, bycatch mitigation measures, fisheries and associated environmental data

9.1.1 Shark fishery ban: Maldives

132. The WPEB **NOTED** paper IOTC–2016–WPEB12–20 which detailed the status of the Shark Fishery Ban in the Maldives and the implementation of the National Plan of Action on Sharks, providing an update with notes on marine turtles, including the following abstract provided by the author:

"Up until 1970s, the shark fishery of the Maldives was a traditional one, where large sharks were caught in need of shark liver oil. This traditional shark fishery evolved to more export oriented fisheries in 1970s, when highly targeted fisheries for sharks developed in the Maldives. These were the deepwater gulper shark fishery, reef-associated shark fishery and oceanic shark fishery. Shark fisheries were undertaken by a minor community, and had always been in conflict with important stakeholders such as the pole-and-line tuna industry and the booming dive tourism industry. The declining status of shark fisheries, exacerbated by unresolved conflicts with other stakeholders led to declaration of total shark fishing ban in 2010."- (see paper for full abstract)

133. The WPEB **NOTED** the reporting of seabird bycatch in the Maldives and **COMMENDED** the use of seabird bycatch mitigation measures, which are in line with Resolution 12/06, despite no seabird bycatch having been reported from the fishery.

134. The WPEB **NOTED** that the data collected by the study would be useful for the current IOTC CITES project, and **REQUESTED** that Maldives liaise with the IOTC Secretariat in terms of sharing of the data.

135. **ACKNOWLEDGING** the national ban on landing sharks in the Maldives, the WPEB **NOTED** the difficulties Maldives has in collecting size frequency information for sharks as sampling programmes currently take place at major landing sites. The WPEB **NOTED** that sharks that were already dead at haulback could be measured by fishers or onboard observers to obtain size frequency information. The WPEB also **NOTED** that information from longliner logbooks indicates that shark interactions are minimal, while interactions with marine turtles and seabirds are negligible and zero respectively.

136. The WPEB **was informed** that there was a single reported incident of illegal shark fishing which is being investigated by the Maldivian Authorities.

9.1.2 Portuguese pelagic sharks research programme

137. The WPEB **NOTED** paper IOTC–2016–WPEB12–21 which provided an update of the Portuguese pelagic sharks research programme in the Indian Ocean, including samples and data up to 2015, including the following abstract provided by the authors:

"Portuguese longliners targeting swordfish and operating in the Indian Ocean regularly capture elasmobranchs as bycatch. Of those, the blue shark (Prionace glauca) and the shortfin mako shark (Isurus oxyrinchus) constitute the two main shark species captured, even though several other species are also occasionally captured. IPMA, the Portuguese Institute for the Ocean and Atmosphere, is responsible for the National Data Collection Program, deploying fishery observers on longline vessels to collect fisheries data and samples. Therefore, IPMA has currently the means and opportunity to collect a wide variety of biological samples that are of ultimate importance to the work of the Working Party on Ecosystems and Bycatch. In this document we present the current Portuguese pelagic shark research program for the Indian Ocean, and provide details regarding the collection of shark samples for the near future, specially for BTH and OCS as per IOTC Resolution 12/09 and 13/06, respectively."

138. The WPEB **NOTED** that all samples are collected by fisheries observers, based on commercial vessels, and that samples have been collected as far south as 30 degrees South where catches of porbeagle shark are known to occur. The WPEB further **NOTED** very few samples of porbeagle sharks have been collected by observers due to the EU retention ban and restrictions on the sampling of porbeagle sharks (i.e., as a CITES species) – rather than due to issues of species misidentification with blue sharks and shortfin mako sharks.

139. The WPEB **NOTED** that genetic samples that would be useful for the IOTC stock structure project and **ENCOURAGED** the authors to collaborate with the team leading the EU-funded project.

9.1.3 Shark bycatch: Kenya

140. The WPEB **NOTED** paper IOTC–2016–WPEB12–22 which detailed growth, mortality and exploitation rates of shark species caught as bycatch in small-scale tuna fisheries in coastal Kenya, including the following abstract provided by the author:

"Growth, mortality and exploitation rates in fish are critical correlates with which to evaluate many other biological (and physiological) processes such as productivity, yield per recruit, prey availability, habitat suitability, and even feeding kinematics. Despite the importance of these processes, the implementation of modern methods for determining these parameters for elasmobranchs has tended to lag well behind that of teleosts. Data were collected from artisanal fisher landings at various fish landing sitesalong the Kenya coast. The landings were inspected for sharks for 2-weeks in a month for 12 months (June 2012 to May 2013). Specimens were identified to species level,and total lengths were measured for the most common shark species landed and grouped into monthly length-frequencies to analyze for growth and mortality parameters using the FAO ICLARM Stock Assessment Tools (FiSAT II). The growth parameters were estimated for five shark species using the monthly length-frequencies (from June 2012 to May 2013) analyzed by routines in the FiSAT II package. Results showed S. lewini and C. limbatus to have similar asymptotic lengths, L∞ (of 97.07 cm) but with a higher growth rate (K) for S. lewini (0.76 yr-1) compared to C. limbatus of 0.48 yr-1. The lowest growth rate (0.33 yr-1) was derived for C. amblyrhynchos. Total mortality (Z) and exploitation rate (E) were both highest in S. lewini (1.69 yr-1 and 0.56 yr-1, respectively), while C. ambyrhynchos had the lowest total mortality at 0.76 yr-1, and C. limbatus the lowest exploitation rate at 0.10. The results are discussed in relation to stocks performance and overfishing threats of the shark species. There is need to continuously monitor the populations of sharks in Kenya and the WIO region for purposes of conservation."

141. The WPEB **NOTED** that the majority of samples were collected from juvenile or smaller sized specimens, and that the use of Electronic Length Frequency Analysis (ELEFAN I) software to estimate growth parameters may be sufficient for juvenile specimens, but less reliable in the case of modelling older age cohorts, resulting in low

estimates of L_{∞}. The WPEB therefore **SUGGESTED** the authors collect vertebrae from a range of different sized specimens to better estimate the growth of larger fish.

142. **NOTING** the results of the study appear to indicate maturation at unusually small sizes for grey reef sharks and scalloped hammerheads, the WPEB **SUGGESTED** that the individuals sampled might possibly be different species or a sub-population limited to that region and **ENCOURAGED** the authors to collect tissue samples for a genetic analysis to be carried out.

9.1.4 Shark species identification: Sri Lanka

143. The WPEB **NOTED** paper IOTC–2016–WPEB12–23 which provided the identification of fourteen pelagic shark species of the Indian Ocean occurring around Sri Lanka; using morphological characters of their fins, including the following abstract provided by the authors:

"Sharks are of great commercial importance in the marine fisheries sector in Sri Lanka. They are taken in large quantities for human consumption, especially to obtain shark fins, which is an export oriented product and to a lesser extent for the extraction of liver oil. Past research has reported 60 species of sharks. Among the shark landings in Sri Lanka Silky shark (Carchahinus falciformis) is the dominant species followed by Blue sharks (Prionace glauca) Oceanic whitetip shark (Carcharhinus longimanus) and Scalloped hammerhead (Sphyrna lewini) respectively. Contribution of other sharks including Shortfin mako (Isurus oxyrinchus), Smooth hammerhead shark (Sphyrna zygaena), Longfin mako (Isurus paucus) Great hammerhead shark (Sphyrna mokarran) and Blacktip reef shark (Carcharhinus melanopterus) sharks to the total shark landings is relatively very small. Under the Shark Fisheries Management regulations in 2015; prohibition of catching Common thresher shark (Alopias vulpinus), Big-eye thresher shark (Alopias superciliosus), Pelagic thresher shark (Alopias pelagicus), Oceanic whitetip shark (Carcharhinus longimanus) and Whale shark (Rhincodon typus) in high seas weredeclared."- (see paper for full abstract)

144. The WPEB **NOTED** that 65% of the total catch recorded in Sri Lanka comes from the longline and 35% from the gillnet fisheries and that estimates of sharks catches are based on whole round weights, with fins attached.

145. The WPEB **REQUESTED** that any information on total catches of sharks, by species, be shared with the IOTC Secretariat (in addition to data currently reported by Sri Lanka), to facilitate work currently being undertaken by an IOTC consultant to reconstruct the catch series for blue sharks.

9.1.5 Shark bycatch: Thai tuna longliners

146. The WPEB **NOTED** paper IOTC–2016–WPEB12–24 which detailed shark caught by Thai tuna longline in the Indian Ocean during 2014-2015, including the following abstract provided by the authors:

"This report was based on the data extracted from fishing logbooks by Thai tuna longliners which declared to Department of Fisheries, Thailand. Data from their logbooks displayed important information of their fishing operation and effort. During the years 2011-2015, fishing grounds were mainly in the Western of Indian Ocean with 2,070 fishing day. The total catch by numbers were 65,283 fishes with 2,323.22 tonnes. The average catch rate of total catch were 11.39 individual fish/1,000 hooks or 405.44 kg/1,000 hooks. The major group caught were tuna, billfish, sharks and other species for 79.92%, 12.71%, 5.96% and 1.41% of the total catch, respectively. Shark were caught 3,949 fishes with 138.55 tonnes. The average catch rate of shark were 0.69 individual fish/1,000 hooks and 24.18 kg/1,000 hooks. The percentage of shark to the total catch were 6.05% by number and 5.96% by weight. In 2014, shark were caught 1,145 fishes with 49.95 tonnes. The average catch rate of shark were 1.04 individual fish/1,000 hooks and 45.25 kg/1,000 hooks. The percentage of shark to the total catch is 7.82% by number and 8.73% by weight. In 2015, shark were caught 1,835 fishes with 58.88 tons. The average catch rate of shark were 1.03 individual fish/1,000 hooks and 32.92 kg/1,000 hooks. Species composition of shark to the total catch were blue shark, mako shark and unidentified shark for 8.28%, 0.94% and 0.60% by weight or 6.10%, 1.56% and 0.62% by number, respectively."

147. The WPEB **NOTED** that the fleet is not currently operating in the Indian Ocean, but that observers will be deployed when the fleet begins operations again.

9.1.6 Silky shark mitigation measures: purse seiners

148. The WPEB **NOTED** paper IOTC–2016–WPEB12–39 which provided options for the mitigation of silky shark bycatch in tropical tuna purse seine fisheries, including the following abstract provided by the authors:

"Pelagic sharks are not targeted by tropical tuna purse seine fisheries, but they are caught incidentally, especially around floating objects like FADs. The shark bycatch-to-tuna catch ratio in purse seine fisheries is quite small, on average, less than 0.5% in weight. Over 90% of that bycatch is composed of silky sharks, Carcharhinus falciformis. Because of their low reproductive rates and other life history characteristics, silky sharks are a vulnerable species. Other gear types such as longlines or gillnets have a larger impact on silky sharks than purse seine fisheries do. The contribution of purse seining to the total catch of this species

varies by Ocean: From 4% in the Indian and eastern Pacific Oceans, to about 25% in the western and Central Pacific Ocean. Within the purse seine fishery, all set types catch silky sharks, with the highest catch rates being on natural logs (which represent a relatively small fraction of the total number of sets) followed by man-made FADs. Catches on floating object sets (both natural and man-made) tend to be 2 to 6 times higher than they are on free swimming schools. The global magnitude of catch of the purse seine fishery is quite large, so reducing the mortality caused by these fisheries can contribute towards global conservation efforts. This document summarizes mitigation techniques that can be used in this fishery."- (see paper for full abstract)

149. The WPEB **NOTED** that the success of mitigation measures depends, to a large extent, on the compliance of skippers in implementing the range of measures, which in turn should be cost-efficient, practical to be implemented in order to be widely accepted. ISSF is actively engaged with skippers to ensure mitigation measures are adopted as widely as possible.

150. The WPEB **NOTED** that other species of sharks besides silky sharks have also been reported around FADs, notably oceanic whitetip sharks, but to a much lesser extent than silky sharks which tend to occur in larger numbers and associated in groups.

151. The WPEB **NOTED** that material is also available on best practice guidelines for the safe handling and release of devil and manta rays which are currently followed by 100% of the EU and Seychelles purse seine fleets.

9.1.7 Depredation: Portugal pelagic longliners

152. The WPEB **NOTED** paper IOTC–2016–WPEB12–35 which provided an overview of depredation in the Portuguese pelagic longline fleet in the Indian Ocean, including the following abstract provided by the authors:

"Depredation has aroused great interest over the last few decades due to the expansion of distant fishing, in particular pelagic and bottom longlines. As part of the monitoring of the Portuguese pelagic longline fleet, catches and depredation records were taken by scientific observers on board commercial vessels from Portugal. Data were compiled and analyzed for the periods 2011-2015 in the southern area of the Indian Ocean. A total of 445 fishing sets were monitored in the period, with a total of 26,366 fish catches, including 778 depredation events. The percentage of depredation increasing yearly along the time series. The two main predated species were swordfish and escolar, with significant differences in prey size for swordfish, but not for escolar. However, the highest proportions of depredation were observed on tuna and small pelagic fishes. For swordfish specimens, the effects of spatial variables (latitude and longitude) were significant on the rate of depredation events. The results presented in this study provide a first overview of the depredation patterns in the Portuguese pelagic longline fishery in the Indian Ocean that can help to promote more informed management and conservation measures."

153. The WPEB **NOTED** that the recorded level of depredation by sharks (54%) is similar to the global level (60%) based on the global studies conducted in 3 Oceans, however the overall depredation rate recorded in this study (3%) is lower than the global estimates (8%) (IOTC, 2008).

154. The WPEB **NOTED** that these mortalities by depredation may constitute an important part of the total mortalities and while they are not recorded in logbooks and nominal catch data, they are recorded in the observer data and for CPUE estimation.

9.2 Review of mitigation measures contained in Resolution 13/06 for Oceanic whitetip shark

155. The Chair reminded WPEB12 that a provisional no-retention measure for oceanic whitetip sharks (Resolution 13/06) has been applicable to the Convention Area since 2013 to all fishing vessels in the IOTC record of authorised vessels, except for artisanal fisheries operating exclusively in their respective EEZs for the purpose of local consumption, and for an objection received from India. The WPEB is required to provide guidance to the Scientific Committee for its 2016 review of the effectiveness of measure.

9.2.1 Population trends: Oceanic whitetip sharks

156. The WPEB **NOTED** paper IOTC–2016–WPEB12–25on using FADs to estimate a population trend for the oceanic whitetip shark in the Indian Ocean, including the following abstract provided by the authors:

"Count data of oceanic whitetip sharks (OCS) associated with Fish Aggregating Devices (FADs) were used to derive a population trend for the species in the western Indian Ocean. Observer data from the French and Spanish purse seine fleets, combined with a historic database from the Soviet Union were used in the analyses. The combined time series spanned from 1986 to 2015. Results indicated a declining population trend. The OCS population in the Indian Ocean was estimated to be three times smaller in recent years (2000-2015) compared to historic years (1986-1999)."

157. The WPEB **NOTED** that the analysis assumed the oceanic whitetip is a solitary species, whereas if its social behaviour is similar to silky sharks (more aggregation) then a more complicated analysis would be required.

158. The WPEB **NOTED** that increases in FAD usage over time would not likely influence the estimates unless the density of FADs becomes high enough that one FAD may attract a shark away from another FAD. Although the modelling included both natural and man-made FADs, information on the FAD type for each set was not available and thus could not be included in the analysis.

159. The WPEB **SUGGESTED** that it would be good to extend this work with more data such as research cruises or other catch records that identify oceanic whitetip sharks specifically, particularly for the earlier years.

160. The WPB **DISCUSSED** the possibility of analysing the same dataset using a larger number of time intervals in order to create more points for a time series analysis, and/or to separate out the periods in which the measure was implemented (2013 onward) and when observer coverage is high (2015 onward). The WPEB **SUGGESTED** it may also be possible to include a spatial element in future analysis, for example to account for areas with higher FAD densities.

9.2.2 Hooking mortality: pelagic longliners

161. The WPEB **NOTED** paper IOTC–2016–WPEB12–26 which analysed hooking mortality of oceanic whitetip sharks caught in a pelagic longline fishery targeting swordfish in the SW Indian ocean, including the following abstract provided by the author:

"The Portuguese pelagic longline fishery in the Indian Ocean started in the late 1990's, targeting mainly swordfish in the southwest region, but in the more recent period has also expanded to the southeast. Pelagic sharks are an important component of this fishery, with some species, such as oceanic whitetip, discarded due to management recommendations. This working document revises data on the hooking (at-haulback) mortality of oceanic whitetip sharks captured and discarded by this fishery. The overall at-haulback mortality for oceanic whitetip sharks was 50.0%, which is higher than the estimates for the Atlantic (34.2%). The specimen size is significant for the odds of at-haulback mortality, with mortality decreasing as specimen size increases. Caveats of this study are the limited sample size, the fact that it focuses only in one fishery and fleet, with data restricted mainly to the temperate southwest Indian Ocean. Additionally, this study focuses only on the short term immediately mortality, while the overall mortality might be higher due to the potential post-release mortality, that is still currently unknown. In conclusion, and even though preliminary, this work presents new and important information on the potential efficiently of the no-retention measures currently in place for oceanic whitetip sharks in the Indian Ocean."

162. The WPEB **DISCUSSED** a range of mitigation measures that might be used to complement no-retention measures for oceanic whitetip shark. The WPEB **EXPRESSED** concern at the use of shark longlines by Indonesian vessels but **NOTED** that they are not considered to be widely used in the region, so a ban may have limited effectiveness.

163. The WPEB **ACKNOWLEDGED** the need for best practice guidelines for safe release from longline and gill net gear, noting work being conducted by WWF Pakistan in this regard and **REQUESTED** that any existing guidelines be distributed more widely for review and trialling.

164. The WPEB **QUERIED** the potential for magnetic materials or acoustic pingers to be used as shark deterrents and mitigation measures, and recalled that these techniques were considered by the IOTC Shark Year Plan to still be in an experimental phase and in need of further testing. One participant suggested that in addition to mitigation measures, oceanic whitetip sharks should be considered for listing on CITES Appendix I.

9.2.3 CITES species data mining

165. The WPEB **NOTED** paper IOTC–2016–WPEB12–37 which provided a progress report on data mining for CITES-listed species, stock status and review of mitigation measures for oceanic whitetip shark(*Carcharhinus longimanus*), including the following abstract provided by the author:

"The recent listings of hammerhead, oceanic whitetip, porbeagle sharks and manta species by CITES are expected to affect a number of IOTC member nations that are catching and/or exporting sharks caught in directed fisheries and as bycatch. This project has five main objectives, namely; 1) Improve and expand regional data on stock structures for oceanic whitetip shark (Carcharhinus longimanus) and CITES listed hammerhead sharks, namely Sphyrna lewini, S. mokarran and S. zygaena; (2) Support parties in the Indian Ocean region in the implementation of CITES shark listings; (3) Increase capacity of CITES parties in the Indian Ocean region for the making of non-detriment findings for the above species, based upon better knowledge of the status of shared stocks; (4) Encourage regional cooperation in the sharing of biological, and fisheries data for coherent fisheries management of shared stocks of CITES -listed sharks; and (5) Support parties that have been identified as priority countries for capacity development for the implementation of CITES listings. For several priority regions and countries identified by an FAO study, a

needs assessment conducted on behalf of the CITES Secretariat, identified that available information (fisheries and biological) to support the making of Non-Detriment Findings (NDFs) is in general very poor across all regions. Theimprovement of the availability of such information is therefore a priority in CITES capacity building."

166. The WPEB **ACKNOWLEDGED** the plan to hold a data preparatory workshop and suggested that workshop participants could be initially identified through discussions in the margins of this meeting. The author clarified that although the study's objectives mention the implementation of the CITES listing and NDFs, the purpose of the study is rather to assist countries with understanding the impact of CITES listing on their fisheries.

167. The WPEB **NOTED** that a similar initiative was recently funded by CITES in the Western Central Pacific and a report from that workshop (https://www.wcpfc.int/node/27363), which also covered hammerhead sharks, may provide valuable information for the Indian Ocean workshops. It was also noted that a guidance document on Non Detriment Findings (NDFs) for CITES-listed sharks is available on the CITES website and may be helpful. The author also clarified that the initiative is not linked to IUCN Red List assessments or WWF's Global Shark and Ray Initiative.

9.3 Review of new information on the status of other sharks

9.3.1 Nominal and standardised CPUE indices

9.3.2 Selection of Stock Status indicators for other sharks

168. The WPEB **AGREED** that as no new information was presented for other shark species in 2016, that previous indicators (if any), as well as the most recent catch estimates would be used to update the management advice from last year.

9.4 Development of management advice on the status of other shark stocks and update of other shark species Executive Summaries for the consideration of the Scientific Committee

9.4.1 Consideration of options for alternative management measures for other sharks in the IOTC area of competence

169. The WPEB **ADOPTED** the management advice developed for a subset of other shark species commonly caught in IOTC fisheries for tuna and tuna-like species, as provided in the draft resource stock status summaries and **REQUESTED** that the IOTC Secretariat update the draft stock status summary for sharks with the latest 2015 catch data (if applicable), and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration:
    - Oceanic whitetip sharks (*Carcharhinus longimanus*)– Appendix X
    - Scalloped hammerhead sharks (*Sphyrna lewini*) – Appendix XI
    - Shortfin mako sharks (*Isurus oxyrinchus*) – Appendix XII
    - Silky sharks (*Carcharhinus falciformis*) – Appendix XIII
    - Bigeye thresher sharks(*Alopias superciliosus*) – Appendix XIV
    - Pelagic thresher sharks(*Alopias pelagicus*) – Appendix XV

10. OTHER BYCATCH AND BYPRODUCT SPECIES INTERACTIONS

10.1 Review new information on other bycatch and byproduct, in terms of biology, ecology, fisheries interactions and bycatch mitigation measures

10.2 Review of new information on the proposed retention of non-target species by various gears

170. The WPEB **NOTED** that no progress was made on this item.

10.3 Marine turtles

10.3.1 Review new information on marine turtle biology, ecology, fisheries interactions and bycatch mitigation measures

10.3.2 Data and reporting requirements

171. The WPEB **RECALLED** the IOTC Resolutions relevant to marine turtle species (notably Resolutions 15/01, 15/02 and 12/04), including the data recording and reporting (Table 2) requirements by which Contracting Parties and Cooperating Non-Contracting Parties (CPCs) are required to collect and report all marine turtle interaction data.

TABLE 2. 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[1] and observer programs[*schemes*]) and provide to the IOTC Secretariat no later than 30 June of the following year in accordance with Resolution 10/02 [*superseded by 15/02*] (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.

[1]Discard data from logbooks should be submitted to the IOTC Secretariat formally as required according to IOTC reporting procedures based on the requested fisheries statistics and data submission forms that can be found on the IOTC website: www.iotc.org/data/requested-statistics-and-submission-forms

10.3.3 Marine turtle mitigation measure effectiveness in tuna longline fisheries

172. The WPEB **NOTED** paper IOTC–2016–WPEB12–27 which provided results from the first WCPFC Workshop on Joint Analysis of Sea Turtle Mitigation Effectiveness, including the following abstract provided by the authors:

"There are seven species of sea turtles and six of these are considered to be threatened with extinction according to IUCN Red List criteria (i.e. critically endangered, endangered or vulnerable; IUCN 2015). Factors such as human consumption of meat and eggs, predation on eggs, nesting disturbance, climate change, marine pollution and boat collisions all have contributed to declines in sea turtle populations, but interaction with fishing gear is considered to be one of the most serious threats (FAO 2010; Wallace et al. 2011, 2013). Starting over ten years ago, a number of tuna Regional Fisheries Management Organizations (t-RFMOs) have adopted conservation and management measures that require mitigation to reduce the impacts of fishing operations on sea turtles. However, the effectiveness of these measures remains largely unexamined due to a lack of information on implementation, compliance and species-specific interaction and mortality rates(Clarke et al. 2014)." – (see paper for full abstract)

173. The WPEB **NOTED** that the study aims to characterize sea turtle interaction and mortality rates across the Pacific. Longline observer data in the Eastern Pacific are sparse and despite requests could not be provided for the workshop. As a result, the gear and condition models are based mainly on Western and Central Pacific Ocean (WCPO) observer data, however, if appropriate effort data can be accessed it might be possible to estimate interaction and mortality rates for the Pacific as a whole.

174. The WPEB **NOTED** that longline observer coverage in the WCPO is still considerably below the 5% requirement and is unlikely to be representative of all fleets, however, it is still a reasonable basis for the workshop analyses.

175. The WPEB **NOTED** that sea turtle at-vessel mortality depends on whether it can reach the surface to breathe. As a result, sea turtles hooked on the first and second shallowest hooks between floats have higher survival rates than those hooked on deeper hooks.

176. The WPEB **NOTED** that sea turtles may be impacted by purse seiners using entangling FADs or ghost gear entanglement in addition to the longline fisheries being assessed in the workshops, however, the lack of data on the types of FADs deployed in the Pacific and the extent of sea turtle interactions with those FADs means that analysis is not possible at this time.

177. The WPEB **NOTED** that the use of non-entangling FADs is mandatory and used in the Atlantic and Indian Oceans (IOTC Resolution 15/08 and ICCAT recommendation 15/01) which will reduce interactions between turtles and purse seiners in those Oceans.

178. The WPEB **NOTED** the workshop is an ABNJ Tuna Project initiative focused on the Pacific. Although there are no plans to conduct a similar workshop in the Indian Ocean, the Indian Ocean Southeast Asian Marine Turtle MOU has been invited to nominate a participant for the second Pacific workshop.

10.3.4 European project to mitigate impacts off longline fisheries on marine turtles

179. The WPEB **NOTED** the presentation on a sea turtle mitigation and recovery project in the western Indian Ocean, including the following abstract provided by the author:

"The presentation reported the results of the Coca Loca project which aimed at mitigating the impact of longline fisheries on sea turtles bycatch and improving knowledge about loggerhead turtles (Caretta caretta). This European BEST project was initiated by longline fishermen from Reunion Island and spanned 2013 – 2015. Sea turtles (n=215) have been brought back by fishermen to Kélonia healing center (Reunion) to remove the hook and ensure their recovery. This international collaboration at the scale of the western Indian

Ocean enabled the development of tool kits to remove the hook onboard which are now used by fishermen. Satellite tags have been deployed on these turtles to better understand their regional migrations. "

180. The WPEB **NOTED** that within this project a loggerhead turtle, recently tagged on a Portuguese longline vessel in the South Indian Ocean, subsequently transited eastward for a long distance, nearly reaching the coastal waters of Australia.

10.3.5 Review of mitigation measures in 12/04

181. The WPEB **NOTED** paragraph 11 of IOTC Resolution 12/04 states:

(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.

10.3.6 Development of management advice on the status of marine turtle species

182. The WPEB **ADOPTED** the management advice developed for marine turtles, as provided in the draft status summary and **REQUESTED** that the IOTC Secretariat update the draft stock status summary with the latest 2015 interaction data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration:

- Marine turtles (Appendix XVI).

10.4 Seabirds

10.4.1 Review new information on seabird biology, ecology, fisheries interactions and bycatch mitigation measuresStatus of seabirds in the Indian Ocean

183. The WPEB **NOTED** paper IOTC–2016–WPEB12–28 which provided a status update of seabirds in the IOTC area, including the following abstract provided by the author:

"New data on the status of albatrosses and petrels, the seabird most at risk from bycatch in tuna longline fisheries, are presented. On the whole, downward population trends continue, giving cause for serious concerns and highlighting the need to continue and increase efforts from longline fleets to prevent seabird bycatch. New information on Tristan Albatross Diomedea dabbenena highlights the Indian Ocean as an important part of this Critically Endangered albatross's foraging range. Several species, notably Amsterdam Albatross D. amsterdamensis and Black-browed Albatross Thalassarchemelanophris have undergone strong recoveries in recent years, possibly reflecting improved use ofseabird bycatch mitigation measures." – (see paper for full abstract)

184. The WPEB **NOTED** that BirdLife International is currently re-assessing the IUCN threat status for all birds, and that the updated Red List should be available towards the end of 2016. The WPEB **AGREED** that once the revised list is available, the IOTC Seabird Executive Summary should be updated accordingly.

Seabird interactions: Spanish longline fleet

185. The WPEB **NOTED** paper IOTC–2016–WPEB12–29 which detailed the interaction between seabirds and Spanish surface longline targeting swordfish in the Indian Ocean (≥ 25º South) during the period 2011-2015, including the following abstract provided by the authors:

"A total of 310 fishing sets (361,608 hooks) targeting swordfish in the Indian Ocean (lat ≥ 25ºS) between 2011-2015 were analyzed. The areas included in the study are between 25º-36ºS and 34º-72ºE. However, the interaction with seabirds was restricted to areas between 31º-36ºS and 37º-48ºE during the January-April period. A total of 19 seabird individuals during the whole period 2011-2015, identified as belonging to seven species, interacted with the fishing operation (Diomedea exulans, Phoebetria fusca, Procellaria aequinoctialis, Thalassarche carteri, Thalassarche cauta, Thalassarche melanophris, Thalassarche salvini). Most interactions occurred in one year-months and in a single 5ºx5º square. Interactions observed in other areas were minor or regularly null. The overall rate of interaction estimated for areas lat ≥ 25ºS and species combined was estimated at 5.254E-05 seabird/hook. Night setting and low levels of lighting during setting operations as well as other fishing protocols applied by the vessels were identified as the most important factors to explain the regularly low or null interaction with seabirds." – (see paper for full abstract)

186. The WPEB **COMMENDED** the authors for the study and **ENCOURAGED** more similar studies to be provided in future.

187. The WPEB **REQUESTED** that when presenting information on seabird bycatch, authors should include the technical specifications of mitigation measures used, especially in relation to line-weighting. This should include the mass and type of weights used, and the distance from the hook at which the weights are attached.

Incidental catches of seabirds and marine turtles: Taiwan longliners

188. The WPEB **NOTED** paper IOTC–2016–WPEB12–42 which detailed incidental catch of seabirds and sea turtles by Taiwanese longline fleets in the Indian Ocean between 2009 and 2015, including the following abstract provided by the authors:

"Observers data collected from 149 Taiwanese tuna longline vessel trips, including 14 albacore large-scale tuna longline vessel (LTLV) trips, 41 bigeye LTLVs trips, 57 trips of southern bluefin tuna(SBF) LTLV, 2 trips for part-time-SBF LTLV, and 35 small-scale tuna longline vessel (STLV) trips between 2009 and 2015 were analyzed. Four hundred and forty-four seabirds and 55 sea turtles were incidental caught. Most seabird bycatch was from the SBF LTLVs (64.6%) and 30.4% from albacore LTLVs. There were limited seabird bycatch in the north of 30 S. The highest rate was 0.201 bird per thousand hooks in the south of 30 S Indian Ocean in the first quarter by albacore LSLVs, followed by the same area, last quarter by SBF LTLVs (0.087 bird per thousand hooks). For bycatch species, 64.4% were albatrosses, including yellow-nosed, wandering, sooty, and shy-type, northern royal, white-capped, light-mantle, black-browed, and grey-headed albatrosses. Other seabird included white-chinned petrel, giant petrel and others. Regarding sea turtles, the high bycatch areas were between 10° N ~15° S, 60° ~90° E. The bycatch rate peaked in the third quarter by STLVs (0.0108 turtle per thousand hooks), followed by same fleet in the first quarter (0.0099 turtle per thousand hooks). The major bycatch species was olive ridley (71.0%). The numbers of other species are very limited."

189. The WPEB **COMMENDED** the author for the presentation of seabird bycatch information in the paper.

190. The WPEB **NOTED** with concern the high levels of seabird bycatch recorded south of 30°S, in particular the seabird bycatch rate associated with the albacore large-scale tuna longline vessel fleet of 0.201 birds per thousand hooks in the first quarter.

191. The WPEB **AGREED** with the authors that the results highlighted the urgent need to improve the use of, and strengthen, mitigation measures in order to reduce bycatch rates to acceptable levels, and to ensure that observer programmes are meeting coverage requirements and collecting the data required to assess the effectiveness of mitigation measures used.

Factors affecting seabird bycatch: Japanese longline

192. The WPEB **NOTED** paper IOTC–2016–WPEB12–INF07 which provided an examination of factors affecting seabird bycatch occurrence rate in southern hemisphere in Japanese longline fishery with using random forest, including the following abstract provided by the authors:

"We analyzed the factor affecting bycatch occurrence rate. Random forest was applied to analyze. We constructed four models examining effect of species group, season, year, environmental factors, distance from the colonies, a lunar phase, and catch of fish. Our model was likely to be a statistically appropriate model because out of bags is an acceptable range though a little high. Dominant variables in common with analyzed four models were latitude, longitude, elapsed days from the first day of the year, number of observed hooks, species group, sea surface temperature in this study. Also year, cruise ID and lunar phase were dominant variables in common with two to three models. Those variables would have the large impact on bycatch occurrence rate. Thus, it was suggested that those variables should be considered in the comparison between CPCs and in the collaboration work."

193. The WPEB **NOTED** that bycatch occurrence rate was higher off southern Africa and in the Tasman Sea than in other areas fished, and that bycatch occurrence rate increased in January-March during the albatross breeding season.

194. The WPEB **AGREED** that this study highlights many potential factors affecting seabird bycatch, and were surprised that seabird bycatch mitigation measures were not a significant explanatory variable in any of the models.

195. The WPEB **AGREED** that it would be useful to develop the model further to better understand factors contributing to seabird bycatch, particularly the role of mitigation measures in reducing seabird bycatch.

Seabird bycatch: Japanese longline fleet

196. The WPEB **NOTED** paper IOTC–2016–WPEB12–INF08 which provided modelling of bycatch occurrence rate of seabirds for Japanese longline fishery operated in southern hemisphere, including the following abstract provided by the authors:

"We modeled the bycatch occurrence rate in consideration of factors of year and season and examined longitudinal changes in the rate across years. We used operational data obtained by scientific observers from 1997 through 2015. As a preliminary analysis, differences in species composition of seabirds bycaught between northern and southern regions of waters south of 20°S were examined through hierarchical cluster analysis. Bycatch species composition was changed at the boundary of 400S, 350S and 400S, off Cape, in Indian Ocean and in the Tasman Sea, respectively. Presence/absence of seabird bycatch data by set was modeled with the generalized additive model (GAM). The data for the GAM analysis were split in two by a boundary dividing the data into northern and southern areas. Estimated bycatch occurrence rate varied at relatively low level in the model of the northern area, while that varied at relatively high level in the model of the southern area. Bycatch occurrence rates in an east-west direction differed not only among year periods but also among seasons in both waters north and south of 350S. It was suggested the importance of consideration of longitudinal variation of bycatch occurrence rate among year and season to estimate total bycatch number."

197. The WPEB **NOTED** the results showed that grey-headed albatross was the dominant bycatch species in the southern areas, whereas white-chinned petrels were the dominant species bycaught in the northern areas. The boundaries selected for the study were based on current information regarding species composition and bycatch rates increasing further south.

198. The WPEB **NOTED** that the cluster analysis was based on species composition of the BPUE, and demonstrated a notable step-change in species composition of bycatch at 35°S in the Indian Ocean.

199. The WPEB **NOTED** paper IOTC–2016–WPEB12–INF09 which detailed the operational pattern of Japanese longliners in the south of 25S in the Atlantic and the Indian Ocean for the consideration of seabird bycatches, including the following abstract provided by the authors:

"Catch and effort data of Japanese longliners operated in the south of25S in the Atlantic and the Indian Oceans in the period between 2010 and 2015 was analyzed to investigate its effect on the seabird bycatch. Off South Africa waters and the southwest Indian Oceans were indicated to be main fishing ground of Japanese longliner, where they caught southern bluefin tuna, albacore, bigeye and yellowfin tunas. Results of analysis indicate general tendency of increased ratio of southern bluefin tuna and decreased ratio of albacore and bigeye tunas to in between 2010 –2013 and 2014 –2015. This target shifts accompanied the southward shift of operational ground. The results of this study also indicated that the main fishing ground of Japanese longliners in off South Africa located further south area at about 5 degrees than the one in the southwest Indian Ocean due to the effect of warm Agulhas Current. These findings should be considered in the analysis of seabird bycatch data."

200. The WPEB **NOTED** that species composition of target catch has changed drastically by area and that environmental conditions complicate catch patterns off South Africa. In the Eastern Indian Ocean environmental conditions are more consistent and less complex, and fish composition doesn't show the same spatial variability.

201. The WPEB **RECOGNISED** that it is important to consider and account for these factors when assessing seabird bycatch.

202. The WPEB **NOTED** paper IOTC–2016–WPEB12–INF10 which provided information about seabirds bycatch in area south of 25 S latitude in 2010 from 2015, including the following abstract provided by the authors:

"In the present study, seabird bycatch data collected by on-board observers in the area south of 25S in the Atlantic and the Indian Ocean in recent years is quickly reviewed. Results revealed there is common tendency in between the southern bluefin tuna catch pattern and seabird bycatch pattern. Seabird bycatch pattern is also suggested to be influenced by geographical area as well as environmental condition. The results of this study is also indicate that the recent increasing trend of the nominal CPUE of seabird is biased by the recent increase of the observer data in the area with higher seabird CPUE. These finding would offer some important information for the catch and effort analysis of seabird bycatch."

203. The WPEB **COMMENDED** the scientists from Japan for undertaking such a significant body of work and for presenting this to the meeting.

204. The WPEB **NOTED** with concern that nominal CPUE of seabirds shows an increasing trend (approximately 0.3 birds/1000 hooks in 2015) off South Africa in the area 20°W-50°E, 25°S-55°S, and **AGREED** with the authors that urgent action is required to better understand the reasons for these high levels of bycatch and to address them.

205. The WPEB **AGREED** that the results highlighted the urgent need to improve the use of, and strengthen, mitigation measures in order to reduce bycatch rates to acceptable levels, and to ensure that observer programmes are meeting coverage requirements and collecting the data required to assess the effectiveness of mitigation measures used.

Effectiveness of seabird conservation measures: SBT fisheries

206. The WPEB **NOTED** paper IOTC–2016–WPEB12–30, a scoping paper which provided approaches for measuring and monitoring the effectiveness of seabird conservation measures in SBT longline fisheries, including the following abstract provided by the authors:

"This paper scopes potential methods for monitoring the effectiveness of tuna Regional Fisheries Management Organisations (RFMO) seabird Conservation and Management Measures (CMMs). An initial draft was prepared for the meeting of the CCSBT Effectiveness of Seabird Mitigation Measures Technical Group (SMMTG), Tokyo, Japan, 4-6 November 2014, and this revised version incorporates discussion and recommendations from that meeting. The paper considers the following four elements of assessment: • Reviewing the content (i.e. the actual requirements and specifications) of tuna RFMO seabird CMMs • Reviewing the availability of relevant data reported by tuna RFMO longline fleet • Reviewing the degree of implementation by vessels/fleets • Monitoring the level and impacts of bycatch Grey boxes contain the questions that formed the focus of discussion at the SMMTG meeting." – (see paper for full abstract)

207. The WPEB **NOTED** that the CCSBT SMMTG highlighted the importance of tuna RFMOs working collaboratively in their seabird assessments, and the advantages of combining regular monitoring of seabird bycatch by each tuna RFMO with periodic (every 3-5 years) joint tuna RFMO work at a more detailed level. The WPEB further **NOTED** that the seabird bycatch component of FAO's GEF-funded Common Oceans Tuna Project (also known as the ABNJ tuna project) is progressing some of the actions identified by CCSBT's SMMTG.

Lumo leads

208. The WPEB **NOTED** paper IOTC–2016–WPEB12–33 which analysed the use of Lumo leads as a new, safe seabird mitigation device for pelagic longline fisheries, including the following abstract provided by the authors:

"Seabird bycatch from pelagic longline fisheries can be reduced when Best Practice mitigation measures are used in combination; however widespread adoption of Best Practice remains a problem, threatening many seabird species globally. Lumo Leads provide a line-weighting technique for seabird bycatch mitigation that works without compromising fish catch, fishing operations efficiency or crew safety. Unlike conventional weighted swivels, Lumo Leads are attached to monofilament lines in such a way that they can slide up and down the line and simply slip off the line during a bite-off. Lumo Leads of different mass (45 and 60 g) and colour (black or glowing), were tested onboard Korean pelagic longline vessels, at varying distances from the hook (5 cm, 60 cm, 100 cm and 200 cm), with their impact on seabird bycatch, target catch, fishing operations and crew safety recorded. Trials were completed over three trips in two years onboard three vessels, representing 217,000 experimental hooks. Only two seabirds were caught throughout the study; one on unweighted branchlines and one on a weighted (lumo lead) branchline." – *(see paper for full abstract)*

209. The WPEB **NOTED** the lack of incidents of safety concerns that this study found, noting that a type of sliding lead was used. The WPEB also **NOTED** that the optimal line weighting configurations reported in this study conformed to the ACAP Best Practice advice contained in IOTC–2016–WPEB12–34.

ACAP best practice advice: update

210. The WPEB **NOTED** paper IOTC–2016–WPEB12–34 which detailed the ACAP best practice advice for reducing the impact of pelagic longline fishing operations on seabirds, including the following abstract provided by the authors:

"The incidental mortality of seabirds, mostly albatrosses and petrels, in longline fisheries continues to be a serious global concern and was the major reason for the establishment of the Agreement on the Conservation of Albatrosses and Petrels (ACAP). ACAP routinely reviews the scientific literature regarding seabird bycatch mitigation in fisheries, and on the basis of these reviews updates its best practice advice. The most recent review was conducted in May 2016, and this document presents a distillation of that review for the consideration of the IOTC Working Party on Ecosystems and Bycatch. On the basis of the most recent review, ACAP has confirmed that a combination of weighted branch lines, bird scaring lines and night setting remains the best practice approach to mitigate seabird bycatch in pelagic longline fisheries. Changes to previous advice apply only to the recommended minimum standards for line weighting regimes, now updated to the following configurations: (a) 40 g or greater attached within 0.5 m of the hook; or (b) 60 g or greater attached within 1 m of the hook; or (c) 80 g or greater attached within 2 m of the hook. In addition, ACAP endorsed the inclusion in the list of best practice mitigation measures of two hook-shielding devices. These devices encase the point and barb of baited hooks until a prescribed depth or immersion time has been reached (set to correspond to a depth beyond the diving range of most seabirds) thus preventing seabirds gaining access to the hook and becoming hooked during line setting. ACAP recognizes that factors such as safety, practicality and the characteristics of the fishery should also be taken into

account when considering the efficacy of seabird bycatch mitigation measures and consequently in the development of advice and guidelines on best practice."

211. The WPEB **NOTED** that previous IOTC line weighting recommendations are 10 years old and that new suggested specifications are based on scientific findings. The updated ACAP advice regarding line-weighting specifications was based on the provision of new results on the sink rates of different line weighting configurations, and studies relating line-weighting configurations to seabird bycatch rates.

212. The WPEB **ACKNOWLEDGED** that moving the weight closer to the hook decreases seabird bycatch, and that the updated line weighting specifications had been shown to significantly reduce seabird bycatch by increasing the sink rate of branch lines, and thus reducing the time that diving seabirds can access the baited hooks. However, the WPEB **NOTED** that there are some concerns regarding crew safety associated with line-weighting due to possible fly-back incidents following bite-offs.

213. The WPEB **RECALLED** that line weighting is one of the three mitigation measures listed in Resolution 12/06, and that the minimum line-weighting standards included in Resolution 12/06 conform with the previous ACAP advice, and would thus need to be updated to bring them in line with the updated advice from ACAP.

214. The WPEB **RECOMMENDED** that Resolution 12/06 be reviewed and **ENCOURAGED** the line weighting specifications to be updated to conform with the latest ACAP advice: (a) 40 g or greater attached within 0.5 m of the hook; or (b) 60 g or greater attached within 1 m of the hook; or (c) 80 g or greater attached within 2 m of the hook. CPCs are **ENCOURAGED** to test the safety and practicality of the above mentioned measure as well as sliding lead devices for line weighting, and to report the results back to the WPEB or SC.

215. **NOTING** some concerns expressed regarding crew safety associated with fly-backs following bite-off events, the WPEB **ENCOURAGED** CPCs to reduce this risk by using sliding leads, which slide down the branch line following bite-offs or when the line breaks under tension, thereby greatly reducing the incidence of fly-backs towards the vessel. Another approach to reduce the risk of injury is to alter the angle at which the weighted branch line is retrieved so that crew are not directly in the path of the weight should the branch line break under high tension. Options include welding an open metal loop to the top rail next to the fish gate, or welding a short metal post perpendicular to the top rail. An even simpler option is to use the smooth post of the fish gate itself.

216. The WPEB **NOTED** that ACAP's latest advice also recommends the inclusion of two hook-shielding devices as an additional mitigation option to the current requirement in Resolution 12/06, which is to use two of the three mitigation measures currently prescribed by IOTC (line weighting, bird-scaring lines or night-setting).

217. The WPEB **RECOMMENDED** that when Resolution 12/06 is reviewed, the two hook-shielding devices recommended by ACAP as best practice mitigation measures be incorporated as additional, stand-alone mitigation options for use in IOTC fisheries operating south of 25°S, and that these measures should conform with the technical specifications and performance attributes detailed in the ACAP advice. The WPEB **CLARIFIED** that if used, the hook-shielding devices would not need to be combined with any other mitigation measure. In relation to the Smart Tuna Hook, the WPEB **NOTED** that on the basis of information provided, after release from the hook the shield sinks to the seafloor where it corrodes within 12 months, the byproduct of which is iron oxide and carbon. However, the WPEB **NOTED** concerns regarding pollution associated with the discarded shields of the Smart Tuna Hooks, and **REQUESTED** that further information be made available to clarify the potential effects.

Bycatch indicators: ACAP

218. The WPEB **NOTED** paper IOTC–2016–WPEB12–31 which reported on the development of ACAP seabird bycatch indicators, data needs, methodological approaches and reporting requirements, including the following abstract provided by the authors:

"The Agreement on the Conservation of Albatrosses and Petrels (ACAP) is a multilateral environmental agreement that seeks to achieve and maintain a favourable conservation status for albatrosses and petrels. The Agreement is currently ratified by 13 countries. In addition, a number of non-Party Range States actively participate in the work of the Agreement. The Agreement provides a framework for coordinating and undertaking international activity to mitigate known threats to populations of affected species, including fisheries bycatch. In order to monitor and report on the performance of the Agreement, a Pressure-State-Response framework is being developed and implemented by ACAP. The primary Pressure indicator for bycatch comprises two linked components: i) the seabird bycatch rate across each of the fisheries of member Parties, and ii) the total number of birds killed (bycaught) per year of ACAP species (per species where possible). The Seabird Bycatch Working Group of ACAP is currently undertaking work to develop guidelines on issues that need to be considered in estimating and reporting against these bycatch indicators and, considering the estimation methods currently in use, to propose guidance and recommendations to achieve consistent reporting. This paper provides an outline of the recommendations

and guidelines that have been developed to date. It is important to note that this represents work in progress, and is presented here to encourage linkages between the ACAP process and similar work being undertaken within IOTC and other RFMOs."

219. The WPEB **AGREED** that this work is of relevance to IOTC's review of the seabird conservation measure. The WPEB11 (para. 223) agreed that the bycatch indicators proposed (bycatch rates, and total number of birds killed) would be useful candidate indicators for the review of Resolution 12/06.

220. The WPEB **NOTED** that the ACAP process would focus initially on ACAP countries, and that the reporting framework is being developed to incorporate data rich and data poor scenarios. However, it is intended that the guidelines would be more broadly applicable and hopefully help facilitate a wider-scale assessment of seabird bycatch.

221. The WPEB **AGREED** that it would be useful and important to maintain linkages between the ACAP process and efforts within IOTC and through the seabird component of the Common Oceans (ABNJ) Tuna Project to estimate and monitor seabird bycatch.

Data collection opportunities

222. The WPEB **NOTED** paper IOTC–2016–WPEB12–32 which detailed data collection opportunities for assessing the use and effectiveness of seabird conservation measures, including the following abstract provided by the authors:

"The role of seabird bycatch from tuna longline operations in driving several seabird species, particularly albatrosses, towards extinction is very well established. The lack of reliable data on at-sea activities from longline vessels is widely acknowledged as a severe shortcoming for assessing seabird bycatch rates and the impacts of tuna longline fishing on threatened seabird species. The WPEB has lamented the lack of data in this regard on numerous occasions. Therefore scientists should use multiple approaches to obtaining data. The IOTC's transhipment observer programme could, with very minor additional effort, provide a valuable additional data source on the nature and extent of the use of various measures mandated under Resolution 12/06 to prevent seabird bycatch. Such data (including digital images) that IOTC observers could be mandated to collect should be 1. subject to the IOTC's confidentiality rules 2. captured/curated by the IOTC Secretariat 3. made available to WPEB upon request for assessing seabird bycatch impacts and use of various measures4. used for scientific purposes only, and should explicitly not be used for compliance monitoring."

223. The WPEB **RECOGNISED** that although the IOTC Regional Observer Programme (ROP) for transhipment is primarily a mechanism for compliance monitoring, it does provide potential opportunities for gathering photographs and information for scientific purposes, including on seabird bycatch mitigation measures. Therefore, the WPEB **RECOMMENDED** that the collection of seabird bycatch mitigation photographs through the ROP is trialled as a pilot.

Seabird identification guides

224. The WPEB **NOTED** paper IOTC–2016–WPEB12–41 which provided an addendum to the seabird identification cards for fishing vessels operating in the Indian Ocean data collection opportunities for assessing the use and effectiveness of seabird conservation measures, including the following abstract provided by the authors:

"IOTC Seabirds Identification Cards for Fishing Vessels Operating in the Indian Ocean covers seabirds mainly from Southern and Central Indian Ocean and includes only three species i.e. flesh-footed shearwater, wedge-tailed shearwater and masked booby from Northern Indian Ocean (Arabian sea). In addition, existing IOTC Seabirds Identification Cards does not include some species of sea birds which are associated with tuna school such as tropic birds, noddies, gulls and terns. Considering these lacunae, WWF-Pakistan has drafted a Seabirds Identification Cards which will be equally helpful to observers, skippers and scientists from not only Northern Indian Ocean but will cover entire IOTC area of competence."

225. The WPEB **NOTED** that the proposed addendum would be useful and thanked the authors for their good work thus far. The WPEB **THANKED** BirdLife International for its offer to review the cards developed thus far.

10.4.2 Data and reporting requirements

226. The WPEB **RECALLED** each of the IOTC Resolutions relevant to seabirds (notably Resolutions 15/02 and 12/06, including the recording and reporting requirements (Table 3). Contracting and Cooperating Non-Contracting Parties (CPCs) are required to collect and report incidental bycatch of seabirds.

TABLE 3. IOTC data collection and reporting requirements for seabirds.

Resolution	Paragraph

IOTC Resolution 12/06: *On reducing the incidental bycatch of seabirds in longline fisheries*	Paragraph 1 (start): CPCs shall record data on seabird incidental bycatch by species, notably through scientific observers in accordance with Resolution 11/04 and report these annually. Paragraph 2: CPCs that have not fully implemented the provisions of the IOTC Regional Observer Scheme outlined in paragraph 2 of Resolution 11/04 shall report seabird incidental bycatch through logbooks, including details of species, if possible[1]. Paragraph 3: CPCs shall provide to the Commission as part of their annual reports, information on how they are implementing this measure.

[1]Discard data from logbooks should be submitted to the IOTC Secretariat formally as required according to IOTC reporting procedures based on the requested fisheries statistics and data submission forms that can be found on the IOTC website: www.iotc.org/data/requested-statistics-and-submission-forms

10.4.3 Assessment of data submissions in response to IOTC circular 2016-043

227. The **RECALLED** the requests and recommendations from WPEB11:

*The WPEB **REQUESTED** that BirdLife International should work intersessionally with interested CPCs and the IOTC Secretariat to prepare a summary table (example below) that can be presented to the next meeting of the SC for their consideration and discussion. Completing such a summary table would not replace the need for CPCs to formally submit data to the IOTC Secretariat as required by IOTC Resolutions.*
***Example table**: Summary seabird bycatch*

*The WPEB **RECOMMENDED** that CPCs with significant fishing effort south of 25°S to undertake their own assessments on the levels and nature of implementation of Resolution 12/06 by their fleets, and present papers, similar to that presented in paper IOTC–2015–WPEB11–37 Rev_1, to the WPEB meeting in 2016.*

*The WPEB **RECOMMENDED** that CPCs bring data to the WPEB meeting in 2016, as the Commission via Resolution 12/06 required the WPEB and SC to undertake this task in 2015, which has not been possible due to insufficient data, and that a collaborative analysis of the impacts of Resolution 12/06 be undertaken during the WPEB meeting, if feasible. CPC review papers and datasets should include the following information/data from logbooks and/or observer schemes, where appropriate and should cover the period 2011 to 2015:*

- *Total effort south of 25°S by area and time, at the finest scale possible*
- *Observed effort south of 25°S by area and time, at the finest scale possible*
- *Observed seabird mortality rates south of 25°S by area and time, at the finest scale possible*
- *Descriptions of fleet structure /target species by time and area, and an indication of observer coverage per fleet/target species for effort south of 25°S*
- *Data on which seabird bycatch mitigation measures were used, on a set-by-set/cruise basis if possible or per vessel, or at the finest scale possible*
- *Descriptions of the specifications of seabird bycatch mitigation measures used according to the fields in the Regional Observer Scheme manual and in relation to the specifications given in Res 12/06*

228. The WPEB **NOTED** a brief presentation of the data submitted by CPCs in response to IOTC circular 2016-043 provided by the IOTC Secretariat.

229. The WPEB **NOTED** that four CPCs (Australia, EU-Portugal, Japan and South Africa) of the 14 CPCs which report tuna longline effort south of 25°S to IOTC, submitted data in response to the call for data submission on seabirds (IOTC Circular 2016-043). In addition, three CPCs submitted substantive papers on seabird bycatch (China(Taiwan), EU-Spain and Japan).

230. **ACKNOWLEDGING** that key aspects of the data call, notably those relating to data on the seabird bycatch mitigation measures used in relation to the data submitted, were not provided in sufficient detail, the WPEB **NOTED** that assessments of the actual performances of various combinations of mitigation measures could not be undertaken.

231. **NOTING** that some CPCs with fishing effort south of 25°S have yet to provide the data requested in the data call (IOTC circular 2016-043**),** the WPEB **REQUESTED** that these outstanding data be submitted to the Secretariat prior to the 2016 Scientific Committee meeting.

232. The WPEB **NOTED** the similarity between the summary tables of seabird bycatch requested in circular 2016-043 and the Bycatch Data Exchange Protocol (BDEP) template. Consequently, the WPEB **REQUESTED** that in the future the Secretariat collate the relevant observer data received into the BDEP template.

10.4.4 Review of mitigation measures in 12/06

233. The WPEB **NOTED** that the Scientific Committee has requested that the WPEB analyse the impact of Resolution 12/06 on seabird bycatch no later than 2016.

234. The WPEB **NOTED** that from the data and papers presented, there are some clear indications regarding the effectiveness of Resolution 12/06. Encouragingly, the EU data showed extremely low seabird bycatch rates; this is likely due to the fact that the fleet targets swordfish with night setting, and the vessels use line weights and/or tori lines. Also relatively little of the reported effort was at higher latitudes. The specifications of the line weighting regime used by these fleets was not reported (IOTC-2016-WPEB12-29).

235. The WPEB **NOTED** that in contrast to this, the papers from China(Taiwan) and Japan indicate that seabird bycatch rates either remain high (former) or have increased since 2014 (latter). Further, the modelling work carried out by Japan (IOTC-2016-WPEB12-INF07-INF10) indicated that the mitigation measures currently used by their fleet have not reduced significantly the seabird bycatch rates and did not explain the patterns of seabird bycatch. This suggests that the mitigation measures used by those fleets should be strengthened.

236. The WPEB **NOTED** that the difficulties of securing accurate, complete and timeous submissions of data from CPCs have thus far prevented a full assessment of the effectiveness of Resolution 12/*06 (On reducing the incidental bycatch of seabirds in longline fisheries)*. The WPEB **AGREED** that the WPEB Chair, Vice Chairs, IOTC Secretariat and other interested parties would work intersessionally to develop the analyses further, based on data that has already been submitted, for presentation to the SC.

237. The WPEB also **NOTED** the series of seabird bycatch assessment and capacity building workshops for National Scientists planned by BirdLife International and BirdLife South Africa, through the Common Oceans Tuna Project, and **ENCOURAGES** CPCs with significant tuna longline effort south of 25°S to participate in that process. The WPEB further **REQUESTED** BirdLife South Africa to report on the outcomes of these workshops at the next meeting of the WPEB.

10.4.5 Development of management advice on the status of seabird species

238. The WPEB **ADOPTED** the management advice developed for seabirds, as provided in the draft status summary and **REQUESTED** that the IOTC Secretariat update the draft stock status summary with the latest 2015 interaction data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration:
    - Seabird (Appendix XVII).

10.5 Marine mammals

10.5.1 Review new information on marine mammal biology, ecology, fisheries interactions and bycatch mitigation measures

10.5.2 Development of management advice on the status of marine mammal species

239. The WPEB **NOTED** that no advice in this regard was discussed at the WPEB12.

11. WPEB PROGRAM OF WORK

11.1 Revision of the WPEB Program of Work 2017–2021

240. The WPEB **NOTED** paper IOTC–2016–WPEB12–11 which provided the WPEB12 with a revision of the WPEB Program of Work (2017-2021) with an opportunity to consider and revise the WPEB Program of Work (2017–2021), by taking into account the specific requests of the Commission, Scientific Committee, and the resources available to the IOTC Secretariat and CPCs.

241. The WPEB **RECALLED** the request of the Scientific Committee in 2015 (SC17. para. 178) that: "*during the 2015 Working Party meetings, each group not only develop a Draft Program of Work for the next five years containing low, medium and high priority projects, but that all High Priority projects are ranked. The intention is that the SC would then be able to review the rankings and develop a consolidated list of the highest priority projects to meet the needs of the Commission. Where possible, budget estimates should be determined, as well as the identification of potential funding sources*."

242. The WPEB **NOTED** the additional items added to the programme of work this year:
    - 2.1.6 The development of a proposal for Resolution 16/04
    - 3.4 Ecological Risk Assessment (Preparatory work: 2017; full ERA: 2018)

- 9.3 Assessment of trophic relationships in pelagic bycatch using chemical tracers

243. The WPEB **NOTED** the range of research projects on ecosystems and bycatch, 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 in early November 2016.

244. The WPEB **RECOMMENDED** that the SC consider and endorse the WPEB Program of Work (2017–2021), as provided at Appendix XVIII.

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

245. The WPEB **NOTED** with thanks, the contributions of the Invited Expert for the meeting, Dr Malcolm Francis and **ENCOURAGED** him to maintain links with IOTC scientists to aid in the improvement of approaches to assess ecosystem and bycatch issues in the IOTC area of competence.

246. 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 2016, by the Invited Expert:
    - **Expertise:** Sharks –stock assessment; including from regions other than the Indian Ocean; data poor assessment approaches, including indicator-based analysis, for sharks.

12. OTHER BUSINESS

12.1 Southern hemisphere stock status assessment of porbeagle shark

247. The WPEB **NOTED** the update from the WCPFC's ABNJ Tuna Project Technical Coordinator-Sharks and Bycatch on the southern hemisphere porbeagle (*Lamna nasus*) shark assessment which is a joint project between WCPFC and CCSBT (IOTC–2016–WPEB12–INF03 Rev_2). After considering data holdings from a number of countries, the consultant (NIWA) is assisting scientists from New Zealand, Japan, Uruguay and Argentina to produce indicators of stock status. The project is continuing efforts to engage scientists from Chile as their longline fishery is considered to be an important source of stock status information. Indicators will be combined into a traditional stock assessment, which will address both stock status and exploitation rates, and a risk assessment model, which will address exploitation rates only. Recognising that the study is a rare opportunity to obtain information about this species and solidify cooperation amongst new partners, the project's deliverable schedule has been extended to early 2017 to allow for better development of indicators by project collaborators. It will then be presented to CCSBT and WCPFC later in 2017.

248. The WPEB **THANKED** the Common Oceans (ABNJ) Tuna Project for funding the participation of the Technical Coordinator-Sharks and Bycatch (Dr Shelley Clarke) in this meeting.

12.2 Bigeye thresher sustainability status assessment

249. The WCPFC's ABNJ Tuna Project Technical Coordinator-Sharks and Bycatch also provided an update on the Pacific-wide bigeye thresher (*Alopias superciliosus*) shark sustainability status assessment (IOTC–2016–WPEB12–INF01). Although the scope of the study covers only the Pacific, it was noted that IOTC has adopted no-retention measure for this species and Sri Lanka has proposed it for listing on CITES Appendix II at the upcoming Conference of Parties (COP17). Data have been provided by 12 countries via SPC, and special confidentiality arrangements were developed to incorporate data held by the United States and Japan. A spatially-explicit risk assessment methodology is applied by the consultant (NIWA) to assess current fisheries impacts against a notional limit reference point (LRP). The study was not completed in time to be submitted to and reviewed by the WCPFC Scientific Committee in August 2016, but consultant's draft is expected to be ready shortly and will be placed on the ABNJ Tuna Project website in time to be referenced as an Information Paper for CITES COP17.

12.3 Ecosystem Based Fisheries Management (EBFM) joint meeting of tRFMOs in 2016

250. The WPEB **NOTED** that a joint meeting of tRFMOs will be held in Rome, Italy, in December 2016, to consider progress in applying an ecosystem approach to fisheries management. This meeting is organised by the ABNJ Common Oceans project and the WPEB Chair, SC Chair and IOTC Secretariat will be attending. The WPEB **REQUESTED** that the outcomes are presented to the WPEB13.

12.4 Date and place of the 13th and 14th Sessions of the Working Party on Ecosystems and Bycatch

251. The WPEB **AGREED** on the importance of having IOTC working party meetings within key CPCs catching species of relevance to the working party. Following a discussion on who would host the 13th and 14th Sessions of the WPEB in 2017 and 2018 respectively, the WPEB **NOTED** that the IOTC Secretariat would liaise with potential hosts intersessionally, noting the offer from WWF-Pakistan, to determine who might be able to host the

13th Session in conjunction with the Working Party on Billfish. The meeting locations will be communicated by the IOTC Secretariat to the SC for its consideration at its next session in December 2016 (Table 4).

Table 4. Draft meeting schedule for the WPEB (2017 and 2018)

	2017			2018		
Meeting	**No.**	**Date**	**Location**	**No.**	**Date**	**Location**
Working Party on **Billfish** (WPB)	15th	11-15 September (5d)	Seychelles	16th	4-8 September (5d)	?
Working Party on **Ecosystems and Bycatch** (WPEB)	13th	5-9 September (5d)	Seychelles	14th	10-14 September (5d)	?

252. The WPEB **NOTED** the importance of having a degree of stability in the participation of CPCs to each of the working party meetings and **ENCOURAGED** participants to regularly attend each meeting to ensure as much continuity as possible.

12.5 Review of the draft, and adoption of the Report of the 12th Session of the Working Party on Ecosystems and Bycatch

253. The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB11, provided at Appendix XIX, 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 IX
- Oceanic whitetip sharks (*Carcharhinus longimanus*)– Appendix X
- Scalloped hammerhead sharks (*Sphyrna lewini*) – Appendix XI
- Shortfin mako sharks (*Isurus oxyrinchus*) – Appendix XII
- Silky sharks (*Carcharhinus falciformis*) – Appendix XIII
- Bigeye thresher sharks(*Alopias superciliosus*) – Appendix XIV
- Pelagic thresher sharks(*Alopias pelagicus*) – Appendix XV

Other species/groups

- Marine turtles – Appendix XVI
- Seabirds – Appendix XVII

254. The report of the 12th Session of the Working Party on Ecosystems and Bycatch (IOTC–2016–WPEB12–R) was **ADOPTED** on the16 September 2016.

APPENDIX I
LIST OF PARTICIPANTS

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APPENDIX II
AGENDA FOR THE 12TH WORKING PARTY ON ECOSYSTEMS AND BYCATCH

Date: 12–16 September 2016
Location: Seychelles
Venue: STC conference centre, Victoria
Time: 09:00 – 17:00 daily
Chair: Dr Rui Coelho (EU,Portugal); **Vice-Chair**: Dr Reza Shahifar (I.R. Iran) & Dr Ross Wanless (South Africa)

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

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

3. **THE IOTC PROCESS: OUTCOMES, UPDATES AND PROGRESS**
   - 3.1 Outcomes of the 18th Session of the Scientific Committee (IOTC Secretariat)
   - 3.2 Outcomes of the 20th Session of the Commission (IOTC Secretariat)
   - 3.3 Review of Conservation and Management Measures relevant to Ecosystems and Bycatch (IOTC Secretariat)
   - 3.4 Progress on the recommendations of WPEB11 (IOTC Secretariat)

4. **REVIEW OF DATA AVAILABLE ON ECOSYSTEMS AND BYCATCH**
   - 4.1. Review of the statistical data available for ecosystems and bycatch species (IOTC Secretariat)
   - 4.2. Regional Observer Scheme – update (IOTC Secretariat)

5. **REVIEW OF NATIONAL BYCATCH ISSUES IN IOTC MANAGED FISHERIES AND NATIONAL PLANS OF ACTION** (sharks; seabirds; marine turtles) (CPCs and IOTC Secretariat)
   - 5.1. Review of applications for '*not applicable*' NPOA status (IOTC Secretariat)
   - 5.2. Updated status of development and implementation of National Plans of Action for seabirds and sharks, and the implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations (CPCs).

6. **NEW INFORMATION ON BIOLOGY, ECOLOGY, FISHERIES AND ENVIRONMENTAL DATA RELATING TO ECOSYSTEMS AND BYCATCH SPECIES**
   - 6.1. Review new information on environment and ecosystem interactions and modelling, including climate change issues affecting pelagic ecosystems in the IOTC area of responsibility (all)

7. **GILLNET FISHERIES: PROBLEMS AND NEEDS** (recommendations from the SC / decisions of the Commission)
   - 7.1. Regional review of the data available for gillnet fleets operating in the Indian Ocean (all)
   - 7.2. Training on species identification, bycatch mitigation and data collection for gillnet fleets – updates, plans of action and identification of other potential sources of assistance (all)

8. **BLUE SHARK**
   - 8.1. Review new information on blue shark biology, stock structure, bycatch mitigation measures, fisheries and associated environmental data (all)
   - 8.2. Review of new information on the status of blue shark (all)
     - Nominal and standardised CPUE indices
     - Stock assessments (including data poor approaches): preparation for 2017 assessment
     - Selection of Stock Status indicators for blue shark
   - 8.3. Development of management advice for blue shark and update of blue shark Executive Summary for the consideration of the Scientific Committee (all)
     - Consideration of options for alternative management measures for blue shark in the IOTC area of competence

9. OTHERS SHARKS AND RAYS (Priority species: Oceanic whitetip shark)

9.1. Review new information on other shark and ray biology, stock structure, bycatch mitigation measures, fisheries and associated environmental data (all)

9.2. Review of mitigation measures contained in Resolution 13/06 for Oceanic whitetip shark

9.3. Review of new information on the status of other sharks (all)

- Nominal and standardised CPUE indices
- Selection of Stock Status indicators for other sharks

9.4. Development of management advice on the status of other shark stocks and update of other shark species Executive Summaries for the consideration of the Scientific Committee (all)

- Consideration of options for alternative management measures for other sharks in the IOTC area of competence

10. OTHER BYCATCH AND BYPRODUCT SPECIES INTERACTIONS

10.1. Review new information on other bycatch and byproduct, in terms of biology, ecology, fisheries interactions and bycatch mitigation measures (all)

10.2. Review of new information on the proposed retention of non-target species by various gears (all)

10.3. Marine turtles

- Review new information on marine turtle biology, ecology, fisheries interactions and bycatch mitigation measures (all);
- Review of mitigation measures in Resolution 12/04 (all);
- Development of management advice on the status of marine turtle species (all).

10.4. Seabirds

- Review new information on seabird biology, ecology, fisheries interactions and bycatch mitigation measures (all);
- Assessment of data submissions in response to IOTC circular 2016-043 (all);
- Review of mitigation measures in Resolution 12/06 (all);
- Development of management advice on the status of seabird species (all).

10.5. Marine mammals

- Review new information on marine mammal biology, ecology, fisheries interactions and bycatch mitigation measures (all);
- Development of management advice on the status of marine mammal species (all).

11. WPEB PROGRAM OF WORK

11.1. Revision of the WPEB Program of Work 2017–2021 (Chairperson and IOTC Secretariat)

11.2. Development of priorities for an Invited Expert/s at the next Working Party on Ecosystems and Bycatch meeting (Chairperson)

12. OTHER BUSINESS

12.1. Update: Southern hemisphere stock status assessment of porbeagle shark (all)

12.2. Update: Ecosystem Based Fisheries Management (EBFM) joint meeting of tRFMOs (Chairperson)

12.3. Date and place of the 13th and 14th Sessions of the Working Party on Ecosystems and Bycatch (Chairperson and IOTC Secretariat)

12.4. Review of the draft, and adoption of the Report of the 12th Session of the Working Party on Ecosystems and Bycatch (Chairperson)

APPENDIX III
LIST OF DOCUMENTS

Document	Title	Availability
IOTC–2016–WPEB12–01a	Agenda of the 12th Working Party on Ecosystems and Bycatch	✓(10 February 2016) ✓(1 July 2016)
IOTC–2016–WPEB12–01b	Annotated agenda of the 12th Working Party on Ecosystems and Bycatch	✓(16 August 2016)
IOTC–2016–WPEB12–02	List of documents of the 12th Working Party on Ecosystems and Bycatch	✓(16 August 2016)
IOTC–2016–WPEB12–03	Outcomes of the 18th Session of the Scientific Committee (IOTC Secretariat)	✓(26 August 2016)
IOTC–2016–WPEB12–04	Outcomes of the 20th Session of the Commission (IOTC Secretariat)	✓(26 August 2016)
IOTC–2016–WPEB12–05	Review of Conservation and Management Measures relevant to ecosystems and bycatch (IOTC Secretariat)	✓(26 August 2016)
IOTC–2016–WPEB12–06	Progress made on the recommendations and requests of WPEB11 and SC18 (IOTC Secretariat)	✓(24 August 2016)
IOTC–2016–WPEB12–07	Review of the statistical data and fishery trends for ecosystems and bycatch species (IOTC Secretariat)	✓(26 August 2016)
IOTC–2016–WPEB12–08	Improvements to the IOTC database (IOTC Secretariat)	✓(26 August 2016)
IOTC–2016–WPEB12–09 Rev_1	Update on the implementation of the IOTC Regional Observer Scheme (IOTC Secretariat)	✓(28 August 2016)
IOTC–2016–WPEB12–10 Rev_1	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 (IOTC Secretariat)	✓(24 August 2016)
IOTC–2016–WPEB12–11	Revision of the WPEB Program of Work (2017–2021) (IOTC Secretariat)	✓(24 August 2016)
IOTC–2016–WPEB12–12	Iranian fishing vessels bycatch in IOTC area of competence in 2015 (R.Shahifar)	✓(17 August 2016)
IOTC–2016–WPEB12–13 Rev_1	Trace elements in oceanic pelagic communities in the Western-Central Indian Ocean (N. Bodin, D. Lesperance, R.	✓(29 August 2016) ✓(10 September 2016)
IOTC–2016–WPEB12–14	Progress of tuna regional fisheries management organizations in applying ecosystem-based fisheries management (M. J. Juan-Jordá, H. Murua, H. Arrizabalaga, N. K. Dulvy and V. Restrepo)	✓(22 August 2016)
IOTC–2016–WPEB12–15	Entanglement risk of marine megafauna and sensitive habitats with FADs in BIOT (T. Davies, H. Duffy, J. Moir Clark, J. Pearce and C. Mees)	Withdrawn
IOTC–2016–WPEB12–16 Rev_1	Estimating the composition and capture status of bycatch using Chinese longline observer data in the Indian Ocean (C. Gao and X. Dai)	✓(28 August 2016)
IOTC–2016–WPEB12–17	Composition and abundance of pelagic sharks caught by Indonesian drifting gillnet fisheries in the Indian Ocean (D.Novianto, A.F.Nugroho and R.R.Zedta)	✓(28 August 2016)
IOTC–2016–WPEB12–18	Estimates of intrinsic rate of population change and steepness for blue shark (*Prionace glauca*) in the Indian Ocean (D. Rosa & R. Coelho)	✓(26 August 2016)
IOTC–2016–WPEB12–19	Preliminary standardized CPUE of blue shark in the Indonesian tuna longline fishery estimated from scientific observer data, for the period 2005 – 2014 (D. Novianto, B. Setyadji & R. Coelho)	✓(24 August 2016)
IOTC–2016–WPEB12–20 Rev_1	Status of the Shark Fishery Ban in the Maldives and the Implementation of the National Plan of Action on Sharks- An update with notes on marine turtles (K. Ali)	✓(05 September 2016)
IOTC–2016–WPEB12–21	Update of the Portuguese pelagic sharks research program in the Indian Ocean, including samples and data up to 2015 (R. Coelho, P. Lino and D. Rosa)	✓(26 August 2016)
IOTC–2016–WPEB12–22 Rev_1	Growth, mortality and exploitation rates of shark species caught as bycatch in small-scale tuna fisheries in coastal Kenya (B.K.Kiilu)	✓(28 August 2016)

Document	Title	Availability
IOTC–2016–WPEB12–23 Rev_1	Identification of fourteen pelagic shark species of the Indian ocean occurring around Sri Lanka; using morphological characters of their fins (R.A.M. Jayathilaka, S.S.K. Haputhanthri and H.A.C.C. Perera)	✓(28 August 2016)
IOTC–2016–WPEB12–24	Shark caught by Thai tuna longline in the Indian Ocean during 2014-2015 (P. Luesrithawornsin, P. Lirdwitayaprasit and A. Wongkeaw)	✓(28 August 2016)
IOTC–2016–WPEB12–25 Rev_1	Using FADs to estimate a population trend for the oceanic whitetip shark in the Indian Ocean (M. T. Tolotti, M. Capello, P. Bach, E. Romanov, H. Murua and L. Dagorn)	✓(28 August 2016)
IOTC–2016–WPEB12–26	Hooking mortality of oceanic whitetip sharks caught in a pelagic longline fishery targeting swordfish in the SW Indian Ocean: comments on the efficiency of no-retention measures (R. Coelho)	✓(26 August 2016)
IOTC–2016–WPEB12–27	Results from the First WCPFC Workshop on Joint Analysis of Sea Turtle Mitigation Effectiveness (S.Clarke, T.Peatman and S.Caillot)	✓(17 August 2016)
IOTC–2016–WPEB12–28	A status update of seabirds in the IOTC area (R. Wanless and Wieslawa Misiak)	✓(31 August 2016)
IOTC–2016–WPEB12–29	Interaction between seabirds and Spanish surface longline targeting swordfish in the Indian Ocean (≥ 25º South) during the period 2011-2015 (J. Fernández-Costa, A. Ramos-Cartelle, A. Carroceda and J. Mejuto)	✓(26 August 2016)
IOTC–2016–WPEB12–30	Scoping Paper: Approaches for Measuring and Monitoring the Effectiveness of Seabird Conservation Measures in SBT Longline Fisheries (CCSBT Technical Group)	✓(17 August 2016)
IOTC–2016–WPEB12–31	ACAP seabird bycatch indicators, data needs, methodological approaches and reporting requirements (A. Wolfaardt, I. Debski, W .Misiak and N. Walker)	✓(27 August 2016)
IOTC–2016–WPEB12–32	Data collection opportunities for assessing the use and effectiveness of seabird conservation measures (R.Wanless)	✓(28 August 2016)
IOTC–2016–WPEB12–33 Rev_1	Lumo leads: a new, safe seabird mitigation device for pelagic longline fisheries (D.Rollinson)	✓(28 August 2016) ✓(9 September 2016)
IOTC–2016–WPEB12–34	ACAP advice for reducing the impact of pelagic longline fishing operations on seabirds (M. Favero, A. Wolfaardt and N. Walker)	✓(27 August 2016)
IOTC–2016–WPEB12–35	Depredation in the Portuguese pelagic longline fleet in the Indian Ocean (R. Lechuga, D. Rosa & R. Coelho)	✓(26 August 2016)
IOTC–2016–WPEB12–36	Preliminary Analysis and Data Development for Blue Shark (*Prionace glauca*) Catch Reconstruction (J.Rice and S.Martin)	✓(28 August 2016)
IOTC–2016–WPEB12–37	Progress report on data mining for CITES-listed species, stock status and review of mitigation measures for Oceanic whitetip shark (*Carcharhinus longimanus*) (J.Rice)	✓(28 August 2016)
IOTC–2016–WPEB12–38 [not presented]	Update of standardized CPUE of blue shark (*Prionace glauca*) in the Indian Ocean estimated from Japanese observer data between 1992 and 2015 (Y. Semba and M. Kai)	✓(26 August 2016)
IOTC–2016–WPEB12–39	Mitigation of Silky Shark Bycatch in Tropical Tuna Purse Seine Fisheries (ISSF)	✓(28 August 2016)
IOTC–2016–WPEB12–40	Bycatch of the commercially important species of the tuna gillnet fisheries of Pakistan (M.Moazzam, M.W.Khan and R.Nawaz)	✓(28 August 2016)
IOTC–2016–WPEB12–41	Addendum to the seabird identification cards for fishing vessels operating in the Indian Ocean (M.Moazzam, A.Riaz and R.Nawaz)	✓(28 August 2016)
IOTC–2016–WPEB12–42	Incidental catch of seabirds and sea turtles by Taiwanese longline fleets in the Indian Ocean between 2009 and 2015 (H. Huang)	✓(26 August 2016)
Information papers		
IOTC–2016–WPEB12–INF01	Pacific-wide bigeye thresher shark (*Alopias superciliosus)* sustainability status assessment (D. Fu, M. Roux, S. Clarke and M. Francis)	✓(9 August 2016)
IOTC–2016–WPEB12–INF02	Trial Application of the BDEP Template for Summarizing Bycatch Data (P. Williams, N.Smith, I.Tuiloma, C.Falasi and S.Clarke)	✓(9 August 2016)

Document	Title	Availability
IOTC–2016–WPEB12–INF03 Rev_2	Southern Hemisphere Porbeagle Stock Status Assessment – an update (S.Clarke)	✓(9 August 2016) ✓(31 August 2016)
IOTC–2016–WPEB12–INF04	Blue Shark catches reported to the IOTC Secretariat, and a review of current estimation procedures (IOTC Secretariat)	✓(31 August 2016)
IOTC–2016–WPEB12–INF05	Compendium of ISSF at-sea bycatch mitigation research activities as of July, 2016 (V. Restrepo, L. Dagorn, G. Moreno, F. Forget, K. Schaefer, I. Sancristobal, J. Muir and D. Itano)	✓(16 August 2016)
IOTC–2016–WPEB12–INF06	The conservation status and priorities for albatrosses and large petrels (R.A. Phillips, R. Gales, G.B. Baker, M.C. Double, M. Favero, F. Quintana, M.L. Tasker, H. Weimershirch, M. Uhart and A. Wolfaardt)	✓(27 August 2016)
IOTC–2016–WPEB12–INF07	Examination of factors affecting seabird bycatch occurrence rate in southern hemisphere in Japanese longline fishery with using random forest (Y. Inoue, M. Kanaiwa, K.Yokawa, K. Oshima)	✓(8 September 2016)
IOTC–2016–WPEB12–INF08	Modelling of bycatch occurrence rate of seabirds for Japanese longline fishery operated in southern hemisphere (Y. Inoue, M.Kanaiwa, K.Yokawa, K.Okamoto and K. Oshima)	✓(8 September 2016)
IOTC–2016–WPEB12–INF09	Operational pattern of Japanese longliners in the south of 25S in the Atlantic and the Indian Ocean for the consideration of seabird bycatches (K.Yokawa, K. Oshima, Y. Inoue and N. Katsumata)	✓(8 September 2016)
IOTC–2016–WPEB12–INF10	Information of seabirds bycatch in area south of 25 S latitude in 2010 from 2015 (N. Katsumata, K. Yokawa and K. Oshima)	✓(8 September 2016)
IOTC-2016-WPEB12-INF11	Bycatch analysis of tuna gillnet fisheries of Pakistan: An analysis of bycatch data from 2013-2015 (U. Shahid, M. Moazzam Khan, R. Nawaz, S. A. Razzaq and S. Ayub)	✓(11 September 2016)
Data sets		
IOTC–2016–WPEB12–DATA01	Bycatch datasets available	✓(16 August 2016)
IOTC–2016–WPEB12–DATA02	Data Catalogue	✓(3 August 2016)
IOTC–2016–WPEB12–DATA03	Data for the assessment of Indian Ocean Blue Shark	✓(3 August 2016)
IOTC–2016–WPEB12–DATA05 Rev_1	Nominal Catches per Fleet, Year, Gear, IOTC Area and species	✓(3 August 2016) ✓(24 August 2016)
IOTC–2016–WPEB12–DATA06	Catch and Effort - longline fisheries	✓(3 August 2016)
IOTC–2016–WPEB12–DATA07	Catch and Effort - vessels using pole and lines or purse seines	✓(3 August 2016)
IOTC–2016–WPEB12–DATA08	Catch and Effort - coastal fisheries	✓(3 August 2016)
IOTC–2016–WPEB12–DATA09	Catch and Effort - all vessels	✓(3 August 2016)
IOTC–2016–WPEB12–DATA10	Catch and Effort - reference	✓(3 August 2016)
IOTC–2016–WPEB12–DATA11	Size Frequency - Sharks	✓(3 August 2016)
IOTC–2016–WPEB12–DATA12	Data Shark Equations	✓(3 August 2016)
IOTC–2016–WPEB12–DATA13	Size frequency - reference	✓(3 August 2016)

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

Extract from IOTC–2016–WPEB12–07

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

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

The nominal catch data for all shark species are presented in Fig. 1 by fleet. Very few fleets reported catches of sharks in the 1950s, but the number of fleets reporting has increased over time. Total reported shark catches have also increased over time with a particularly dramatic increase in reported catches in the 1990s, reaching a peak of approximately 120 000mt in 1999. Since then, nominal catches have fluctuated and are currently around 112 000 mt. Notably, India reported particularly high catches of unidentified shark species in 2015 (22 972mt).

The nominal catch data should be considered with caution given the historically low reporting rates. In addition to the underestimates from lack of reporting, when the catches are reported they are thought to represent only the catches of those species that are retained onboard without taking in to account discards (nominal catches). In many cases the reported catches refer to dressed weights while no information is provided on the type of processing undertaken, creating more uncertainty in the estimates of catches in live weight equivalents. Nevertheless, reporting rates in recent years have improved substantially (Appendix 4) following the adoption of new measures by the Commission on sharks and other bycatch, which call for IOTC CPCs to collect and report more detailed statistics on bycatch species to the IOTC Secretariat.

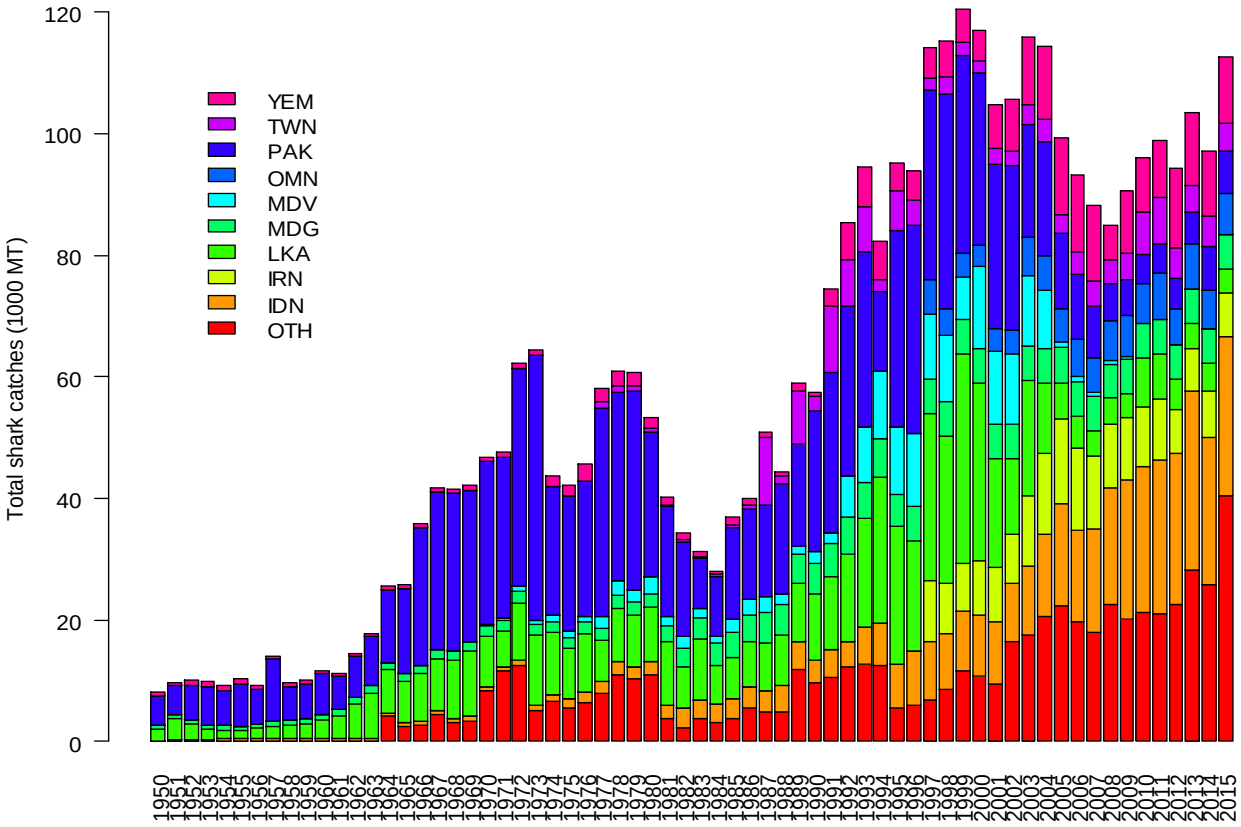


Fig. 1. Total reported nominal catches of sharks by fleet from 1950–2015 (YEM = Yemen, TWN = Taiwan,China, PAK = Pakistan, MDV = Maldives, MDG = Madagascar, LKA = Sri Lanka, IRN = I.R.Iran, IDN = Indonesia, OTH = all others).

Main reported gear types associated with shark bycatch for IOTC fisheries

Figure 2 shows the distribution of catches across gear type. Gillnets are associated with the highest reported nominal catches of sharks, historically and still contribute to over 40% of catches. This is followed by the longline fleets which contributed substantially to shark catches from the 1990s, and handline and troll line fisheries in more recent years. Of

the gillnets fisheries, the majority comprise standard, unclassified gillnets, followed by combinations of gillnets, handlines and troll lines and gillnet/longline combinations. Figure 3 shows the main gear types used by fleets over the last 15 years.

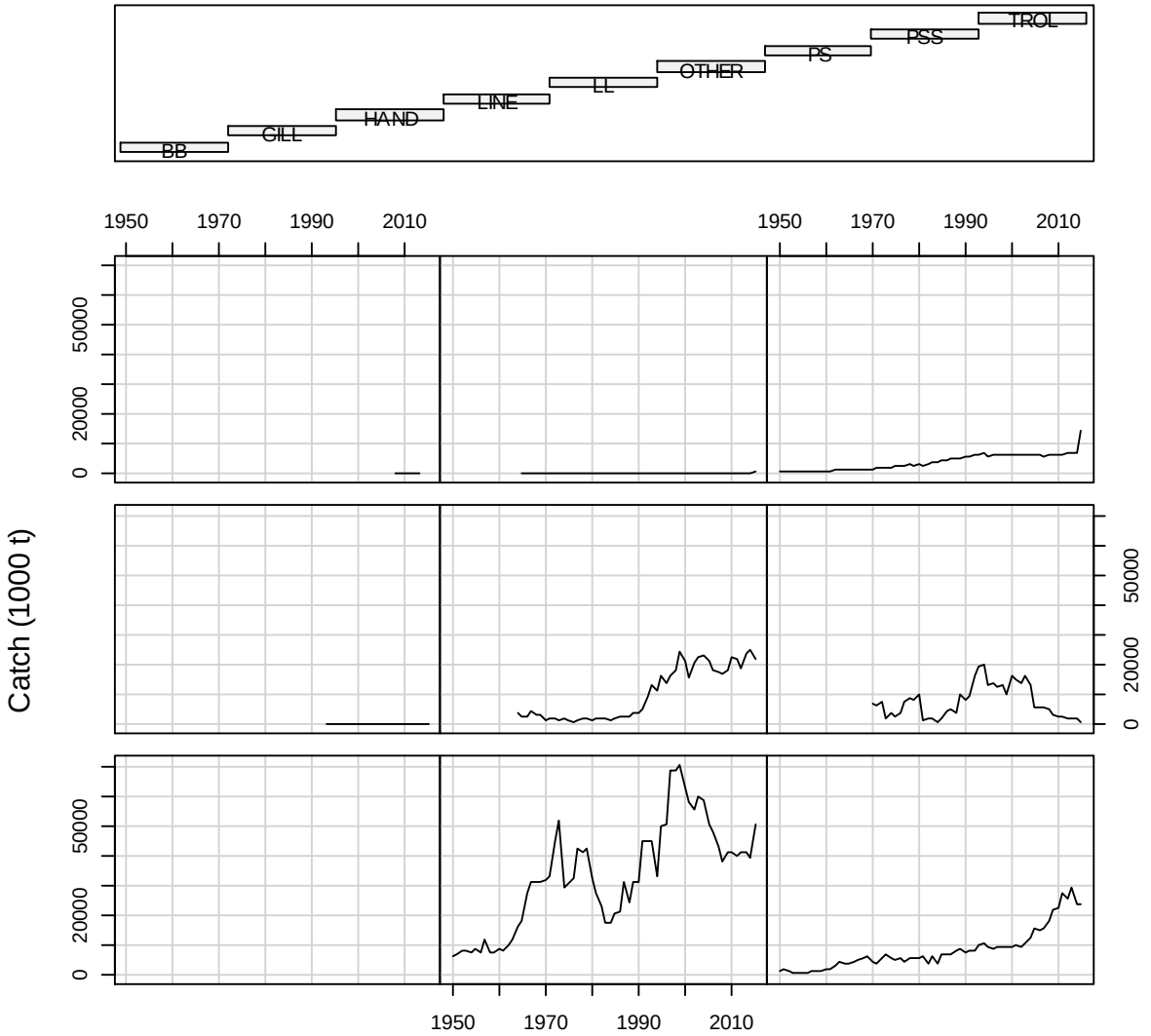


Figure 2. Nominal catches of sharks reported by gear type (1950–2015). Gears are listed bottom left to top right: Bait boat/pole and line (BB), gillnet (GILL), Handline (HAND), Line (LINE), logline (LL), Purse seine (PS), small purse seines/ring nets (PSS), troll lines (TROLL) and all other gear types (OTHER).

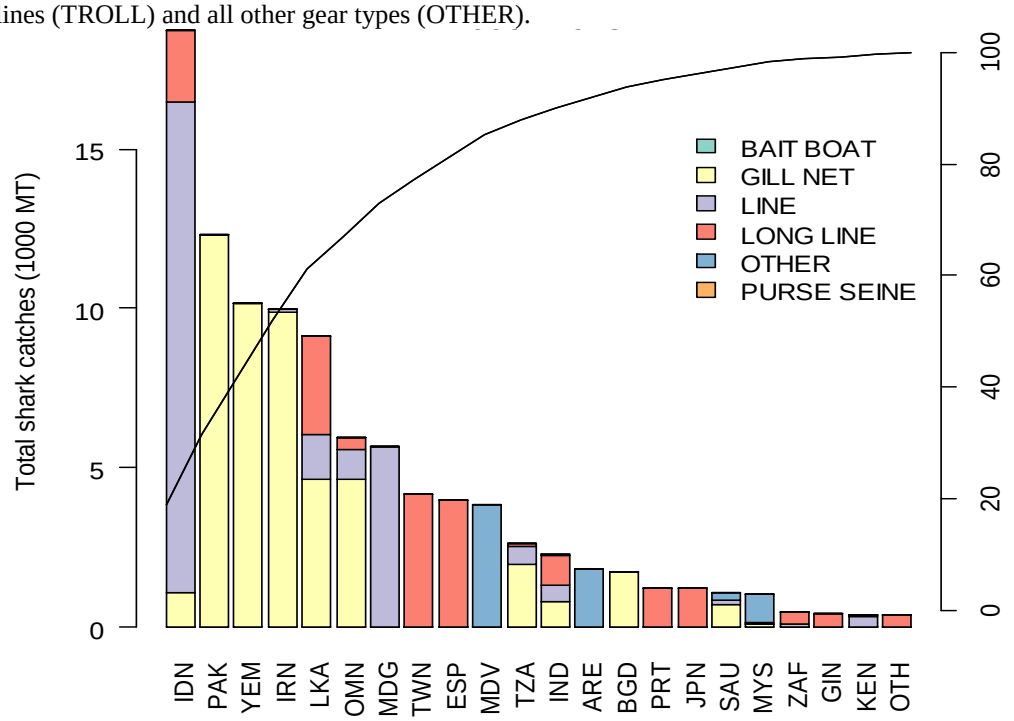


Figure 3. Average annual shark catches by gear type and reporting country in recent years (2000-2015)

Main species of sharks caught in IOTC fisheries

A list of all species of sharks that are known to occur in Indian Ocean fisheries directed at IOTC species (IOTC fisheries) or pelagic sharks is provided in Appendix 2. In addition to an increase in reporting of shark catches over time, the resolution of the data provided has been improving with an increased proportion of reported shark catches provided identified to species/genus (Fig.4a). Of the shark catches reported by species, the blue shark forms the greatest proportion, comprising over 60% of total catches, with silky, threshers, hammerheads and mako sharks forming a smaller percentage (Fig. 4b).

The increase in reporting by species is apparent in the species-specific catch series (Fig. 5) with steadily increasing trends in reporting since the 1970s seen for blue sharks, thresher sharks, hammerhead sharks and mako sharks. The oceanic whitetip shark nominal catch series has changed in recent years due to a reallocation of catches reported by India and is now dominated by the Sri Lankan longline-gillnet fisheries which peaked just prior to 2000. The reported catches of silky shark show a similar trend with a peak just prior to 2000 followed by a steady decline, again based almost exclusively on data from the Sri Lankan longline-gillnet combination fisheries. The effect of single fleet reports in the nominal catch series by species is apparent when looking at Fig.5b which highlights how the catch series of each species is dominated by very few fleets which are reporting by species.

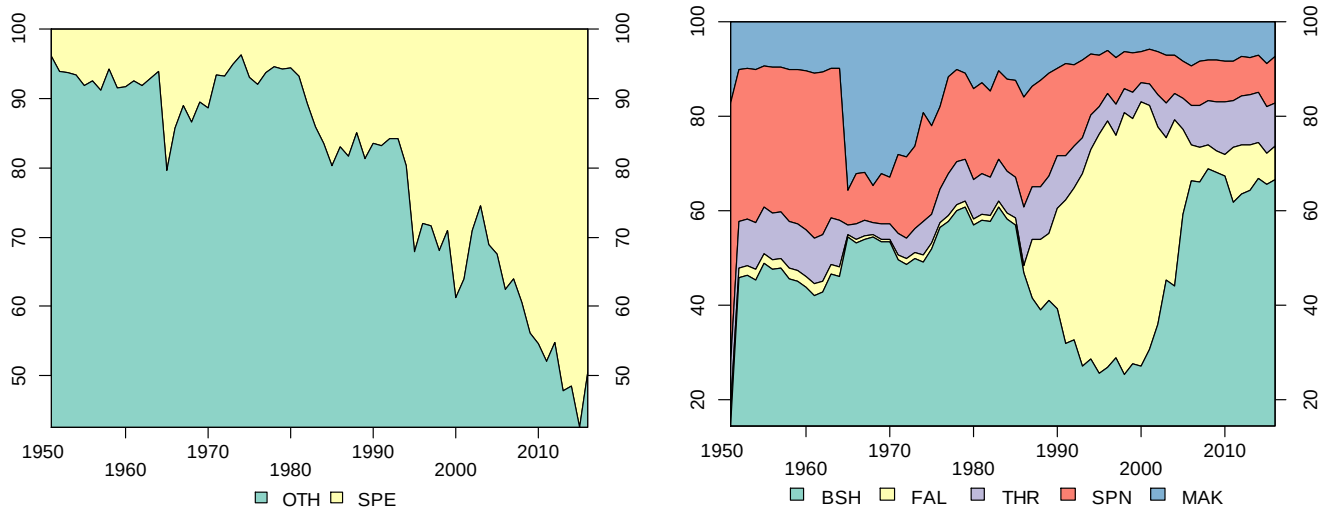


Fig. 4. a) Proportion of shark catches reported by species and as aggregate catch (OTH) and b) proportion of nominal shark catches by species

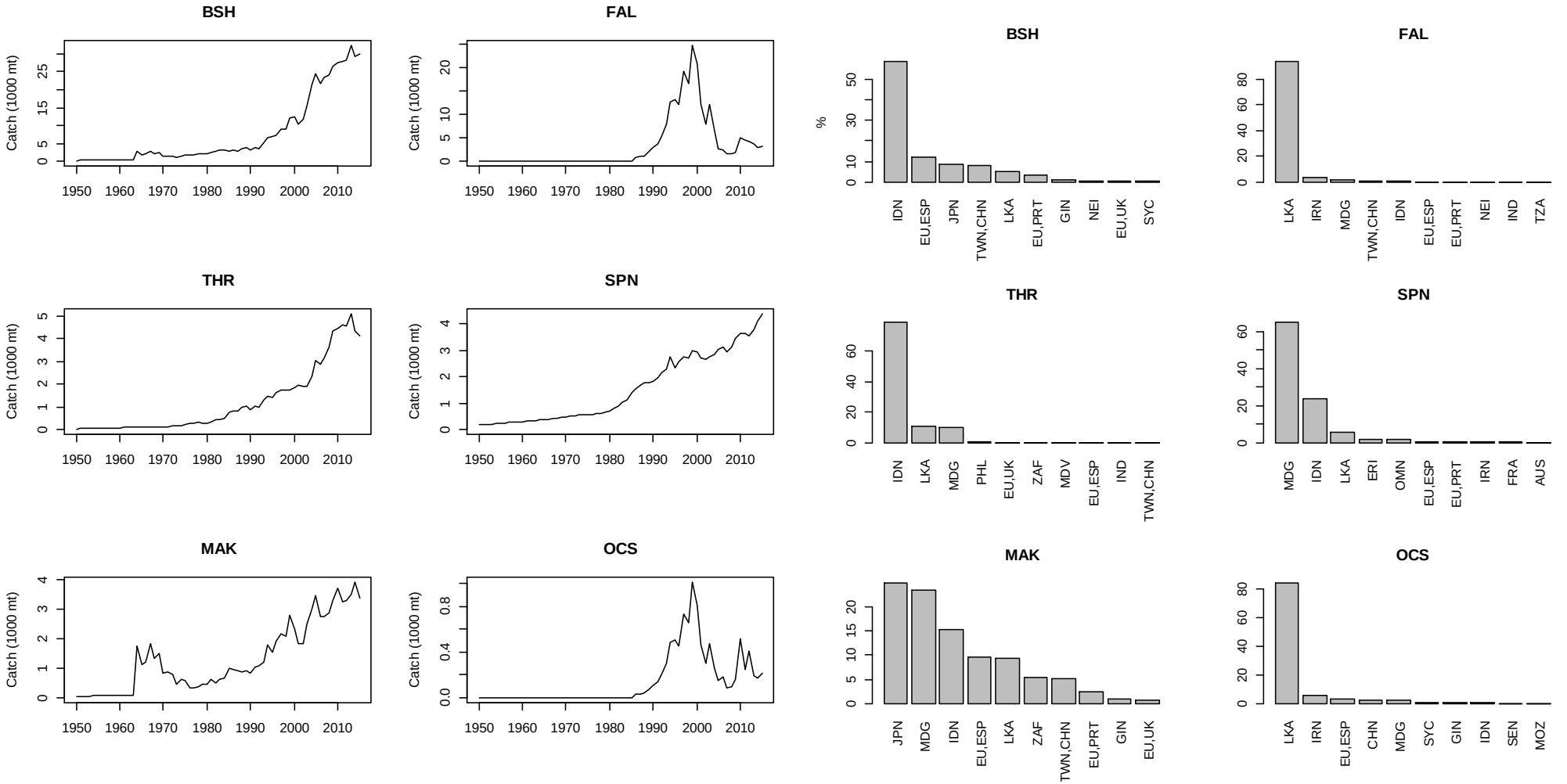


Fig. 5. a) Total nominal catches by species for all fleets (1950-2015) and b) contribution of each fleet to the total data series

Trends in species catches by gear types are summarised in Table 1. Nominal shark catches by longliners comprise predominantly blue shark followed by mako and silky sharks, while reported catches of handline gears are also dominated by blue shark, followed by thresher sharks. Purse seine catches are dominated by silky shark. Troll lines reported relatively high catches of hammerhead sharks. Reporting by species is very uncommon for gillnet fleets, where the majority of shark catches are reported as aggregates. Nevertheless, this is improving as shown in Fig. 6 by the level of species-specific reporting by the gillnet fleet of I.R. Iran. This figure highlights the relatively high catches of the Indonesia line fisheries (including troll lines, hook and line, hand line and coastal longlines[2]) and the gillnet fisheries of Pakistan, Yemen and I.R. Iran.

Table 1. Species-specific catches by gear type from 2005–2015 (Bait boat/pole and line (BB), gillnet (GILL), Handline (HAND), Line (LINE), logline (LL), Purse seine (PS), small purse seines/ring nets (PSS) and troll lines (TROL).

	BB	GILL	HAND	LINE	LL	PS	PSS	TROL
OTH	100%	92%	15%	100%	22%	28%	100%	66%
BSH	0%	3%	59%	0%	62%	0%	0%	0%
FAL	0%	4%	0%	0%	6%	72%	0%	2%
THR	0%	0%	17%	0%	0%	0%	0%	3%
SPN	0%	0%	6%	0%	0%	0%	0%	23%
MAK	0%	0%	3%	0%	9%	0%	0%	7%
OCS	0%	0%	0%	0%	1%	0%	0%	0%
RMB	0%	0%	0%	0%	0%	0%	0%	0%

[2] These are longlines which are operated by smaller vessels (<15m) and generally deployed within the EEZ.

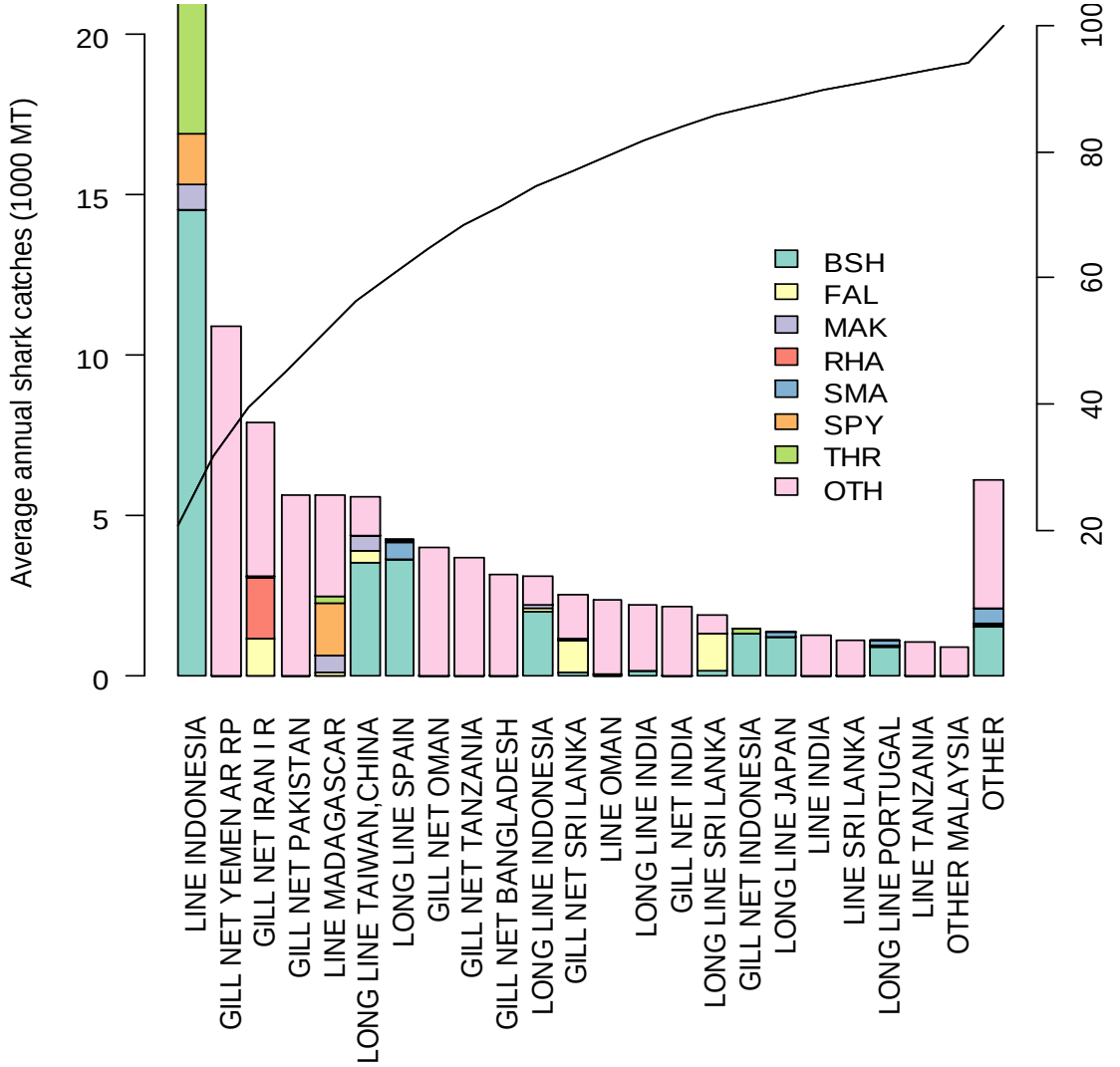


Fig. 6. Annual average shark catches reported by fleet and species from 2010–2015

Catch rates of the IOTC fleets

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 quantities of pelagic sharks.

- **Pole and line fisheries:** The shark catches reported for the pole and line fisheries of Maldives are very low and none are reported for India. The amounts of sharks caught by these fisheries, if any, are not thought significant.

- **Gillnet fisheries:** The species of sharks caught are thought to vary significantly depending on the area of operation of the gillnets:
    - Gillnets operated in areas having low concentrations of pelagic sharks: The gillnet fisheries of most coastal countries operate these gears in coastal waters. The abundance of pelagic sharks in these areas is thought low.
    - Gillnets operated in areas having high concentrations of pelagic sharks: Gillnets operated in Sri Lanka, Indonesia and Yemen (waters around Socotra), in spite of being set in coastal areas, are likely to catch significant amounts of pelagic sharks.

- **Gillnets operated on the high seas:** Vessels from Taiwan,China were using drifting gillnets (driftnets) from 1982 to 1992, when the use of this gear was banned worldwide. The catches of pelagic sharks were very high during this period. Driftnet vessels from I.R. Iran and Pakistan have been fishing on the high seas since, but with lower catch rates. This was initially in waters of the Arabian Sea but covering a larger area in recent years as they expanded their range to include the tropical waters of the western Indian Ocean and Mozambique Channel. The quantity of sharks caught by these fleets is thought to be relatively high, representing between 25–50% of the total combined catches of sharks and other species.

- **Gillnet/longline fishery of Sri Lanka:** Between 1,200 and 3,200 vessels (12 m average length) operating gillnets and longlines in combination have been harvesting important amounts of pelagic sharks since the mid-1980s. The longlines are believed to be responsible for most of the catches of sharks. Catches of sharks comprised ~45% of the total combined catch for all species in 1995 and declined to <2% in the late 2000s. The fleet has been shifting towards predominantly longline gear in recent years but most catches are still reported as aggregates of the combination gear.

- **Fisheries using handlines:** The majority of fisheries using hand lines and trolling in the Indian Ocean operate these gears in coastal waters, so although the total proportion of sharks caught has been high historically, the amount of pelagic sharks caught are thought to be low. The proportion of other species of sharks might change depending on the area fished and time of the day.

- **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 up a small proportion of the total catches of all species by longline fleets. These catches series for sharks are, therefore, thought to be very incomplete. Nevertheless, levels of reporting have improved in recent years, following the implementation of catch monitoring schemes in different ports of landing of fresh-tuna longliners[3], 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 these fisheries 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 amount of sharks caught by longliners targeting swordfish in the IOTC area of competence has been increasing since the mid-1990s. 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 are known to alternate between targeting swordfish and sharks (particularly blue sharks) 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. Limited nominal catch data have been reported for the purse seine fleets.
- **Trolling fisheries:** The majority of fisheries trolling in the Indian Ocean operate in coastal waters so the amounts of pelagic sharks caught are thought to be 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.

Figure 7 indicates the catch rates of sharks as a proportion of total catches as reported in the IOTC database. This suggests that some of the reported catch rates for the longline fleet are lower than expected and highlights the patchiness of the data leading to highly variable catch rates over time.

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

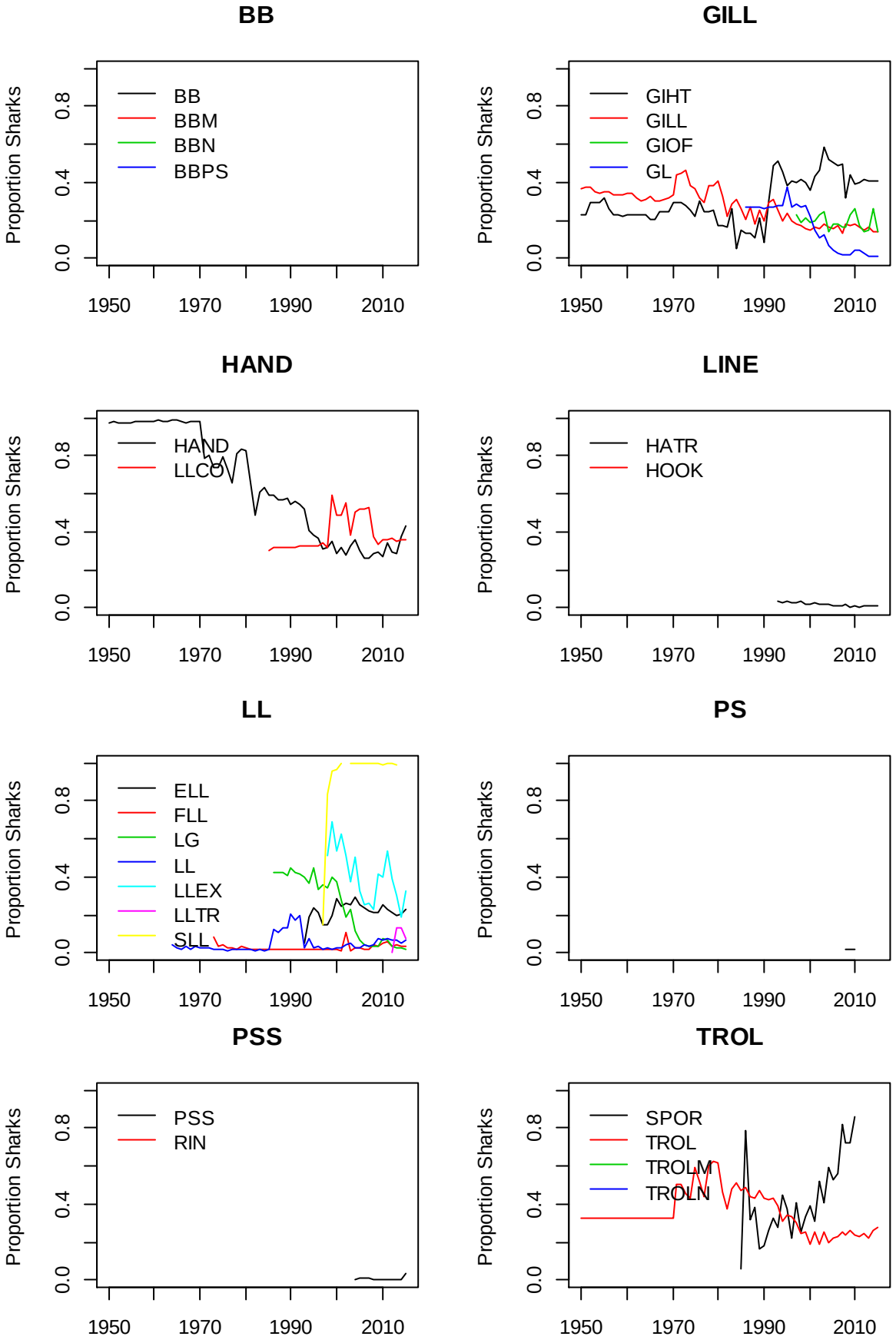


Figure 7. Proportion of reported shark catch as a fraction of total reported catch by gear type over time

Spatial information on sharks catches

Fig. 8 and Fig. 9 present the spatial catches of sharks reported in numbers for deep-freezing longliners flagged by Taiwan,China over time. The reporting by species has improved over time, indicating that the majority of the catches are blue shark with an increase in catches of silky shark in the northern Indian Ocean apparent in recent years, however, the presence of low numbers of dusky shark in the reported catches are somewhat surprising given its coastal distribution and may reflect species identification errors.

Fig. 10 shows the shark catches reported by the Japanese longline fleet from 2009–15. These show a clear dominance of blue sharks, followed by relatively minor catches of shortfin mako shark and porbeagle shark. However, it is important to note that time-area catches of sharks by species are only available from 2007 for Taiwan,China or 2009 for Japan, while these fleets have been operating in the Indian Ocean since the 1950s. Unlike Taiwan,China, for which spatially disaggregated catches of sharks are available aggregated by species from up to the late 1970s, Japan has not provided spatially disaggregated 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, only including those species which have been listed as mandatory for reporting. More limited time-area catches of sharks are also available from some other fleets, as recorded in Appendix 3.

Figure 11 shows catches by the Seychelles longline fleet from 2006 onwards showing a dominance in catches of blue shark, followed by makos in the southern regions.

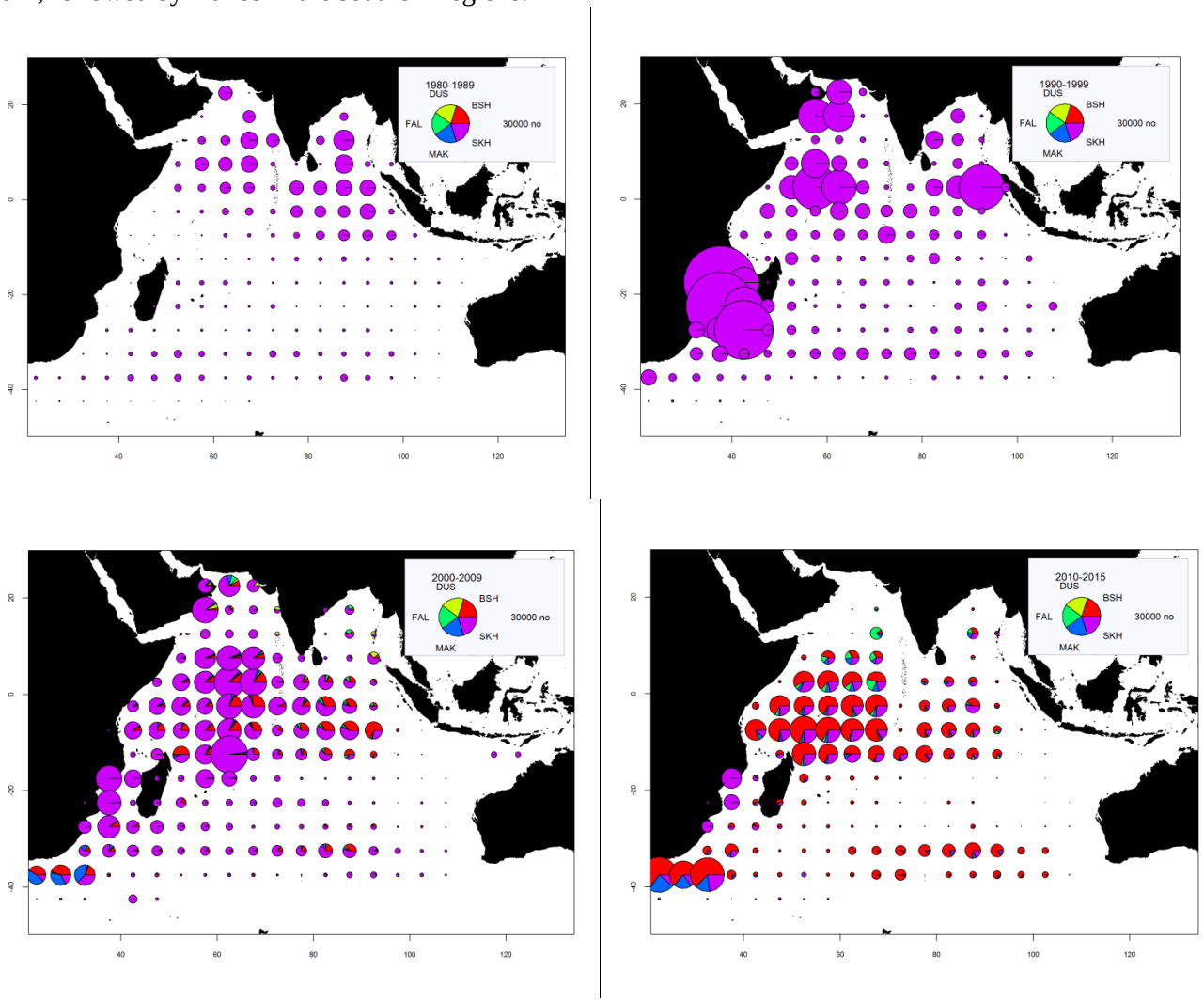
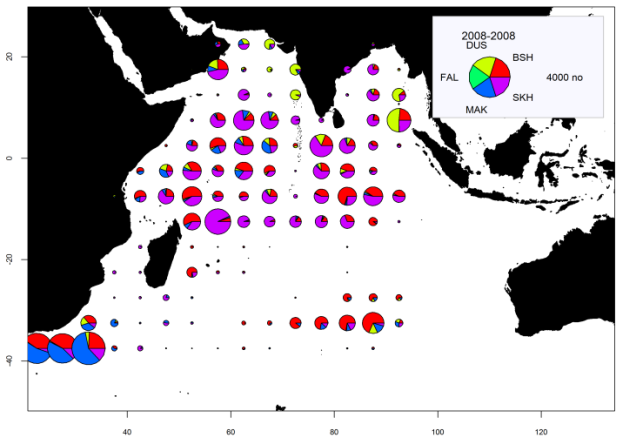


Fig. 8. Time-area catches (total numbers) of sharks for deep-freezing longliners flagged in Taiwan,China, by decade (also including 2010–15) and species. Unidentified shark catches are shown in purple.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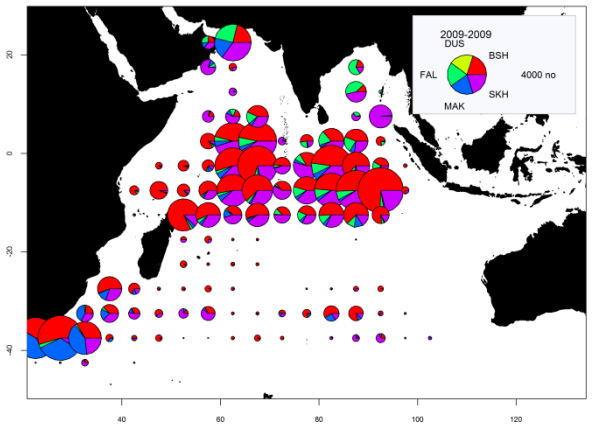
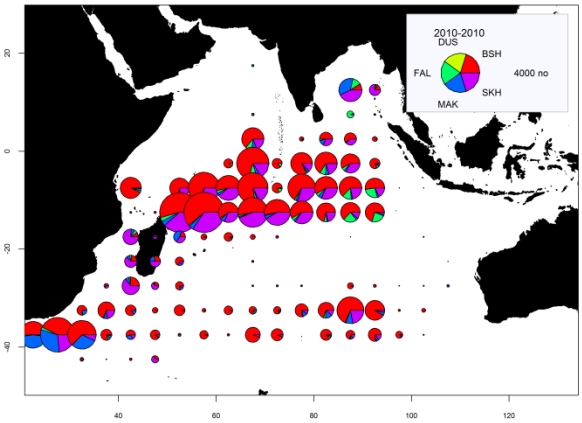

2009-2009
DUS
BSH
FAL
4000 no
SKH
MAK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FAL
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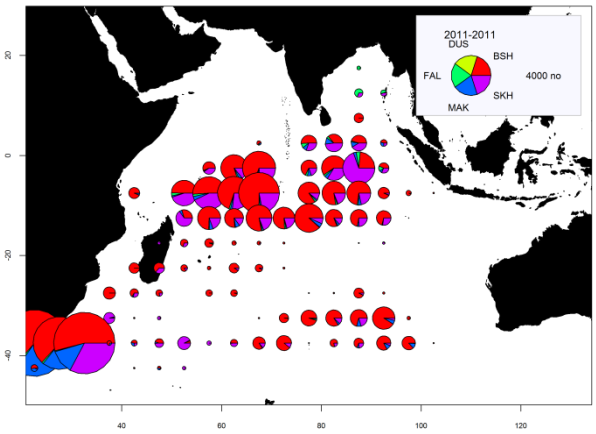
SKH
MAK


2011-2011
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BSH
FAL
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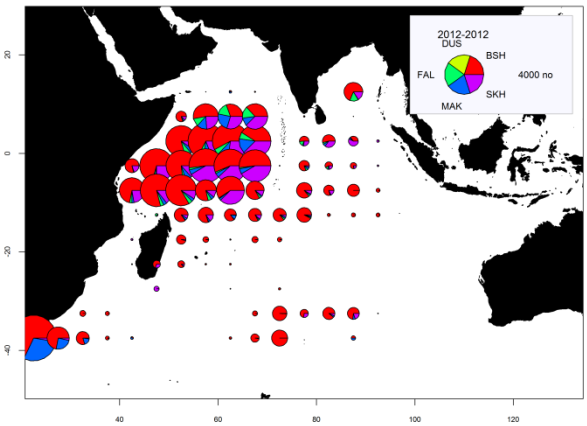
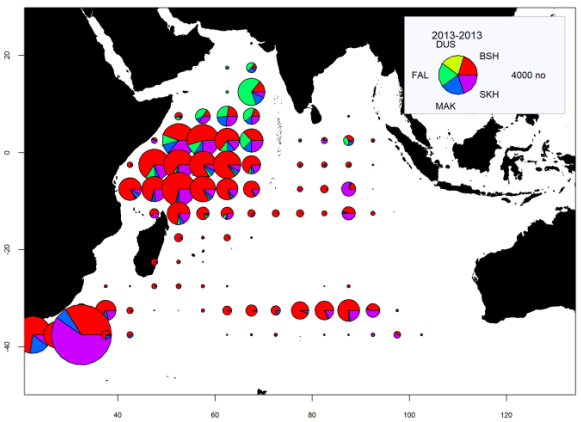
SKH
MAK


2012-2012
DUS
BSH
FAL
4000 no
SKH
MAK


2013-2013
DUS
BSH
FAL
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SKH
MAK

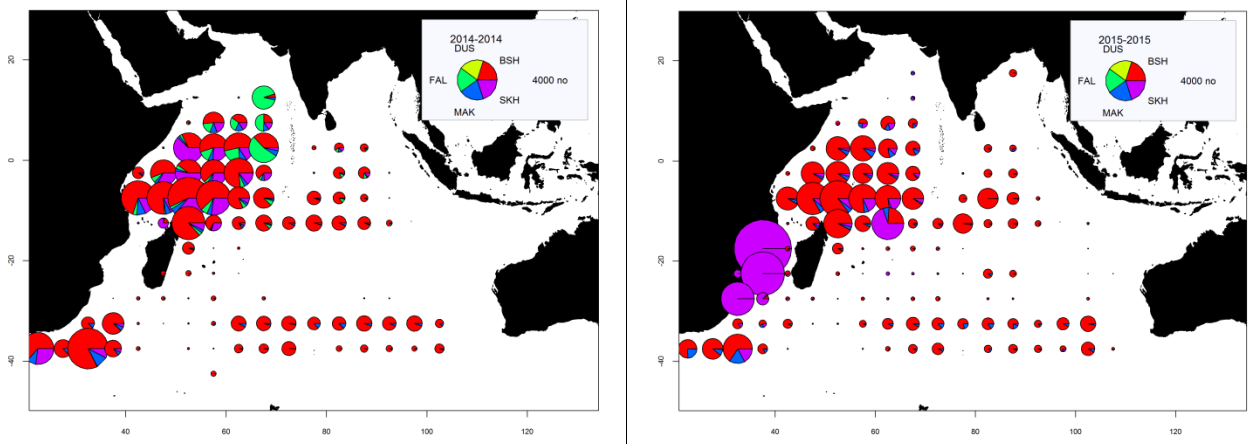
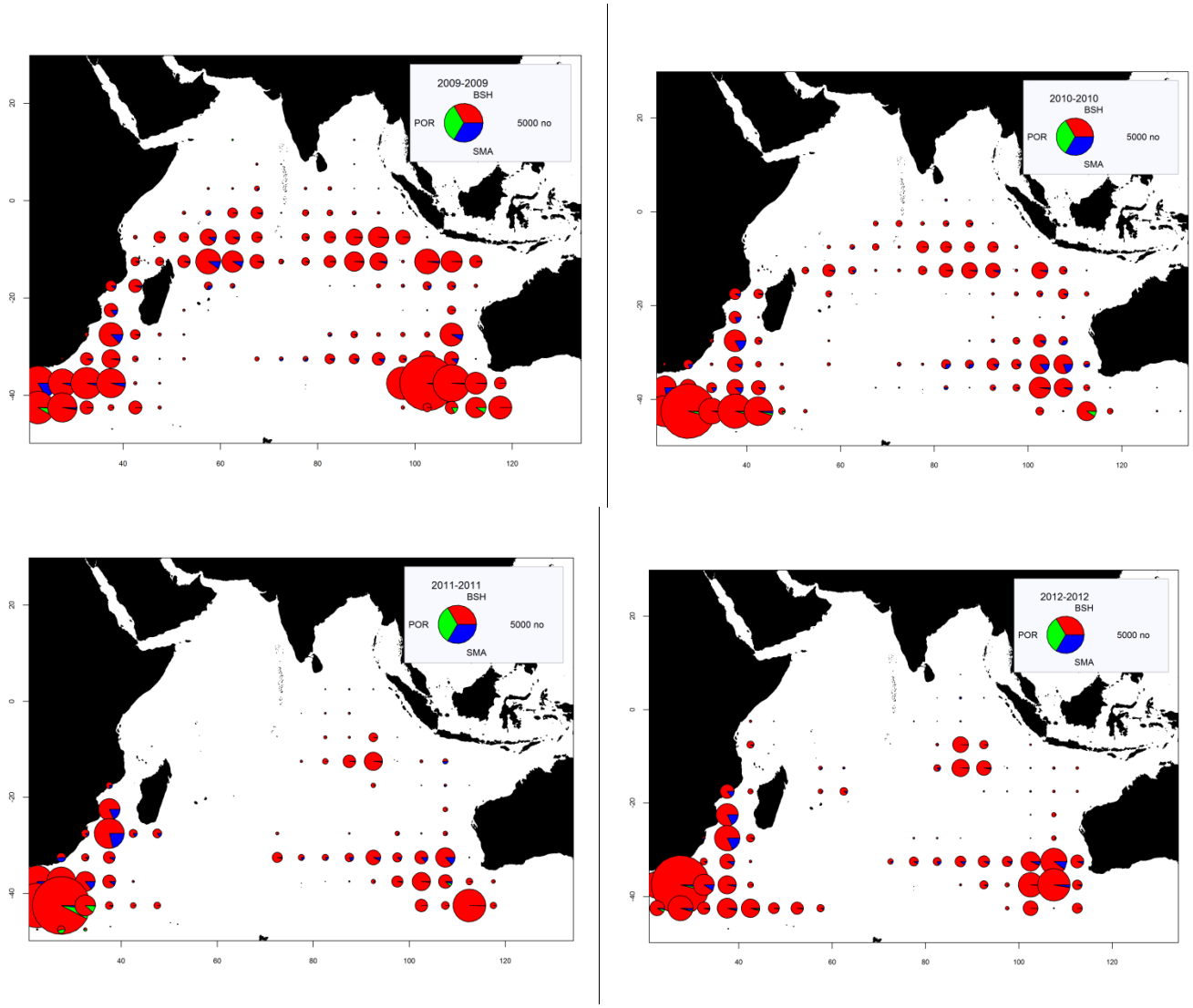


Fig. 9. Time-area catches (total numbers) of sharks for deep-freezing longliners flagged in Taiwan,China, by year (2008–15) and species. Unidentified shark catches are shown in purple.



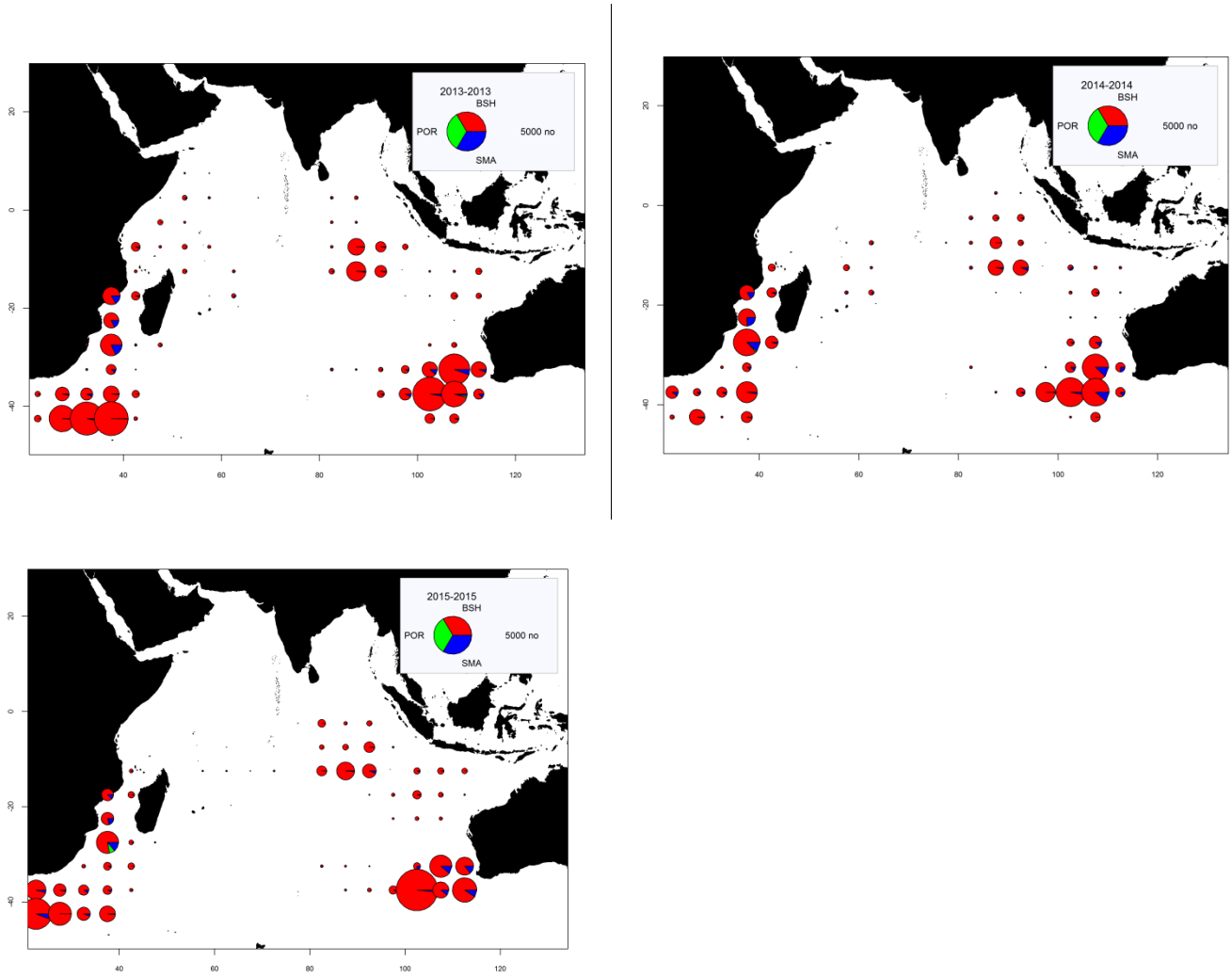
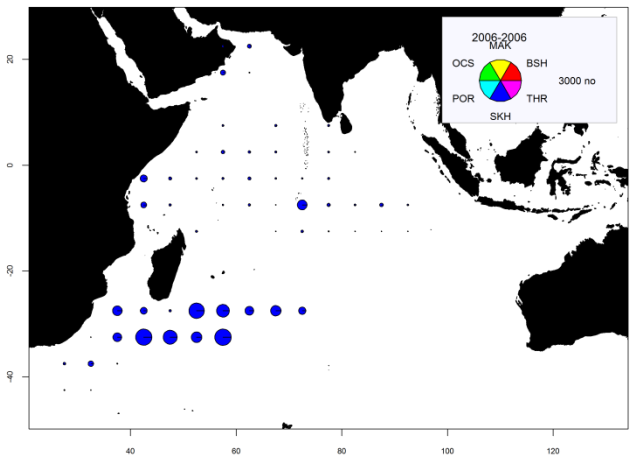
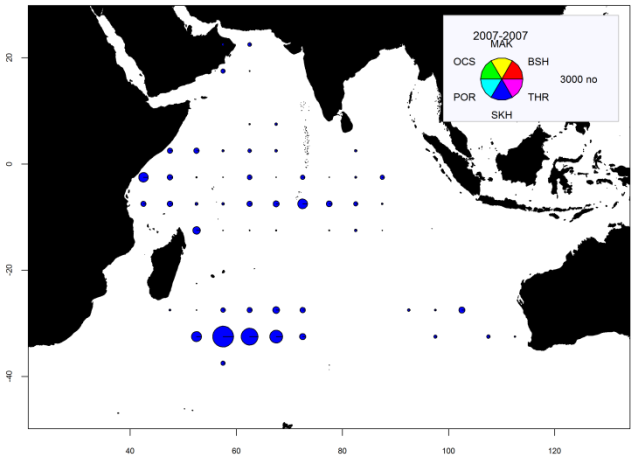
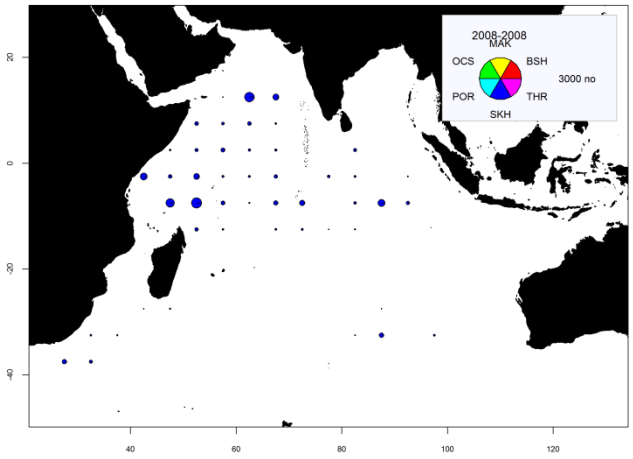
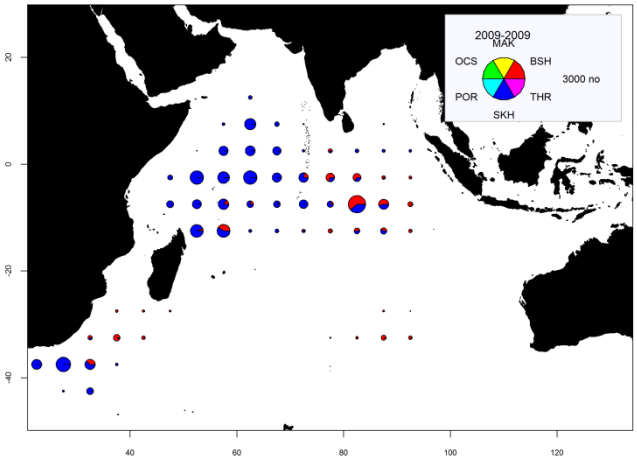


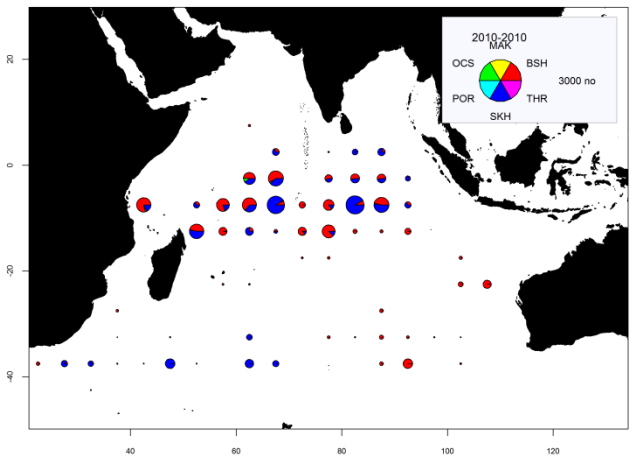
Fig. 10. Time-area catches (total numbers) of sharks for deep-freezing longliners flagged in Japan by year (2009–15) and species.

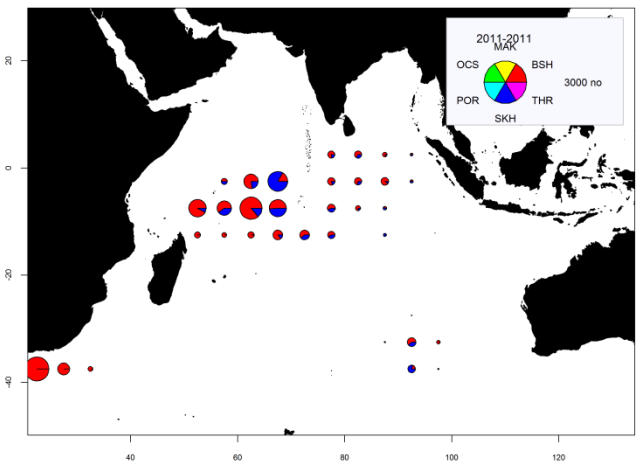

2006-2006
MAK
OCS
BSH
3000 no
POR
THR
SKH


2007-2007
MAK
OCS
BSH
3000 no
POR
THR
SKH


2008-2008
MAK
OCS
BSH
3000 no
POR
THR
SKH


2009-2009
MAK
OCS
BSH
3000 no
POR
THR
SKH


2010-2010
MAK
OCS
BSH
3000 no
POR
THR
SKH


2011-2011
MAK
OCS
BSH
3000 no
POR
THR
SKH

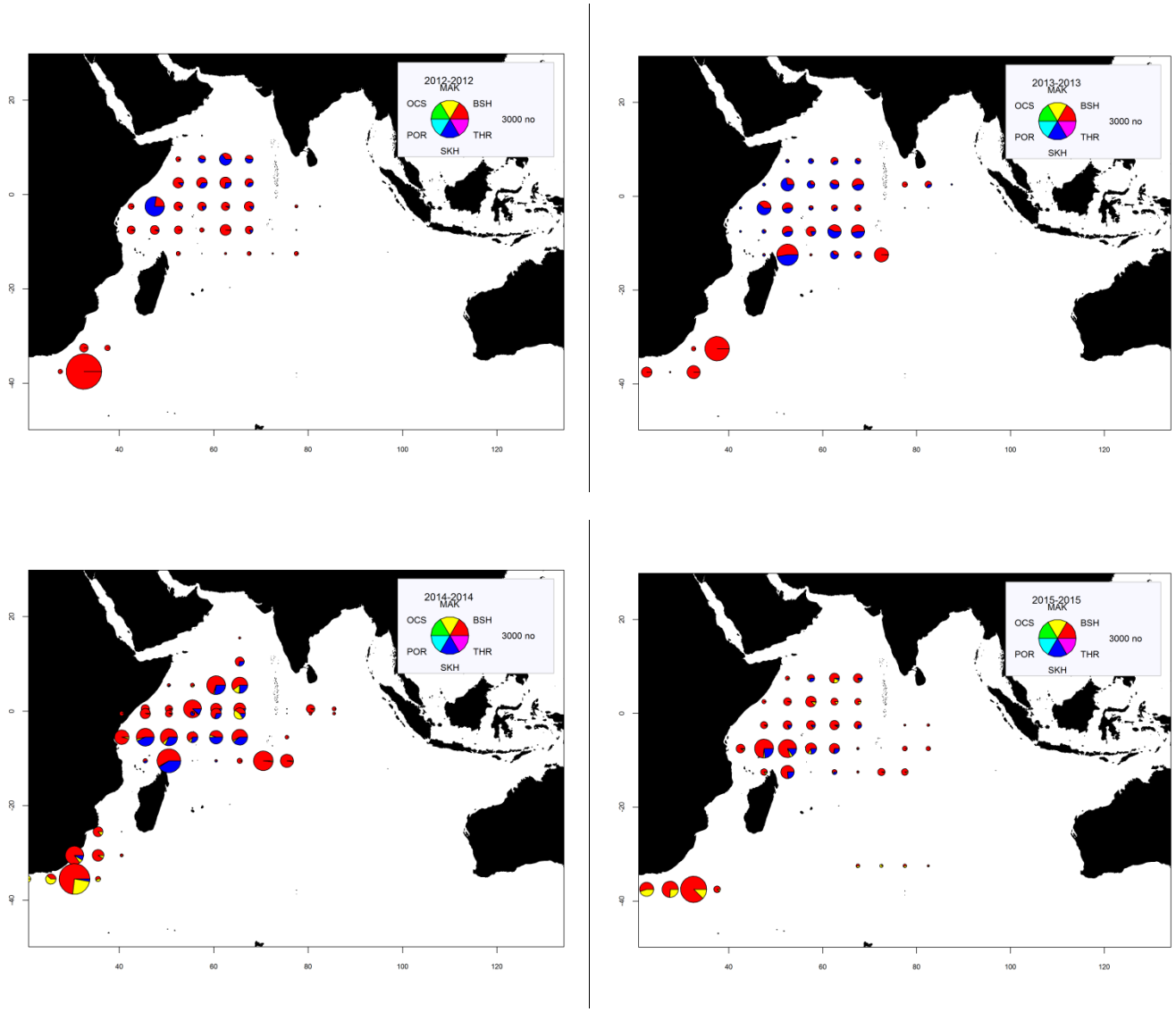


Figure 11. Time-area catches (total numbers) of sharks for Seychelles flagged longliners by year (2006–15) and species.

Length frequency data

Due to the different types of length measurement reported, a number of conversions were performed to standardise the length-frequency information. Given the increasing amount of data reported and the need for standardisation, a set of species-specific conversion factors and proxies that have been agreed by the Working Party on Ecosystems and Bycatch could help improve the estimates. Conversion factors currently used are provided in Appendix 4. Size frequency data are reported using different length classes ranging from 1cm to 10cm intervals. In addition to this, there appears to be rounding taking place when the smaller size intervals are used, creating abnormal peaks in the distributions. The graphs shown below have been aggregated to 5cm intervals in order to smooth this effect.

Fig. 12 shows the aggregated fork length frequency distribution for the longline fleets reporting size information on blue sharks for all areas between 2005 and 2015. The data reported for vessels flagged for China, Japan, Rep. of Korea and EU,Portugal include data reported for longline fleets with observers onboard. The results highlight the difference in size of the individuals caught by different fleets, with the EU fleets, on average, catching larger blue sharks than the other fleets. Fig. 13 shows the length distributions for the other shark species with reported size frequency data aggregated across all fleets and all years given the more limited amount of data available for these species.

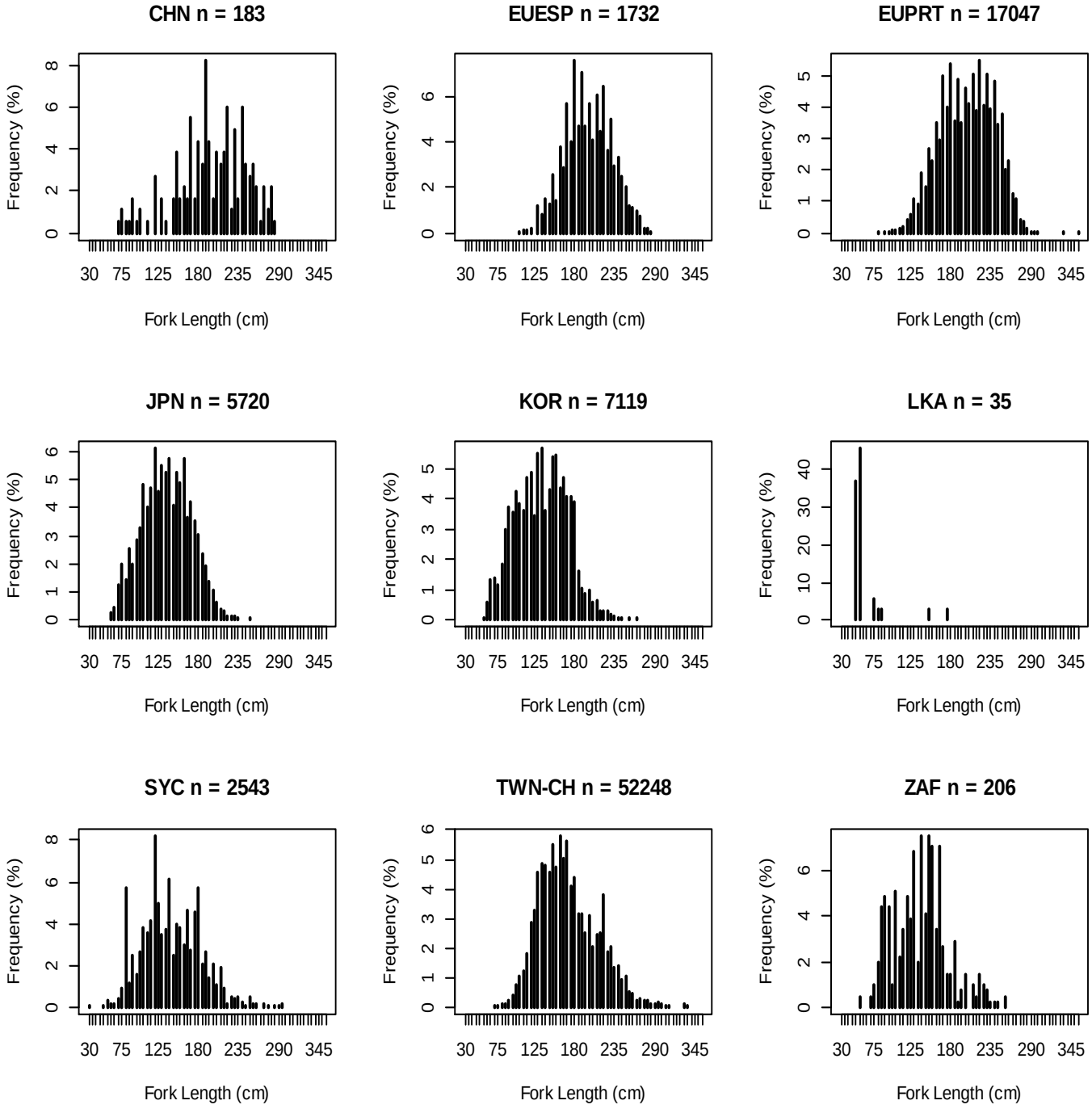


Fig. 12. Fork length frequency distributions (%) of blue shark derived from the samples reported for the longline fleets of China (CHN LL), EU,Spain (EUESP ELL), EU,Portugal (EUPRT ELL), Japan (JPN LL), Korea (KOR LL), Sri Lanka LKA (G/L), Seychelles (SYC LL), Taiwan,China (TWN FLL/LL) and South Africa (ZAF ELL) between 2005 and 2015 in 5 cm length classes.

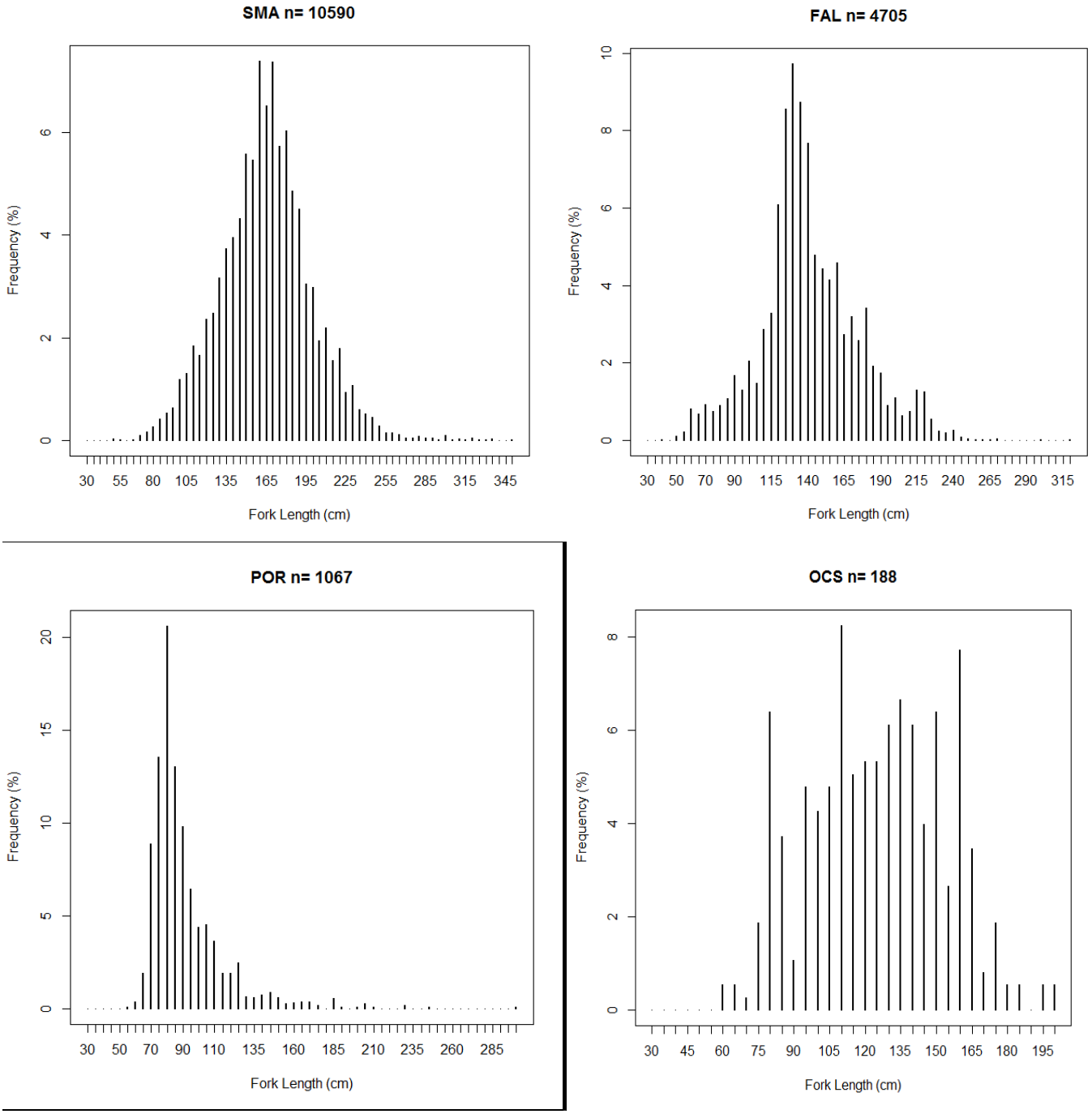


Fig. 13. Fork length frequency distributions (%) for shortfin mako shark (SMA), silky shark (FAL), porbeagle shark (POR) and oceanic whitetip shark (OCS) between 2005 and 2015.

SUMMARY OF FISHERIES DATA AVILABLE FOR SEABIRDS

Main species and fisheries concerned

The main species of seabirds likely to be caught as bycatch in IOTC fisheries are presented in Table 2[4].

Table 2. Main species of seabirds likely to be incidentally caught on longline operations

Common Name	Status*	Scientific Name
Amsterdam Albatross	Critically Endangered	*Diomedea amsterdamensis*
Antipodean Albatross	Vulnerable	*Diomedea antipodensis*
Black-browed Albatross	Endangered	*Thalassarche melanophrys*
Buller's Albatross	Near Threaten	*Thalassarche bulleri*
Campbell Albatross	Vulnerable	*Thalassarche impavida*
Chatham Albatross	Vulnerable	*Thalassarche eremite*
Grey-headed Albatross	Vulnerable	*Thalassarche chrysostoma*
Light-mantled Albatross	Near Threatened	*Phoebetria palpebrata*
Northern Royal Albatross	Endangered	*Diomedea sanfordi*
Southern Royal Albatross	Vulnerable	*Diomedea epomophora*
Salvin's Albatross	Vulnerable	*Thalassarche salvini*
Shy Albatross	Near Threatened	*Thalassarche cauta*
White-capped Albatross	Near Threatened	*Thalassarche steadi*
Sooty Albatross	Endangered	*Phoebetria fusca*
Tristan Albatross	Critically Endangered	*Diomedea dabbenena*
Wandering Albatross	Vulnerable	*Diomedea exulans*
Atlantic Yellow-nosed Albatross	Endangered	*Thalassarche chlororhynchos*
Indian Yellow-nosed Albatross	Endangered	*Thalassarche carteri*
Northern Giant Petrel	Least Concern	*Macronectes halli*
Southern Giant Petrel	Least Concern	*Macronectes giganteus*
White-chinned Petrel	Vulnerable	*Procellaria aequinoctialis*
Westland Petrel	Vulnerable	*Procellaria westlandica*
Short-tailed Shearwater	Least Concern	*Puffinus tenuirostris*
Sooty Shearwater	Near Threatened	*Puffinus griseus*

*****Source IUCN 2006, BirdLife International 2004b.

Longline vessels fishing in southern waters

[4] As in IOTC–2007–WPEB–22, Appendix 2, page 24. Paper submitted on behalf of the Agreement for the Conservation of Albatrosses and Petrels (ACAP)

The interaction between seabirds and IOTC fisheries is likely to be significant only in Southern waters (south of 25° degrees South), an area where most of the effort is exerted by longliners. Incidental catches are, for this reason, likely to be of importance only for longline fleets having vessels operating in these areas. The main fleets reporting longline fishing effort since 1955 in this area are those of Japan (accounting for 61%) and Taiwan,China (accounting for 35%) (Figure 14). Figure 15 shows the spatial distribution of reported effort exerted by longliners for fleets fishing south of 25° south.

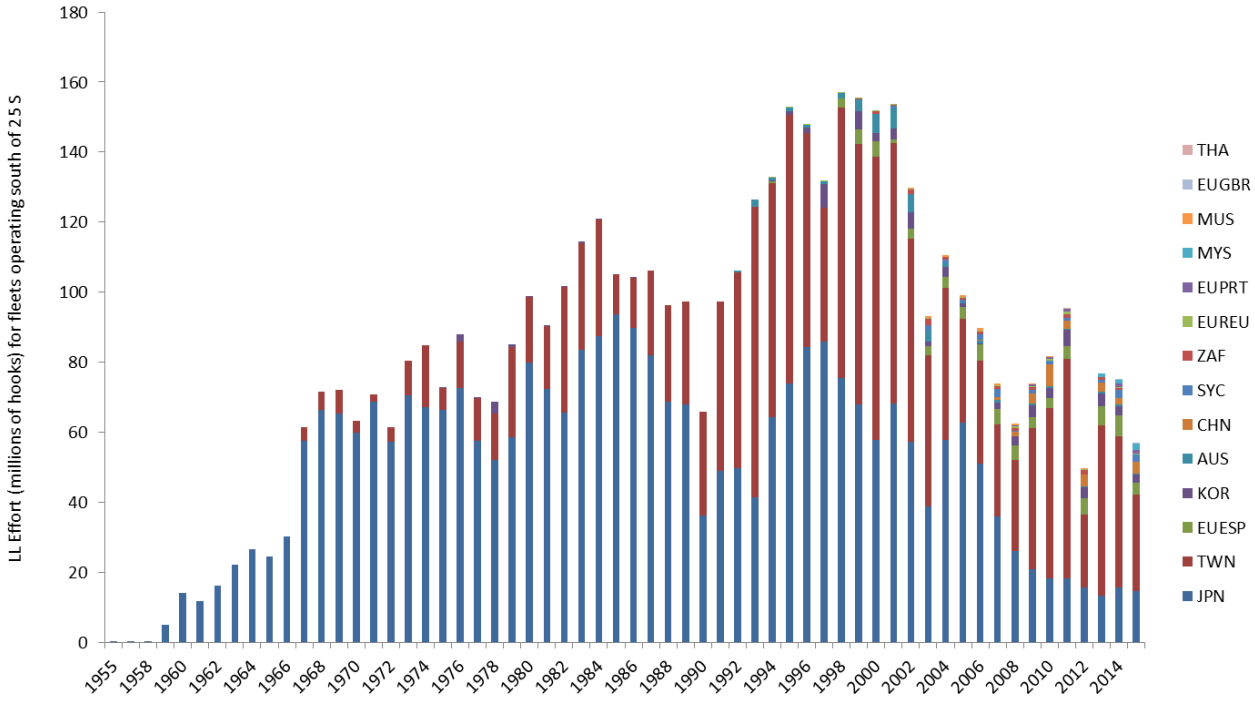


Figure 14. Reported longline effort for fleets operating south of 25° south between 1955 and 2015. (THA = Thailand, EUGBR = EU,UK, MYS = Malaysia, EUPRT = EU,Portugal, EU,REU = EU,France, MUS = Mauritius, ZAF, = South Africa, SYC = Seychelles, CHN = China, AUS = Australia, EUESP = EU,Spain, KOR = Rep. of Kora, TWN = Taiwan,China, JPN = Japan).

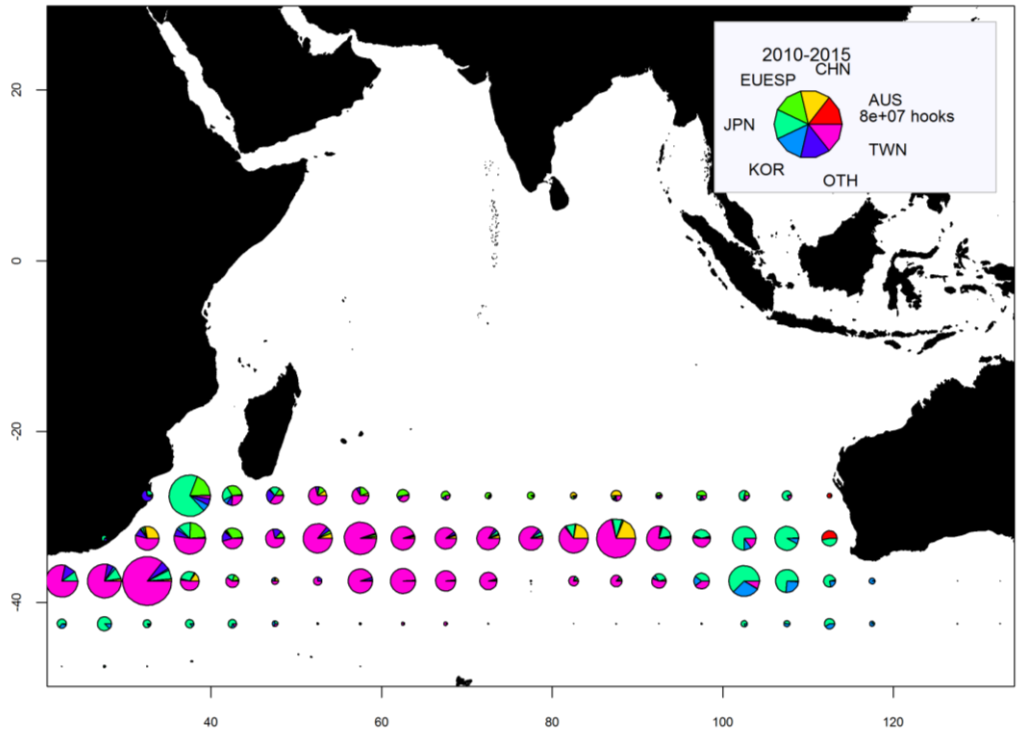


Figure 15. Reported longline effort for fleets operating south of 25° south between 2010 and 2015.

Status of data on seabird bycatch

The reported data available on seabirds caught in the IOTC area of competence are poor quality, sparse and not standardised, as highlighted in paper IOTC-2015-WPEB11-07. As the IOTC database for non-retained catches and the observer database are currently under development, these data will be available for summary by the end of the year.

SUMMARY OF FISHERIES DATA AVILABLE FOR MARINE TURTLES

Main species and fisheries concerned

The main species of marine turtles likely to be caught as bycatch by IOTC fisheries are listed in Table 3**.**

Table 3. Main species of Indian Ocean marine turtles[5].

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

The interaction between marine turtles and IOTC fisheries is likely to be significant only in tropical areas, involving both industrial and artisanal fisheries, notably for:

- Industrial purse seine fisheries, in particular on sets using fish aggregating devices (EU, Seychelles, I.R. Iran, Thailand, Japan)
- Gillnet fisheries operating in coastal waters or on the high seas (Sri Lanka, I.R. Iran, Pakistan, Indonesia)
- Industrial longline fisheries operating in tropical areas (China, Taiwan,China, Japan, Indonesia, Seychelles, India, Oman, Malaysia and the Philippines)

Status of data on marine turtle bycatch

The reported data available on marine turtles caught in the IOTC area of competence are poor quality, sparse and not standardised, as highlighted in paper IOTC-2015-WPEB11-07. As the IOTC database for non-retained catches and the observer database are currently under development, these data will be available for summary by the end of the year.

SUMMARY OF FISHERIES DATA AVILABLE FOR MARINE MAMMALS

The reporting of the interactions of IOTC fisheries with marine mammals has been extremely limited to date, as highlighted in paper IOTC-2015-WPEB11-07. The current low level, lack of standardisation and ad hoc nature of data reporting are not conducive to supporting regional level analyses.

[5] Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia

APPENDIX V
MAIN ISSUES IDENTIFIED CONCERNING DATA ON NON-IOTC SPECIES

General issues

There are a number of key issues with the data that are apparent from this summary. The main points are discussed below.

Sharks

- Unreported catches

Although some fleets have been operating since 1950, there are many cases where historical catches have gone unreported as many countries were not collecting fishery statistics in years prior to 1970. It is therefore thought that important catches of sharks might have gone unrecorded in several countries. There are also a number of fleets which are still not reporting on their interactions with bycatch species, despite fleets using similar gears reporting high catch rates of bycatch.

Some fleets have also been noted to report catches by species only for those that have been specifically identified by the Commission and do not report catches of other species even in aggregate form. This creates problems for the estimation of total catches of all sharks and for attempts to apportion aggregate catches into species groups at a later date. The changing requirements for species-specific reporting also complicates the interpretation of these data.

- Errors in reported catches

For the fleets that do report interactions, there are a number of issues with these estimates. The estimates are sometimes based on retained catches rather than total catches, and so if discarding is high then this is a major source of error. Errors are also introduced due to the processing of the retained catches that is undertaken. This creates problems for calculating total weight or numbers, as sometimes dressed weight might be recorded instead of live weights. For high levels of processing, such as finning where the carcasses are not retained, the estimation of total live weight is extremely difficult.

- Poor resolution of data

Historically, shark catches have not been reported by species but simply as an aggregated total, however, the proportion of catches reported by species has increased substantially in recent years. Misidentification of shark species is also common. Processing creates further problems for species identification, requiring a high level of expertise and experience in order to be able to accurately identify specimens, if at all. The level of reporting by gear type is much higher and catches reported with no gear type allocated form a small proportion of the total.

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

Other bycatch species groups

The reporting of non-IOTC species other than sharks is extremely poor and where it does occur, this is often in the form of patchy information which is not submitted according to IOTC data reporting procedures, is unstandardized and often lacking in clarity. While ad hoc pieces of information from a number of sources have been collated here as far as possible, it is noted that data presented in various documents such as Working Party papers and National Reports are not considered to be formal data submissions to the IOTC. Formal submissions of data in an electronic and standardized format using the available IOTC templates will considerably improve the quality of data obtained and the type of regional analyses that these data can be used for.

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

SHARKS

1. Catch-and-Effort data from gillnet fisheries:

- Drifting gillnet fisheries of I.R. Iran and Pakistan: To date, I.R. Iran and Pakistan have not reported catches of sharks, by species, for the gillnet fisheries.
- 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.
- Freezing longline fisheries of EU,Spain, India, Indonesia, Malaysia, and Oman: These countries have not reported catch-and-effort data of sharks by species 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.

4. Discard levels from surface and longline fisheries:

- Discard levels of sharks from major longline fisheries: to date the EU (Spain, UK), Japan, Taiwan,China and Indonesia, have not provided estimates of total discards of sharks, by species, in particular thresher sharks and oceanic whitetip sharks, although Japan, Taiwan,China and Indonesia are now reporting discards in their observer data.
- Discard levels of sharks for industrial purse seine fisheries: to date, the EU,Spain, I.R. Iran, Japan, Seychelles, and Thailand have not provided estimates of total quantities of discards of sharks, by species, for industrial purse seiners under their flag, although EU, Spain and Seychelles are now reporting discards in their observer data.

5. Size frequency data:

- Gillnet fisheries of I.R. Iran and Pakistan: to date, I.R. Iran and Pakistan have not reported size frequency data for their driftnet fisheries.
- Longline fisheries of India, Malaysia, Oman and Philippines: to date, these countries have not reported size frequency data for their longline fisheries. Sri Lanka has recently reported some size frequency data by species for 2014, however, these data are very limited.
- Coastal fisheries of India, Indonesia, Madagascar 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 IOTC Secretariat has 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 limited amount of biological data available.

OTHER BYCATCH

1. Incidental catches of SEABIRDS:

- Longline fisheries operating in areas with high densities of seabirds. Seychelles, Malaysia, Mauritius, EU(UK) have not reported incidental catches of seabirds for longliners under their flag.

2. Incidental catches of MARINE TURTLES:

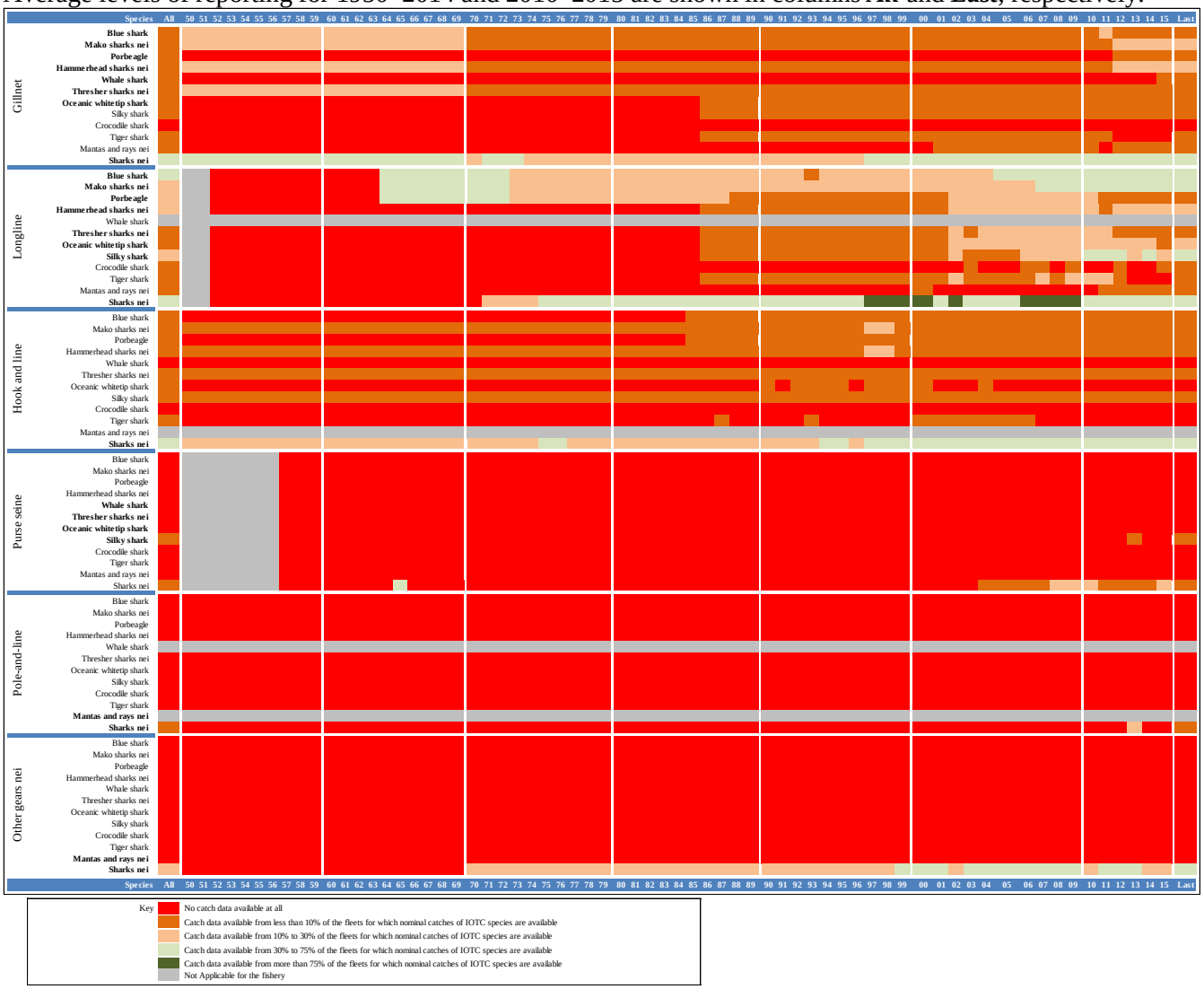
- Gillnet fisheries of Pakistan and Indonesia: to date, there have been no reported incidental catches of marine turtles for the driftnet fisheries.
- Longline fisheries of Malaysia, Oman, India, Philippines and Seychelles: to date, these countries have not reported incidental catches of marine turtles for their longline fisheries.
- Purse seine fisheries of Japan, Seychelles, I.R. Iran 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.

While a number of CPCs have been mentioned specifically here as they have important fisheries or have not provided any information, there are still many CPCs that are providing data that are not consistent with the IOTC minimum reporting standards. This includes not reporting bird bycatch data by species (as required by Resolution 12/06) and not providing an estimation of the total mortality of marine turtles incidentally caught in their fisheries (as required by Resolution 12/04).

APPENDIX VI
AVAILABILITY OF CATCH DATA FOR SHARKS BY GEAR

Availability of catch data for the main shark species expressed as the proportion 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 1950–2015.

Shark species in bold are those identified as mandatory for reporting by each fleet, 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 1950–2014 and 2010–2015 are shown in columns ***All*** and ***Last***, respectively.



APPENDIX VII
IMPLEMENTATION OF THE REGIONAL OBSERVER SCHEME
(Updated 12 September 2016)

CPCs	Active Vessels LOA≥24m or High Seas vessels[6]				Progress	List of accredited observers submitted	Number of observer reports provided[7]					
	LL	PS	GN	BB			2010	2011	2012	2013	2014	2015
MEMBERS												
Australia	2	6			Australia has implemented an observer programme for the longline fleet	**YES: 21**	**2(O)**	**1(O)**	**3(O)**	**No**	**2(O) + 3(E)**	**No**
Belize					No information received by the Secretariat.	**No**	**No**	**No**	**No**	**No**	**No**	**No**
China –Taiwan,China	53 233				China has implemented an observer programme	**YES: 3** **YES: 54**	**1(O)** **No**	**No** **No**	**1(O)** **1(0)**	**1(O)** **19(O)**	**2(O)** **17(O)**	**1(O)** **13(O)**
Comoros					Comoros does not have vessels ≥ 24m. Two observers have been trained under the IOC Regional Monitoring Project, and 5 by SWIOFP.	**YES: 7**	N/A	N/A	N/A	N/A	N/A	N/A
Eritrea	No information received				No information received by the Secretariat.	**N/A**	N/A	N/A	N/A	N/A	N/A	N/A
European Union	17 6 18 1	12 0 17 0			EU has an observer programme on-board its purse seine and longline fleets. To date, no information has been received from EU,UK.	Partial:**EU,France: 64** **EU,Portugal: 4** **EU,Spain : 9** **EU,UK : No**	FRA 6**(O)** **No** **No** **No**	FRA 12**(O)** PRT 1**(O)** **No** **No**	FRA 17 **(O)** PRT 1**(O)** **No** **No**	FRA 15 **(O)** PRT 1**(O)** **1(O)** **No**	FRA 32(O) PRT 1**(O)** **2(O)** **No**	FRA 25(O) PRT 1**(O)** **No** **No**
France (OT)					N/A	**N/A**	No	9(O)	7(O)	7(O)	NA	NA
Guinea					Guinea has had no vessels operating in the Indian Ocean since 2006	**N/A**	N/A	N/A	N/A	N/A	N/A	N/A
India	22				India has not yet developed an observer programme.	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Indonesia	550	18	1		Indonesia has 13 registered IOTC observers and a number of initiatives in place and has recently begun reporting to IOTC.	**YES:9**	**No**	**No**	**No**	**No**	**5(E)**	**No**
Iran, Isl. Rep. of		5	1190		IOTC observer training took place in 2015. 30 observers have now been selected and are due to be deployed in 2016.	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Japan	53	2			Japan started its observer programme on the 1st of July 2010.	**YES: 19**	**8(E)**	**11(E)**	**10(E)**	**7(E)**	**8(E)**	**No**
Kenya					Kenya has had no vessels listed in the active vessel registry since 2010, however, Kenya is developing an observer programme and 5 observers have been trained by SWIOFP.	**YES: 5**	**No**	N/A	N/A	N/A	N/A	N/A

[6]The number of active vessels is given for 2015
[7]Year in which the observed trip has started (E: Electronic; O: Other)

CPCs	Active Vessels LOA≥24m or High Seas vessels[6]				Progress	List of accredited observers submitted	Number of observer reports provided[7]					
	LL	PS	GN	BB			2010	2011	2012	2013	2014	2015
Korea, Rep. of	14	5			Korea has had an observer programme since 2002 and has 28 observers registered in the Indian Ocean.	**YES: 29**	**2(O)**	**No**	**2(O)**	**3(O)**	**3(O)**	**No**
Madagascar	7				Madagascar has developed an observer programme. Five and three observers have been trained through SWIOFP and IOC respectively. However, observer data reported are not to IOTC standards.	**YES: 7**	**No**	**No**	**18(O)[8]**	**8(O)**	**7(O)**	**No**
Malaysia	10				Malaysia is developing plans for the implementation of an observer programme.	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Maldives	28			339	Maldivian vessel landings are monitored by field samplers at landing sites. Maldives is currently developing an at-sea observer programme.	**YES: 4**	**No**	**No**	**No**	**No**	**No**	**No**
Mauritius		7			Mauritius has developed an observer scheme and started submitting datafor 2015.	**YES: 8**	**No**	**No**	**No**	**No**	**No**	**3(O)**
Mozambique	9				Mozambique has an observer programme and has submitted one trip report, but did not have any active vessels ≥24m in 2013.	**YES: 11**	**No**	**No**	**1(O)**	N/A	**No**	**No**
Oman	1				IOTC observer training took take place in 2015, however no observer reports have been submitted as yet.	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Pakistan					IOTC observer training took take place in 2015 and Pakistan is committed to establishing an observer scheme. A crew-based observer scheme has already been initiated by WWF-Pakistan, however no data has yet been submitted to the IOTC Secretariat.	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Philippines					No information received by the Secretariat.	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Seychelles	37	10			Seychelles initiated an observer programme in 2014 and has started to report observer data	**YES: 78**	**No**	**No**	**No**	**No**	**6(O)**	**46(O)**
Sierra Leone	No information received				No information received by the Secretariat.	**N/A**	N/A	N/A	N/A	N/A	N/A	N/A
Somalia	No information received				No information received by the Secretariat.	**N/A**	N/A	N/A	N/A	N/A	N/A	N/A
South Africa	15				South Africa operates an observer programme for foreign vessels operating within the EEZ as well as for national vessels (since 2014).	**YES: 16**	**No**	**12(O)**	**10(O)**	**13(O)**	**8+2(O)[9]**	**7+9(O)**
Sri Lanka	1		1564		Sri Lanka has begun an observer initiative and submitted observer data from pilot trips in 2014 and 2015.	**No**	**No**	**No**	**No**	**No**	**2(O)**	**2(O)**
Sudan	No information received				No information received by the Secretariat.	**N/A**	N/A	N/A	N/A	N/A	N/A	N/A
Tanzania, United Rep.of	3				Tanzania does not currently have an observer programme in place.	**No**	**No**	**No**	**No**	**No**	**No**	**No**

[8]Reports from Madagascar include observers onboard foreign vessels
[9]Reports submitted for foreign vessels operating in the EEZ of South Africa between 2011 and 2013, and foreign + national flagged vessels for 2014 and 2015.

CPCs	Active Vessels LOA≥24m or High Seas vessels[6]				Progress	List of accredited observers submitted	Number of observer reports provided[7]					
	LL	PS	GN	BB			2010	2011	2012	2013	2014	2015
Thailand	6				Thailand conducted observer training in 2015 and is due to begin deployment in 2017 as there were no active vessels in 2016	**YES: 8**	**No**	**No**	**No**	**No**	**No**	**No**
United Kingdom (OT)					The UK(OT) does not have any active vessels in the Indian Ocean.	**N/A**	N/A	N/A	N/A	N/A	N/A	N/A
Yemen	No information received				No information received by the Secretariat.	**No**	**No**	**No**	**No**	**No**	**No**	**No**
COOPERATING NON-CONTRACTING PARTIES												
Bangladesh					No information received by the Secretariat.	**N/A**	N/A	N/A	N/A	N/A	N/A	N/A
Djibouti					No information received by the Secretariat.	**N/A**	N/A	N/A	N/A	N/A	N/A	N/A
Liberia					No information received by the Secretariat.	**N/A**	N/A	N/A	N/A	N/A	N/A	N/A
Senegal					Senegal has not had any active vessels in the Indian Ocean since 2007.	**N/A**	N/A	N/A	N/A	N/A	N/A	N/A

APPENDIX VIII

2015: 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

(*updated12September 2016*)

CPC	Sharks	Date of Implementation	Seabirds	Date of implementation	Marine turtles	Date of implementation	Comments
MEMBERS							
Australia		1st: April 2004 2nd: July 2012		1st: 1998 2nd: 2006 3rd: 2014		2003	**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 2014 and largely fulfills the role of an NPOA in terms of longline fisheries. http://www.antarctica.gov.au/__data/assets/pdf_file/0017/21509/Threat-Abatement-Plan-2014.pdf Australia is developing an NPOA to address the potential risk posed to seabirds by other fishing methods, including longline fishing in state and territory waters, which are not covered by the current threat abatement plan. **Marine turtles:** Australia's current marine turtle bycatch management and mitigation measures fulfill Australia's obligations under the FAO-Sea turtles Guidelines.
Belize							**Sharks:** No information received by the Secretariat. **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.
China		–		–			**Sharks:** Development has not begun. **Seabirds:** Development has not begun. **Marine turtles:** No information received by the Secretariat.
–Taiwan,China		1st: May 2006 2nd: May 2012		1st: May 2006 2nd: Jul 2014			**Sharks:** No revision currently planned. **Seabirds:** No revision currently planned. **Marine turtles:** Domestic laws introduced in 2013. Available on request.
Comoros		–		–			**Sharks:** Development has not begun. **Seabirds:** Development has not begun. **Marine turtles:** No information received by the Secretariat.
Eritrea							**Sharks:** No information received by the Secretariat. **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.
European Union		5 Feb 2009		16-Nov-2012		2007	**Sharks:** Approved on 05-Feb-2009 and it is currently being implemented. **Seabirds:** The EU adopted on Friday 16 November an Action Plan to address the problem of incidental catches of seabirds in fishing gears. **Marine turtles**: European Union Council Regulation (EC) No 520/2007 of 7 May 2007 lay down technical measures for the conservation of marine turtles including articles and provisions to reduce marine turtle bycatch. The regulation urges Member States to do their utmost to reduce the impact of fishing on sea turtles, in particular by applying the measures provided for in paragraphs 2, 3 and 4 of the resolution.

France (territories)		5 Feb 2009		2009, 2011		2015	**Sharks:** Approved on 05-Feb-2009. **Seabirds:** Implemented in 2009 and 2011. 2009 for Barrau's petrel and 2011 for Amsterdam albatross. **Marine turtles:**Implemented in 2015 for the five species of marine turtles that are present in the southwest Indian Ocean.
Guinea							**Sharks:** No information received by the Secretariat. **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.
India							**Sharks:** In preparation. In June 2015, India published a document entitled "Guidance on National Plan of Action for Sharks in India" which is intended as a guidance to the NPOA-Sharks, and seeks to (1) present an overview of the currents status of India's shark fishery, (2) assess the current management measures and their effectiveness, (3) identify the knowledge gaps that need to be addressed in NPOA-Sharks and (4) suggest a theme-based action plan for NPOA-Sharks. **Seabirds:** India has determined that seabird interactions are not a problem for their fleets. However, a formal evaluation has not yet taken place which the WPEB and SC require. **Marine turtles:** No information received by the Secretariat.
Indonesia		–		–			**Sharks:** NPOA guidelines developed and released for public comment among stakeholders in 2010 (funded by ACIAR Australia—DGCF). Training commenced 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. **Seabirds:** Development has not begun. **Marine turtles:** No information received by the Secretariat.
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. **Seabirds:** I.R. Iran determined that seabird interactions are not a problem for their fleet as they consist of gillnet vessels only. i.e. no longline vessels. **Marine turtles:** No information received by the Secretariat.
Japan		03-Dec-2009		03-Dec-2009			**Sharks:** NPOA–Shark assessment implementation report submitted to COFI in July 2012 **Seabirds:** NPOA–Seabird implementation report submitted to COFI in July 2012. **Marine turtles:** No information received by the Secretariat.
Kenya			n.a.	–			**Sharks:** A National Plan of Action for sharks is being developed and shall put in place a framework to ensure the conservation and management of sharks and their long-term sustainable use in Kenya. Preliminary meetings have been held and there are plans to finalise the NPOA by 2017. **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. **Marine turtles:** The Kenyan fisheries law prohibits retention and landing of turtles caught incidentally in fishing operations. Public awareness efforts are conducted for artisanal gillnet and artisanal longline fishing fleets on the mitigations measures that enhance marine turtle conservation.
Korea, Republic of		08-Aug-11		–		_	**Sharks:** Currently being implemented.

							Seabirds: This has already been applied in domestic fisheries and there are plans to submit an IPOA-seabirds to FAO by the end of 2016. **Marine turtles:**All Rep. of Korea vessels fully implement Res 12/04.
Madagascar		–		–			**Sharks:** Development has not begun. **Seabirds:** Development has not begun. 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. **Marine turtles:** No information received by the Secretariat.
Malaysia		2008	n.a.	–		2008	**Sharks:** A review of the NPOA-Shark (2008) 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. **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. **Marine turtles:** A NPOA For Conservation and Management of Sea Turtles had been published in 2008.
Maldives, Republic of		Apr 2015	n.a.	–			**Sharks:** Maldives has developed the NPOA-Sharks with the assistance of Bay of Bengal Large Marine Ecosystem (BoBLME) Project. A stakeholder consultation for the NPOA-Sharks was held in April of 2014. The NPOA-Sharks is in the finalization process and is expected to be published in November of 2014. The longline logbooks ensure the collection of shark bycatch data to genus level. Maldives would be reporting on shark bycatch to the appropriate technical Working Party meetings of IOTC. **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 the 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. **Marine turtles:** Longline regulation has provisions to reduce marine turtle bycatch. The regulation urges longline vessels to have dehookers for removal of hook and a line cutter on board, to release the caught marine turtles as prescribed in Resolution 12/04.
Mauritius							**Sharks:** Mauritius does not issue national or foreign fishing licence to vessels targeting sharks in its Exclusive Economic Zone. However, sharks are usually landed as bycatch. Mauritius will work in consultation with the IOTC Secretariat to prepare a simplified NPOA-sharks for Mauritius. **Seabirds:** Mauritius does not have national vessels operating beyond 25^0S. However, fishing companies have been requested to implement all mitigation measures as provided in the IOTC Resolutions. **Marine turtles:** Mauritius does not have national boats operating outside its EEZ. Moreover, marine turtles are protected by the national law. Fishing companies have been **requested** to carry line cutters and de-hookers in order to facilitate the appropriate handling and prompt release of marine turtles caught or entangled.
Mozambique		–		–			**Sharks**: Drafting of new legislation is in progress which considers the issues of shark conservation in licensing requirements. The SWIOFish project within the framework of the implementation of the Linefish Management Plan is going to finance the NPOA shark from 2015. Moreover, Mozambique has

							developed in 2014, the Terms and Conditions of Licensing for tuna fishing to be attached to fishing license. These contain all the measures for the conservation and management of tuna fisheries and include the aspects related to conservation of sharks, seabirds and marine turtles. **Seabirds**: Mozambique is regularly briefing the Masters of their fishing vessels on the mandatory requirement to report any seabird interaction with longliner fleet. **Marine turtles**: see above.
Oman, Sultanate of							**Sharks:** An NPOA-sharks is currently being drafted and is due to be finalized in 2017 **Seabirds:** Not yet initiated **Marine turtles:**The law does not allow the catch of sea turtles, and the fishermen are requested to release any hooked or entangled turtle. The longline fleet are required to carry out the line cutters and de-hookers.
Pakistan							**Sharks:** Sharks are landed with the fins attached and each and every part of the body of sharks are utilised. A stakeholder consultation workshop was conducted from 28-30 March 2016 to review the actions of the draft NPOA - Sharks. The draft NPOA was circulated to the key stakeholders and comments were received with an end-date of 30 June 2016. The final version of the NPOA - Sharks has been submitted to the provincial fisheries departments for endorsement. Meanwhile, the provincial fisheries departments have passed notification on catch, trade and/or retention of sharks including Thresher sharks, hammerheads, oceanic whitetip, whale sharks, guitarfishes, sawfishes, wedgefishes and mobulids. **Seabirds:** Pakistan considers that seabird interactions are not a problem for Pakistani fishing fleet as our tuna fishing operations do not include longline vessels. **Marine turtles:** Pakistan has already framed Regulations regarding the prohibition of catching and retaining marine turtles. As regards to the reduction of marine turtle bycatch by gillnetters; presently Marine Fisheries Department (MFD) in collaboration with International Union for Conservation of Nature (IUCN) Pakistan, is undertaking an assessment. Stakeholder Coordination Committee Meeting was conducted on 10th September 2014. The "Turtle Assessment Report (TAR)" will be finalized by February 2015 and necessary guidelines / action plan will be finalized by June 2015. As per clause-5 (c) of Pakistan Fish Inspection & Quality Control Act, 1997, "Aquatic turtles, tortoises, snakes, mammals including dugongs, dolphins, porpoises and whales etc" are totally forbidden for export and domestic consumption.
Philippines		Sept. 2009		–			**Sharks:** Under periodic review. **Seabirds:** Development has not begun. No seabird interactions recorded. **Marine turtles:** No information received by the Secretariat.
Seychelles, Republic of		Apr-2007		–			**Sharks:** NPOA-sharks currently being reviewed and a new NPOA is being developed for 2016-19. **Seabirds:** Development has not begun. The industrial longline fleet of Seychelles has been instructed to conform with the requirements of Res. 12/06. **Marine turtles:** No plan developed as the moment.
Sierra Leone							**Sharks:** No information received by the Secretariat. **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.

Somalia							**Sharks:** Somalia is currently revising its fisheries legislation (current one being from 1985) and will consider the development of NPOAs as part of this revision process. **Seabirds:** See above. **Marine turtles:** See above.
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). **Seabirds:** Published in August 2008 and fully implemented. The NPOA-seabirds has been earmarked for review. **Marine turtles:** No information received by the Secretariat.
Sri Lanka			n.a. (provisional)				**Sharks:** An NPOA-sharks has been finalized and is currently being implemented. **Seabirds:** Sri Lanka has determined that seabird interactions are not a problem for their fleets. However a formal review has not yet taken place which the WPEB and SC have approved. **Marine turtles:** Marine turtles are legally protected in Sri Lanka. In the longline fishery only circle hooks are used (J-hooks are banned). Gillnets longer than 2.5 km are now prohibited in domestic legislation on the high-seas. Reporting of bycatch is facilitated via logbooks reserving a separated box.
Sudan							**Sharks:** No information received by the Secretariat. **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.
Tanzania, United Republic of		–		–			**Sharks:** Initial discussions have commenced. **Seabirds:** Initial discussions have commenced. Note: Terms and conditions related to protected sharks and seabirds contained within fishing licenses. **Marine turtles:** No information received by the Secretariat.
Thailand		23-Nov-2005		–			**Sharks:** Second NPOA-sharks currently being drafted. **Seabirds:** Development has not begun. **Marine turtles:** Not yet implemented.
United Kingdom	n.a.	–	n.a.	–		–	British Indian Ocean Territory (Chagos Archipelago) waters are a Marine Protected Area closed to fishing except recreational fishing in the 3nm territorial waters around Diego Garcia. Separate NPOAs have not been developed within this context. **Sharks/Seabirds:** 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. **Marine turtles:**No marine turtles are captured in the recreational fishery. A monitoring programme is taking place to assess the marine turtle population in UK (OT).
Vanuatu		Aug 2014					**Sharks:** Commenced in August 2014. **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.
Yemen							**Sharks:** No information received by the Secretariat. **Seabirds:** No information received by the Secretariat.

							Marine turtles: No information received by the Secretariat.
COOPERATING NON-CONTRACTING PARTIES							
Bangladesh							**Sharks:** No information received by the Secretariat. **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.
Djibouti							**Sharks:** No information received by the Secretariat. **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.
Liberia							**Sharks:** No information received by the Secretariat. **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.
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. **Seabirds:** The need for a NPOA-seabirds has not yet been assessed. **Marine turtles:** No information received by the Secretariat.

Colour key	
NPOA Completed/ FAO Guidelines fully implemented	
NPOA Drafting being finalized / FAO Guidelines partially implemented	
NPOA Drafting commenced / FAO Guidelines being communicated	
Not begun	

APPENDIX IX
EXECUTIVE SUMMARY: BLUE SHARK

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[10]	Indicators		2016 stock status determination
Indian Ocean	Reported catch 2015:	30,054 t	
	Not elsewhere included (nei) sharks[11] 2015:	57,125 t	
	Average reported catch 2011–15:	29,535 t	
	Ave. not elsewhere included (nei) sharks[2] 2011–15:	49,785 t	
	MSY (1,000 t) (80% CI):	Unknown	
	F_{MSY} (80% CI):	Unknown	
	SB_{MSY} (1,000 t) (80% CI):	Unknown	
	F_{2014}/F_{MSY} (range):	(0.44–4.84)[3]	
	SB_{2014}/SB_{MSY} (range):	(0.83–1.75)[3]	
	SB_{2014}/SB_0 (range):	Unknown	

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

[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SHK: sharks various nei; RSK: requiem sharks nei).

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[3]		
		Global status	WIO	EIO
Blue shark	*Prionace glauca*	Near Threatened	–	–

The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean
Sources:IUCN 2007, Stevens 2009

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Stock status. There remains considerable uncertainty about the relationship between abundance, CPUE series and total catches over the past decade (Table 1). Three stock assessment models were applied to the blue shark resource in 2015 (Fig. 1). Two models (SS3 and SRA) produced similar results suggesting the stock is currently subject to overfishing, but not yet overfished, while a third model (BSSPM) suggest the stock was close to MSY levels, but not yet subject to overfishing A best case model could not be selected and so the results represented the range of plausible model runs. The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2012 (IOTC–2012–SC15–INF10 Rev_1) consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type. Blue sharks received a medium vulnerability ranking (No. 10) in the ERA rank for longline gear because it was estimated as the most productive shark species, but was also characterised by the second highest susceptibility to longline gear. Blue shark was estimated as not being susceptible thus not vulnerable to purse seine gear. The current IUCN threat status of 'Near Threatened' applies to blue sharks globally (Table 2). Information available on this species has been improving in recent years. 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 (20–25 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. However, blue shark assessments in the Atlantic and Pacific oceans seem to indicate that blue shark stocks can sustain relatively high fishing pressure. On the weight-of-evidence available in 2015, the stock status is determined to be **uncertain** (Table 1). However, total catches of this species should not exceed 2014 levels, while efforts are made to further evaluate stock status.

Outlook. Increasing effort could result in declines in biomass. 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.

Management advice. A precautionary approach to the management of blue shark should be considered by the Commission, by ensuring that future catches do not exceed current catches. The stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirement on sharks, so as to better inform scientific advice.

The following key points should be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the whole Indian Ocean is unknown.
- **Reference points**: The Commission has not adopted reference points or harvest control rules for any shark species.
- **Main fishing gear** (2011–15): Coastal longline; longline targeting swordfish; longline (deep-freezing).
- **Main fleets** (2011–15): Indonesia; EU,Spain; Taiwan, China; Japan; EU,Portugal.

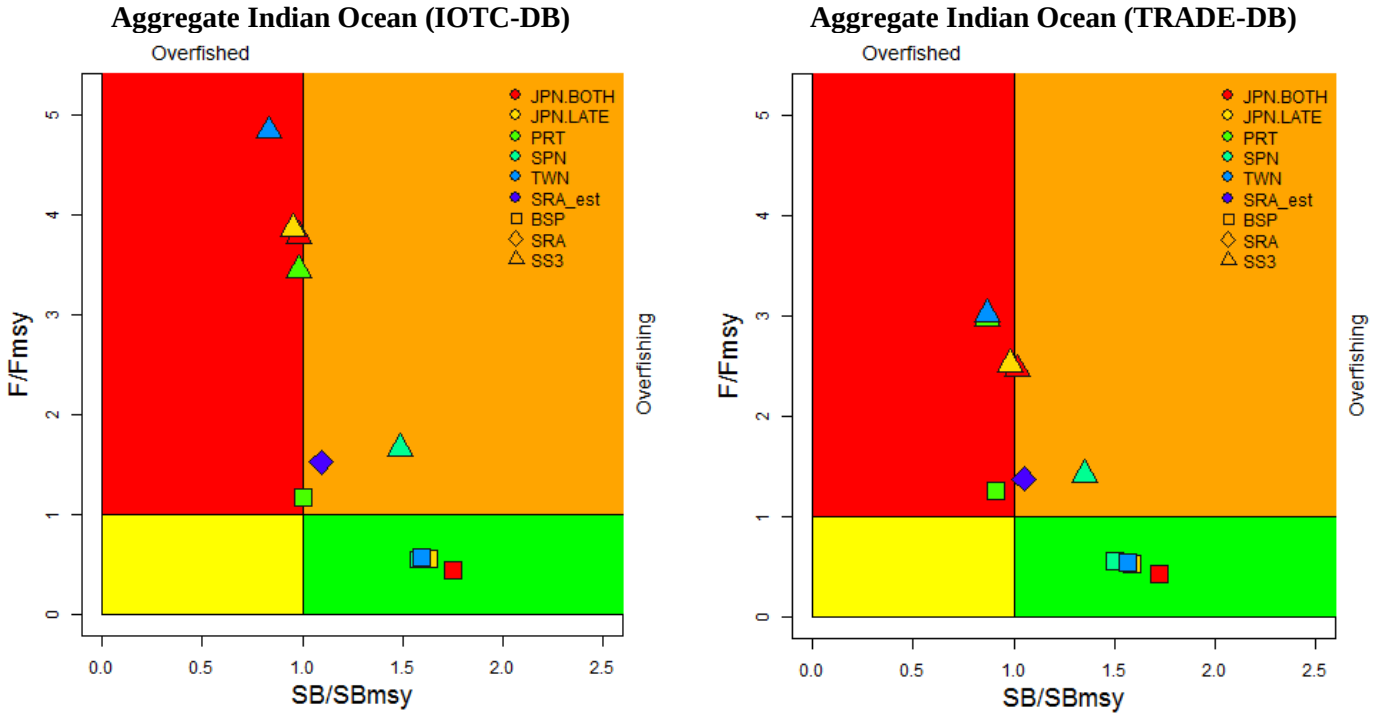


Fig. 1. Blue shark: Aggregated Indian Ocean stock assessment Kobe plot for the 2014 estimate based on a range of models explored with steepness = 0.5, and fits to CPUE series. Note that these are for different datasets, namely the IOTC DB and Trade based datasets (IOTC DB: left panel and TRADE DB: right panel). SS3: Stock Synthesis III; SRA: Stock Reduction Analysis; BSP: Bayesian State-Space Production Model.

Table 3a. Blue shark: Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based reference points for nine constant catch projections using IOTC DB (average catch level from 2012–14 (31,759 t), ± 10%, ± 20%, ± 30% and ± 40%) projected for 3 and 10 years. **Note:** K2MSM projections were not run due to large uncertainty in catch estimates.

Reference point and projection timeframe	**Alternative catch projections (relative to the average catch level from 2012–2014, 31,759 t) and probability (%) of violating MSY-based target reference points ($B_{targ} = B_{MSY}$; $F_{targ} = F_{MSY}$)**								
	60% (19,055t)	**70%** (22,231 t)	**80%** (25,407 t)	**90%** (28,583 t)	**100%** (31,759 t)	**110%** (34,935 t)	**120%** (38,110 t)	**130%** (41,286 t)	**140%** (44,462 t)
$B_{2017} < B_{MSY}$	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

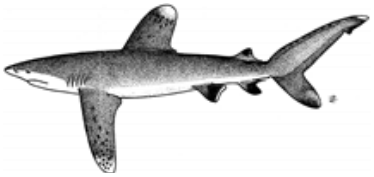
$F_{2017} > F_{MSY}$	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
$B_{2024} < B_{MSY}$	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
$F_{2024} > F_{MSY}$	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Table 3b. Blue shark: Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based reference points for nine constant catch projections using TRADE DB (average catch level from 2012–14 (134,212 t), ± 10%, ± 20%, ± 30% and ± 40%) projected for 3 and 10 years. **Note: K2MSM projections were not run due to large uncertainty in catch estimates.**

Reference point and projection timeframe	**Alternative catch projections (relative to the average catch level from 2012–2014, 134,212 t) and probability (%) of violating MSY-based target reference points ($B_{targ} = B_{MSY}$; $F_{targ} = F_{MSY}$)**								
	60% (80,527 t)	**70%** (93,948 t)	**80%** (107,369 t)	**90%** (120,790 t)	**100%** (134,212 t)	**110%** (147,663 t)	**120%** (161,054 t)	**130%** (174,475 t)	**140%** (187,896 t)
$B_{2017} < B_{MSY}$	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
$F_{2017} > F_{MSY}$	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
$B_{2024} < B_{MSY}$	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
$F_{2024} > F_{MSY}$	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

APPENDIX X
EXECUTIVE 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*)

CITES APPENDIX II species

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

Area[1]	Indicators		2016 stock status determination
Indian Ocean	Reported catch 2015: Not elsewhere included (nei) sharks[2] 2015: Average reported catch 2011–2015: Av. not elsewhere included 2011-2015 (nei) sharks[2]:	211 t 57,125t 248 t 49,785 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2014}/F_{MSY} (80% CI): SB_{2014}/SB_{MSY} (80% CI): SB_{2014}/SB_0 (80% CI):	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species(i.e., SHK: sharks various nei; RSK: requiem sharks nei)

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[3]		
		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.
[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status.There remains considerable uncertainty about the relationship between abundance, standardised CPUE series and total catches over the past decade (Table 1). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2012 (IOTC–2012–SC15–INF10 Rev_1) consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type. Oceanic whitetip shark received a high vulnerability ranking (No. 5) in the ERA rank for longline gear because it was estimated as one of the least productive shark species, and was also characterised by a high susceptibility to longline gear. Oceanic whitetip shark was estimated as being the most vulnerable shark species to purse seine gear, as it was characterised as having a relatively low productive rate, and high susceptibility. 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. 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 likely vulnerable to overfishing. Despite the Despite the limited amount of data, recent studies (IOTC-2016-WPEB12-25) suggest that oceanic whitetip shark abundance has declined in recent years (2000- 2015) compared to historic years (1986- 1999).Available pelagic longline standardised CPUE indices from Japan and EU,Spain indicate conflicting trends as discussed in the full Executive Summary for oceanic whitetip sharks. 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 **uncertain** (Table 1).

Outlook.Maintaining or increasing effort with associated fishing mortality can 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 oceanic whitetip sharks will decline in these areas in the near future, and may result in localised depletion.

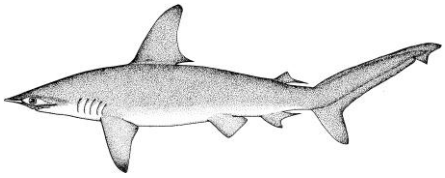
Management advice. A precautionary approach to the management of oceanic whitetip shark should be considered by the Commission, noting that recent studies suggest that longline mortality at haulback is high(50%) in the Indian Ocean (IOTC-2016-WPEB12-26), while mortality rates for interactions with other gear types such as purse seines and gillnets may be higher. Mechanisms need to be developed by the Commission to encourage CPCs to comply with their recording and reporting requirement on sharks, so as to better inform scientific advice.

The following key points should be noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2011–15): Gillnet;gillnet-longline.
- **Main fleets** (2011–15): I.R. Iran; Sri Lanka; Madagascar; China.

APPENDIX XI
EXECUTIVE 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*)

CITES APPENDIX II species

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

Area[1]	Indicators		2016 stock status determination
Indian Ocean	Reported catch 2015: Not elsewhere included (nei) sharks[2]2015: Average reported catch 2011–2015: Av. not elsewhere included (nei) sharks[2] 2011–15:	52 t 57,125t 75 t 49,785 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2014}/F_{MSY} (80% CI): SB_{2014}/SB_{MSY} (80% CI): SB_{2014}/SB_0 (80% CI):	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SHK: sharks various nei; RSK: requiem sharks nei).

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[3]		
		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
[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only
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 2). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2012 (IOTC–2012–SC15–INF10 Rev_1) consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type. Scalloped hammerhead shark received a low vulnerability ranking (No. 14) in the ERA rank for longline gear because it was estimated as one of the least productive shark species, but was also characterised by a lower susceptibility to longline gear. Scalloped hammerhead shark was estimated as the sixth most vulnerable shark species in the ERA ranking for purse seine gear, but with lower levels of vulnerability compared to longline gear, because the susceptibility was lower for purse seine gear. There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. 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.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 **uncertain** (Table 1).

Outlook.Maintaining or increasing effort can result in 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.

Management advice.A precautionary approach to the management of scalloped hammerhead shark should be considered by the Commission. Mechanisms need to be developed by the Commission to encourage CPCs to comply with their recording and reporting requirement on sharks, so as to better inform scientific advice.
The following key points should be noted:

- **Maximum Sustainable Yield (MSY)**: Unknown.
- **Reference points**: Not applicable.
- **Main fishing gear** (2011–15): Gillnet-longline; longline-gillnet; longline (fresh).
- **Main fleets** (2011–15): Sri Lanka; NEI-Fresh.

APPENDIX XII
EXECUTIVE 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		2016 stock status determination
Indian Ocean	Reported catch 2015:	1,268 t	
	Not elsewhere included (nei) sharks[2] 2015:	57,125t	
	Average reported catch 2010–15:	1,447 t	
	Av. not elsewhere included (nei) sharks[2] 2011–15:	49,785 t	
	MSY (1,000 t) (80% CI):	unknown	
	F_{MSY} (80% CI):		
	SB_{MSY} (1,000 t) (80% CI):		
	F_{2014}/F_{MSY} (80% CI):		
	SB_{2014}/SB_{MSY} (80% CI):		
	SB_{2014}/SB_0 (80% CI):		

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SHK: sharks various nei; RSK: requiem sharks nei).

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[3]		
		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
[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only
SOURCES: IUCN 2007, Cailliet 2009

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty about the relationship between abundance, the standardised CPUE series, and total catches over the past decade (Table 1). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2012 (IOTC–2012–SC15–INF10 Rev_1) consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type. Shortfin mako sharks received the highest vulnerability ranking (No. 1) in the ERA rank for longline gear because it was characterised as one of the least productive shark species, and with a high susceptibility to longline gear. Shortfin mako shark was estimated as the third most vulnerable shark species in the ERA ranking for purse seine gear, but with lower levels of vulnerability compared to longline gear, because the susceptibility was lower for purse seine gear. The current IUCN threat status of 'Vulnerable' applies to shortfin mako sharks globally (Table 2). Trends in the Japanese standardised CPUE series from its longline fleet suggest that the biomass has declined from 1994 to 2003, and has been increasing since then. Trends in EU,Portugal longline standardised CPUE series suggest that the biomass has declined from 1999 to 2004, and has been increasing since then. There is a paucity of information available on this species, but this situation has been improving in recent years. 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 can be vulnerable

to overfishing.There is no quantitative stock assessment currently available for shortfin mako shark in the Indian Ocean therefore the stock status is **uncertain**.

Outlook.Maintaining or increasing effort can 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 shortfin mako shark will decline in these areas in the near future, and may result in localised depletion.

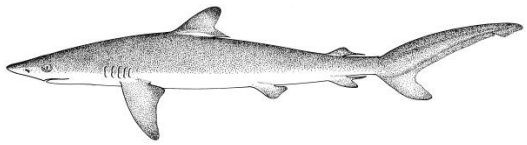
Management advice.A precautionary approach to the management of shortfin mako shark should be considered by the Commission. Mechanisms need to be developed by the Commission to encourage CPCs to comply with their recording and reporting requirement on sharks, so as to better inform scientific advice.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Unknown.
- **Reference points**: Not applicable.
- **Main fishing gear** (2011–15): Longline targeting swordfish; longline (deep-freezing); longline (targeting sharks); gillnet.
- **Main fleets** (2011–15): EU,Spain; South Africa; EU,Portugal; Japan.

APPENDIX XIII
EXECUTIVE 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		2016 stock status determination
Indian Ocean	Reported catch 2015: Not elsewhere included (nei) sharks[2] 2015: Average reported catch 2011–15: Av. not elsewhere included (nei) sharks[2] 2011–15:	3,232 t 57,125t 3,707 t 49,785 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2014}/F_{MSY} (80% CI): SB_{2014}/SB_{MSY} (80% CI): SB_{2014}/SB_0 (80% CI):	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SHK: sharks various nei; RSK: requiem sharks nei).

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[3]		
		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
[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only
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 ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2012 (IOTC–2012–SC15–INF10 Rev_1) consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type. Silky shark received a high vulnerability ranking (No. 4) in the ERA rank for longline gear because it was estimated as one of the least productive shark species, and with a high susceptibility to longline gear. Silky shark was estimated as the second most vulnerable shark species in the ERA ranking for purse seine gear, due to its low productivity and high susceptibility for purse seine gear. 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 but several recent studies have been carried out for this species in the recent years. 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 can be vulnerable to overfishing.Despite the lack of data, there is some anecdotal information suggesting that silky shark abundance has declined over recent decades, including from Indian

longline research surveys, which is described in the full Executive Summary for silky shark sharks. There is no quantitative stock assessment or basic fishery indicators currently available for silky shark in the Indian Ocean therefore the stock status is **uncertain**.

Outlook.Maintaining or increasing effort can 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.

Management advice.A precautionary approach to the management of silky shark should be considered by the Commission. Mechanisms need to be developed by the Commission to encourage CPCs to comply with their recording and reporting requirement on sharks, so as to better inform scientific advice.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Unknown.
- **Reference points**: Not applicable.
- **Main fishing gear** (2011–15): Gillnet; gillnet-longline; longline (fresh); longline-gillnet.
- **Main fleets** (2011–15): Sri Lanka; I.R. Iran; Taiwan,China.

APPENDIX XIV
EXECUTIVE 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		2015 stock status determination
Indian Ocean	Reported catch 2015: Not elsewhere included (nei) sharks[2] 2015: Average reported catch 2011–15: Av. not elsewhere included (nei) sharks[2] 2011–15:	0 t 57,125t 94 t 49,785 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2014}/F_{MSY} (80% CI): SB_{2014}/SB_{MSY} (80% CI): SB_{2014}/SB_0 (80% CI):	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SHK: sharks various nei; RSK: requiem sharks nei).

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[3]		
		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
[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only
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 carcass of thresher sharks of all the species of the family Alopiidae[12].

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status.There remains considerable uncertainty in the stock status due to lack of information necessary for assessment or for the development of other indicators of the stock (Table 1). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2012 (IOTC–2012–SC15–INF10 Rev_1) consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type. Bigeye thresher shark received a high vulnerability ranking (No. 2) in the ERA rank for longline gear because it was characterised as one of the least productive shark species, and highly susceptible to longline gear. Despite its low productivity, bigeye thresher shark has a low vulnerability ranking to purse seine gear due to its low susceptibility for this particular gear.

[12]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 Ecosystemsand Bycatch).

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. 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.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 **uncertain**.

Outlook. Current longline fishing effort is directed to other species, however bigeye thresher sharks is a common bycatch in 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 may be largely ineffective for species conservation. Maintaining or increasing effort, with associated fishing mortality, can result in declines in biomass, productivity and CPUE. However there are few data to estimate 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.

Management advice. The prohibition on retention of bigeye thresher shark should be maintain. Mechanisms need to be developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks, so as to better inform scientific advice.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2011–15): Gillnet-longline; longline-gillnet.
- **Main fleets** (2011–15): Sri Lanka.

APPENDIX XV
EXECUTIVE 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		2016 stock status determination
Indian Ocean	Reported catch 2015: Not elsewhere included (nei) sharks[2] 2015: Average reported catch 2011–15: Av. not elsewhere included (nei) sharks[2] 2011-15:	0 t 57,125t 69 t 49,785 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2014}/F_{MSY} (80% CI): SB_{2014}/SB_{MSY} (80% CI): SB_{2014}/SB_0 (80% CI):	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SHK: sharks various nei; RSK: requiem sharks nei).

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[3]		
		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
[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only
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 carcass of thresher sharks of all the species of the family Alopiidae[13].

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 ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2012 (IOTC–2012–SC15–INF10 Rev_1) consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type. Pelagic thresher shark received a high vulnerability ranking (No. 3) in the ERA rank for longline gear because it was characterised as one of the least productive shark species, and with a high susceptibility to longline gear. Despite its low productivity, pelagic thresher shark has a low vulnerability ranking to purse seine gear due to its low susceptibility for this

[13]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 Ecosystemsand Bycatch).

particular gear. 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. 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.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 **uncertain.**

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 may be largely ineffective for species conservation. Maintaining or increasing effort can result in declines in biomass, productivity and CPUE. However there are few data to estimate 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.

Management advice. The prohibition on retention of pelagic thresher shark should be maintain. Mechanisms need to be developed by the Commission to encourage CPCs to comply with their reporting requirement on sharks, so as to better inform scientific advice.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2011–15): Gillnet-longline; longline-gillnet.
- **Main fleets** (2011–15): Sri Lanka.

APPENDIX XVI
EXECUTIVE SUMMARY: MARINE TURTLES

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
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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[1]
Flatback turtle	*Natator depressus*	Data deficient
Green turtle	*Chelonia mydas*	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Critically Endangered
Leatherback turtle	*Dermochelys coriacea*	Vulnerable
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 2014, The IUCN Red List of Threatened species.Version 2015.2 <www.iucnredlist.org>.Downloaded on 15 July 2015.

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

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. In particular, there are now 35 Signatories to the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA MoU). Of the 35 Signatories to the IOSEA MoU, 23 are also members of the IOTC. While the status of marine turtles is affected by a range of factors such as degradation of marine turtle natural habitats 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 (SC). However, given the lack of reporting of marine turtle interactions by CPCs to date, such an evaluation cannot 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 determine 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.
- From the limited data received, longlining posed the greater apparent risk to marine turtles. The ERA estimated that ~3,500 marine turtles are caught by longline vessels annually, while it was estimated that ~250 marine turtles p.a. are observed in purse seine operations, 75% being released alive (Bourjea et al. 2014). The Ecological Risk Assessment conducted by Nel et al. (2013) set out two separate approaches to estimate gillnet impacts on marine turtles, based on very limited data. The first calculated that 52,425 marine turtles p.a. and the second that 11,400–47,500 turtles p.a. are caught in gillnets (with a mean of the two methods being 29,488 marine turtles p.a.). Anecdotal/published studies reported values of

>5000–16,000 marine turtles p.a. for each of India, Sri Lanka and Madagascar. Of these reports, green turtles are under the greatest pressure from gillnet fishing, constituting 50–88% of catches for Madagascar. 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 the number of individuals.
- That appropriate mechanisms are developed by the Compliance Committee to ensure CPCs comply with their data collection and reporting requirements for marine turtles.

APPENDIX XVII
EXECUTIVE SUMMARY: SEABIRDS

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
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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[14]
Albatross		
Atlantic Yellow-nosed Albatross	*Thalassarche chlororynchos*	Endangered
Black-browed albatross	*Thalassarche melanophris*	Near Threatened
Indian yellow-nosed albatross	*Thalassarche carteri*	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
Grey-headed albatross	*Thalassarche chrysostoma*	Endangered
Petrels		
Cape/Pintado petrel	*Daption capense*	Least Concern
Great-winged petrel	*Pterodroma macroptera*	Least Concern
Grey petrel	*Procellaria cinerea*	Near Threatened
Southern giant petrel	*Macronectes giganteus*	Least Concern
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. Following a data call in 2016, the IOTC Secretariat has received seabird bycatch data from some CPCs. Unfortunately, due to the lack of data submissions from other CPCs, and the limited information provided on the use of seabird bycatch mitigations, the IOTC WPEB has not yet undertaken an assessment for seabirds. 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 the IUCN threat status for all birds is currently being re-assessed; this process is expected to be completed by the end of 2016. A number of international global environmental accords (e.g. Convention on Migratory Species (CMS), the Agreement on the Conservation of Albatrosses and Petrels (ACAP), 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, for albatrosses and large petrels, fisheries bycatch is generally considered to be the primary threat. 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 incidental catches rates have been recorded in the absence of a suite of proven incidental catches mitigation measures.

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

Outlook. Resolution 12/06 *On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries* includes an evaluation requirement (para. 8) by the Scientific Committee in time for the 2016 meeting of the Commission. The level of compliance with 12/06 and the frequency of use of each of the 3 measures (because vessels can chose two out of three possible options) are currently unknown. Methods to evaluate the effectiveness of the mitigation measures prescribed in Res 12/06 need to be developed. Observer reports and logbook data should be analysed to support assessments of the effectiveness of mitigation measures used and relative impacts on seabird mortality rates. Information regarding seabird interactions reported in National Reports should be stratified by season, broad area, and in the form of catch per unit effort. Unless IOTC CPCs become compliant with the data collection, Regional Observer Scheme and reporting requirements for seabirds, the WPEB will continue to be unable to address this issue. The following should be noted:

- The available evidence indicates considerable risk from longline fishing to the status of seabirds in the Indian Ocean, where the best practice seabird incidental catches mitigation measures outlined in Resolution 12/06 are not implemented.
- 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 catches through logbooks, including details of species, if possible.
- Appropriate mechanisms should be developed by the Compliance Committee to assess levels of compliance by CPCs with the Regional Observer Scheme requirements and the mandatory measures described in Res 12/06.

APPENDIX XVIII
WORKING PARTY ON ECOSYSTEMS AND BYCATCH PROGRAM OF WORK (2017–2021)

The Program of Work consists of the following, noting that a timeline for implementation would be developed by the SC once it has agreed to the priority projects across all of its Working Parties:

- **Table 1**: Priority topicsfor obtaining the information necessary to develop stock status indicators for bycatch in the Indian Ocean; and
- **Table 2**: Stock assessment schedule.

Table 1. Priority topics for obtaining the information necessary to develop stock status indicators for bycatch species in the Indian Ocean

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	Timing				
					2017	2018	2019	2020	2021
SHARKS									
1. Stock structure (connectivity and diversity)	1.1 Genetic research to determine the connectivity of select shark species throughout their distribution (including in adjacent Pacific and Atlantic waters as appropriate) and the effective population size.	High (13)	CSIRO/AZTI /IRD/RITF	1.3 m Euro: (European Union; 20% additional co-financing)					
	1.1.1 Next Generation Sequencing (NGS) to determine the degree of shared stocks for select shark species (highest priority species: blue shark, scalloped hammerhead shark, oceanic whitetip shark and shortfin mako shark) in the Indian Ocean with the southern Atlantic Ocean and Pacific Ocean, as appropriate. Population genetic analyses to decipher inter- and intraspecific evolutionary relationships, levels of gene flow (genetic exchange rate), genetic divergence, and effective population sizes.								
	1.1.2 Nuclear markers (i.e. microsatellite) to determine the degree of shared stocks for select shark species (highest priority species: blue shark, scalloped hammerhead shark and oceanic whitetip shark) in the Indian Ocean with the southern Atlantic Ocean and Pacific Ocean, as appropriate.								

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	Timing				
					2017	2018	2019	2020	2021
	1.2 Connectivity, movements and habitat use								
	1.2.1 Connectivity, movements, and habitat use, including identification of hotspots and investigate associated environmental conditions affecting the sharks distribution, making use of conventional and electronic tagging (PSAT).	High (1)	AZTI, IRD, Others	US$80K each species (TBD)	BSH SMA OCS	SMA OCS			
	1.2.2 Whale sharks (RHN): Connectivity, movements, and habitat use, including identification of hotspots and investigate associated environmental conditions affecting distribution, making use of conventional and electronic tagging (P-SAT).	High (24)	IRD	US$50,000 (available from IRD)	RHN				
2. Fisheries data collection	2.1 Historical data mining for the key species and IOTC fleets (e.g. as artisanal gillnet and longline coastal fisheries) and implementation of Regional Observer Schemes, including:								
	2.1.1 Capacity building of fisheries observers (including the provision of ID guides, training, etc.)	High (20)	WWF-Pakistan/ ACAP (seabirds)	US$?? (TBD)					
	2.1.2 Define observer scheme (including minimum requirements) for fleets which are believed to have large catches on pelagic sharks (i.e. various longline and gillnet coastal fisheries) and where those statistics are mostly absent	High (21)		US$?? (TBD)					
	2.1.3 Historical data mining for the key species, including the collection of information about catch, effort and spatial distribution of those species and fleets catching them	High (5)	TBD	US$80K (CITES)					
	2.1.4 Integration of data mining with observer programs to reconstruct species composition and catches of sharks	Medium (26)		US$15k (EU)					
	2.1.5 Electronic monitoring (NOTING the recommendation from the Scientific Committee (SC17.43) that the Commission considers assigning the IOTC Secretariat,	High (12)		US$?? (TBD)					

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	Timing				
					2017	2018	2019	2020	2021
	in consultation with interested IOTC scientists, to develop a project on electronic monitoring in the IOTC area of competence, the Commission NOTED that a concept note/proposal should be developed to allow an evaluation of the efficacy of electronic monitoring in the collection of information on catch, discards and fishing effort as a means to supplement scientific observer coverage for large-scale gillnet vessels. The concept note should include a detailed budget and be communicated to a range of potential funding organisations. (para. 41 of the S19 report))								
	2.1.6 Resolution 16/04 On the development of a pilot project for the Regional Observer Scheme. Development of a proposal for review by the SC19	High (X)							
3. Biological and ecological information (incl. parameters for stock assessment)	3.1 Age and growth research (Priority species: blue shark (BSH), shortfin mako shark (SMA) and oceanic whitetip shark (OCS); Silky shark (FAL))			US$?? (TBD)					
	3.1.1 CPCs to provide further research reports on shark biology, namely age and growth studies including through the use of vertebrae or other means, either from data collected through observer programs or other research programs.	High (4)	CPCs directly	US$?? (TBD)	SMA OCS	OCS			
	3.2 Post-release mortality								
	3.2.1 Post-release mortality (electronic tagging), to assess the efficiency of management resolutions on no retention species (i.e. oceanic whitetip shark (OCS) and thresher sharks), shortfin mako shark SMA) ranked as the most vulnerable species to longline fisheries, and blue shark as the most frequent in catches.	High (2)	IRD/ NRIFSF	US$170K per species (EU)	OCS	BSH, SMK			
	3.2.2 Post-release mortality (electronic tagging), to assess the efficiency of management resolutions on no retention species (i.e. oceanic whitetip shark (OCS) for purse	High (3)	IRD/AZTI	US$80K (TBD)	OCS				

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	Timing				
					2017	2018	2019	2020	2021
	seine fisheries								
	3.2.3 Post-release survivorship (electronic tagging) on whale shark to assess the effect of unintended interaction and efficiency of management resolution of non-intentioned encirclement on purse seine	High (23)	IRD/AZTI	US$50,000 IRD (commenced)	RHN				
	3.3 Reproduction research Priority species: blue shark (BSH), shortfin mako shark (SMA) and oceanic whitetip shark (OCS), and silky shark (FAL))	High (11)	CPCs directly	US$?? (TBD)	SMA OCS FAL	OCS			
	3.4 Ecological Risk Assessment	High (X)			Prep	Full			
4. Shark bycatch mitigation measures	4.1 Develop studies on shark mitigation measures (operational, technological aspects and best practices)								
	4.1.1 Longline selectivity, to assess the effects of hooks styles, bait types and trace materials on shark catch rates, hooking-mortality, bite-offs and fishing yield (socio-economics)	High (14)		US$?? (TBD)					
	4.1.2 Gillnet selectivity, to assess the effect of mesh size, hanging ratio and net twine on sharks catches composition (i.e. species and size), and fishing yield (socio-economics)	High (15)	WWF-Pakistan	US$?? (WWF)					
	4.1.3 Develop guidelines and protocols for safe handling and release of sharks caught on longlines and gillnets fisheries	Med (25)							
5. CPUE standardisation / Stock Assessment / Other indicators	5.1 Develop standardised CPUE series for each key shark species and fishery in the Indian Ocean			US$?? (TBD)					
	5.1.1 Blue shark: Priority fleets: TWN,CHN LL, EU,Spain LL, Japan LL; Indonesia LL; EU,Portugal LL	High (17)	CPCs directly	US$?? (TBD)					

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	Timing				
					2017	2018	2019	2020	2021
	5.1.2 Shortfin mako shark: Priority fleets: Longline and Gillnet fleets	High (19)	CPCs directly	US$?? (TBD)					
	5.1.3 Oceanic whitetip shark: Priority fleets: Longline fleets; purse seine fleets	High (18)	CPCs directly	US$?? (TBD)					
	5.1.4 Silky shark: Priority fleets: Purse seine fleets	Med (27)	CPCs directly	US$?? (TBD)					
	5.2 Stock assessment and other indicators								
	5.2.1 Develop and compare multiple assessment approaches to determining stock status for key shark species (see Table 2)	High (22)	TBD	Part of: 600K Euro (European Union)					
	MARINE TURTLES								
6. Marine turtle bycatch mitigation measures	6.1 Review of bycatch mitigation measures								
	6.1.1 Res. 12/04 (para. 11) Part I. The IOTC Scientific Committee shall request the IOTC Working Party on Ecosystems and Bycatch to: a) Develop recommendations on appropriate mitigation measures for gillnet, longline and purse seine fisheries in the IOTC area; [mostly completed for LL and PS] b) Develop regional standards covering data collection, data exchange and training; c) Develop improved FAD designs to reduce the incidence of entanglement of marine turtles, including the use of biodegradable materials. [partially completed for non-entangling FADS; ongoing or biodegradable FADs)]	High (9)	CPCs directly	US$?? (TBD)					
	6.1.2 Res. 12/04 (para. 11) Part II. The recommendations of the IOTC Working Party on Ecosystems and Bycatch	Low	CPCs	US$??					

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	Timing				
					2017	2018	2019	2020	2021
	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.	(28)	directly	(TBD)					
	6.1.3 Res. 12/04 (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.	High (10)	CPCs directly	Nil					
	SEABIRDS								
7. Seabird bycatch mitigation measures	7.1 Review of bycatch mitigation measures								
	7.1.1 Res. 12/06 (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.	High (6)	Rep. of Korea, Japan, Birdlife International	US$?? (TBD)					

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	Timing				
					2017	2018	2019	2020	2021
	DISCARDS								
8. Bycatch mitigation measures	8.1 Review proposal on retention of non-targeted species								
	8.1.1 The Commission requested that the Scientific Committee review proposal IOTC–2014– S18–PropL Rev_1, and to make recommendations on the benefits of retaining non-targeted species catches, other than those prohibited via IOTC Resolutions, for consideration at the 19th Session of the Commission. (S18 Report, para. 143). Noting the lack of expertise and resources at the WPEB and the short timeframe to fulfil this task, the SC RECOMMENDED that a consultant be hired to conduct this work and present the results at the next WPEB meeting. The following tasks, necessary to address this issue, should be considered for the terms of reference, taking into account all species that are usually discarded on all major gears (i.e., purse-seines, longlines and gillnets), and fisheries that take place on the high seas and in coastal countries EEZs: i) Estimate species-specific quantities of discards to assess the importance and potential of this new product supply, integrating data available at the Secretariat from the regional observer programs, ii) Assess the species-specific percentage of discards that is captured dead versus alive, as well as the post-release mortality of species that are discarded alive, in order to estimate what will be the added fishing mortality to the populations, based on the best current information,iii) Assess the feasibility of full retention, taking into account the specificities of the fleets that operate with different gears and their fishing practices (e.g., transhipment,	High (8)	Consultant	US$?? (TBD)					

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	Timing				
					2017	2018	2019	2020	2021
	onboard storage capacity). iv) Assess the capacity of the landing port facilities to handle and process this catch. v) Assess the socio-economic impacts of retaining non-target species, including the feasibility to market those species that are usually not retained by those gears, vi) Assess the benefits in terms of improving the catch statistics through port-sampling programmes, vii) Evaluate the impacts of full retention on the conditions of work and data quality collected by onboard scientific observers, making sure that there is a strict distinction between scientific observer tasks and compliance issues.								
9. Ecosystems	9.1 Develop a plan for Ecosystem Based Fisheries Management (EBFM) approaches in the IOTC	High (16)	WPEB	US$?? (TBD)					
	9.2 Create an ecosystem model (SEAPODYM) for the main shark species (BSH)	High (7)	Consultant CLS)	43,000€					
	9.3 Assessment of trophic relationships in pelagic bycatch using chemical tracers		SFA	50,000€					

Table 2. Draft: Assessment schedule for the IOTC Working Party on Ecosystems and Bycatch 2017–2021.

	Working Party on Ecosystems and Bycatch				
Species	**2017**	**2018**	**2019**	**2020**	**2021**
Blue shark	**Full assessment***	Indicators; Revisit ERA	Indicators	Indicators	**Full assessment***
Oceanic whitetip shark	Indicators	Revisit ERA	Indicators	**Full assessment***	Revisit ERA
Scalloped hammerhead shark	Indicators	Revisit ERA	Indicators	–	Revisit ERA
Shortfin mako shark	Indicators	Revisit ERA	–	–	Revisit ERA
Silky shark	Indicators	Indicators; Revisit ERA	**Full assessment***	–	Indicators; Revisit ERA
Bigeye thresher shark		Revisit ERA	–	–	Revisit ERA
Pelagic thresher shark	Indicators	Revisit ERA	–	–	Revisit ERA
Porbeagle shark	tRFMO assessment	–	–	–	–
Marine turtles	Review of mitigation measures in Res. 12/04	Revisit ERA	–	Review of mitigation measures in Res. 12/04	Revisit ERA
Seabirds	–	–	Review of mitigation measures in Res. 12/06	–	-
Marine Mammals	–	–	–	–	–
Ecosystem Based Fisheries Management (EBFM) approaches	**Results of joint tRFMO meeting**	–	–	–	–

*Including data poor stock assessment methods; Note: the assessment schedule may be changed dependant on the annual review of fishery indicators, or SC and Commission requests.

APPENDIX XIX
CONSOLIDATED RECOMMENDATIONS OF THE 12TH SESSION OF THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH

Note: Appendix references refer to the Report of the 12th Session of the Working Party on Ecosystems and Bycatch (IOTC–2016–WPEB12–R)

Identification guides for fishing gear

WPEB12.01 (Para. 21)The WPEB **RECALLED** the recommendation made by the WPEB in 2013 and 2014: 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 (WPEB09, para.117).

Regional observer scheme

WPEB12.02 (Para. 54) **RECALLING** the SC18 (para. 134) ***"NOTING** that many CPCs report Regional Observer data in .pdf format, or as data embedded within documents, and also in hard-copy format, the SC **ENCOURAGED** CPCs to report Regional Observer data in any non-proprietary electronic format (e.g. csv, xml, txt, etc.) or in an electronic format that can be easily exported and processed into standard spreadsheet, database or statistical software (e.g. xls, dbase, mdb, etc.). This may be in any electronically readable format as long as all of the agreed minimum data reporting requirements have been fulfilled",* the WPEB **RECOMMENDED** that observer data are submitted in electronic format that could be automatically exported and processed into a standard spreadsheet-like format (e.g. csv, xml, txt, xls, dbase, mdb etc.), avoiding formats whose processing could be time consuming and unnecessarily complex (e.g. pdf, Microsoft Word documents etc.), at the same time ensuring that all of the agreed minimum data reporting requirements have been fulfilled.

Bycatch data exchange protocol (BDEP)

WPEB12.03 (Para. 62) The WPEB **RECOMMENDED** that, on completion of the development of the ROS database and the input of all of the historical data, the IOTC Secretariat continue to populate the BDEP template, adapting it where necessary, and present this to the WPDCS and SC for further review.

Tuna gillnet fisheries

WPEB12.04 (Para. 105) **RECALLING** the previous recommendation from the Scientific Committee, the WPEB **RECOMMENDED** that this is reiterated: *"**NOTING** that gillnets are regularly being used with lengths in excess of 4,000 m (and up to 7,000 m) within and occasionally beyond the EEZ of Pakistan and other IOTC CPCs in the region, and that those used within the EEZ may sometimes drift onto the high seas in contravention of Resolution 12/12, the SC **RECOMMENDED** that the Commission should consider if a ban on large scale gillnets should also apply within IOTC CPC EEZ. This would be especially important given the negative ecological impacts of large scale drifting gillnets in areas frequented by marine mammals and turtles" (SC18 para. 39).*

ACAP best practice advice: update

WPEB12.05 (Para. 216) The WPEB **RECOMMENDED** that Resolution 12/06 be reviewed and **ENCOURAGED** the line weighting specifications to be updated to conform with the latest ACAP advice: (a) 40 g or greater attached within 0.5 m of the hook; or (b) 60 g or greater attached within 1 m of the hook; or (c) 80 g or greater attached within 2 m of the hook. CPCs are **ENCOURAGED** to test the safety and practicality of the above mentioned measure as well as sliding lead devices for line weighting, and to report the results back to the WPEB or SC.

WPEB12.06 (Para. 219) The WPEB **RECOMMENDED** that when Resolution 12/06 is reviewed, the two hook-shielding devices recommended by ACAP as best practice mitigation measures be incorporated as additional, stand-alone mitigation options for use in IOTC fisheries operating south of 25°S, and that these measures should conform with the technical specifications and performance attributes detailed in the ACAP advice. The WPEB **CLARIFIED** that if used, the hook-shielding devices would not need to be combined with any other mitigation measure. In relation to the Smart Tuna Hook, the WPEB **NOTED** that on the basis of information provided, after release from the hook the shield sinks to the seafloor where it corrodes within 12 months, the byproduct of which is iron oxide and carbon. However, the WPEB **NOTED** concerns regarding pollution associated with the discarded shields of the Smart Tuna Hooks, and **REQUESTED** that further information be made available to clarify the potential effects.

Data collection opportunities

WPEB12.07 (Para. 225) The WPEB **RECOGNISED** that although the IOTC Regional Observer Programme (ROP) for transhipment is primarily a mechanism for compliance monitoring, it does provide potential opportunities for gathering photographs and information for scientific purposes, including on seabird bycatch mitigation measures. Therefore, the WPEB **RECOMMENDED** that the collection of seabird bycatch mitigation photographs through the ROP is trialled as a pilot.

Revision of the WPEB Program of Work 2017–2021

WPEB12.08 (Para. 245) The WPEB **RECOMMENDED** that the SC consider and endorse the WPEB Program of Work (2017–2021), as provided at Appendix XVIII.

Review of the draft, and adoption of the Report of the 12th Session of the Working Party on Ecosystems and Bycatch

WPEB12.09 (Para. 254)The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB12, provided at Appendix XIX, 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 IX
- Oceanic whitetip sharks (*Carcharhinus longimanus*)– Appendix X
- Scalloped hammerhead sharks (*Sphyrna lewini*) – Appendix XI
- Shortfin mako sharks (*Isurus oxyrinchus*) – Appendix XII
- Silky sharks (*Carcharhinus falciformis*) – Appendix XIII
- Bigeye thresher sharks(*Alopias superciliosus*) – Appendix XIV
- Pelagic thresher sharks(*Alopias pelagicus*) – Appendix XV

Other species/groups

- Marine turtles – Appendix XVI
- Seabirds – Appendix XVII