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

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

Bangkok, Thailand 20 - 22 October 2008

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1. OPENING OF THE MEETING AND ADOPTION OF THE AGENDA

1. The fourth Meeting of the Working Party on Ecosystems and Bycatch (WPEB) was opened on 20 October 2008 in Bangkok, Thailand, by the Chairperson Mr Riaz Aumeeruddy.

2. Mr Aumeeruddy welcomed the participants (Appendix I) and the agenda for the Meeting was adopted as presented in Appendix II. The list of documents presented to the meeting is given in Appendix III.

2. REVIEW OF THE DATA ON ECOSYSTEMS AND BYCATCH

2.1 STATUS OF IOTC DATABASES

3. The Secretariat provided a report on the status of bycatch and ecosystem data in the IOTC databases (IOTC-2008-WPEB-04).

4. The WPEB recalled the existing data and information reporting requirements for members (Table 1) and noted that Resolution 08/01 adopted by the Commission in June 2008, requires CPC's to provide fisheries statistics for the major shark species. Given this, the working party expected that improvements in the amount and quality of data on sharks would be obtained over the coming years.

Table 1. IOTC data requirements for non-tuna and tuna like species.

Sharks	
IOTC Resolution 05/05 *Concerning the conservation of sharks caught in association with fisheries managed by IOTC*	Paragraph 1: CPCs shall annually report data for catches of sharks, in accordance with IOTC data reporting procedures, including available historical data.
IOTC Resolution 08/01: *Mandatory statistical requirements for IOTC Members and Cooperating Non-Contracting Parties (CPC's)*	Paragraph 3: The provisions, applicable to tuna and tuna-like species, shall also be applicable to the most commonly caught shark species and, where possible, to the less common shark species.
Seabirds	
IOTC Recommendation 05/09 *On incidental mortality of seabirds*	Paragraph 2: CPCs should be encouraged to collect and voluntarily provide the Scientific Committee with all available information on interactions with seabirds, including incidental catches in all fisheries under the purview of IOTC.
IOTC Resolution 08/03 *On reducing the incidental bycatch of seabirds in longline fisheries*	Paragraph 7: CPCs shall provide to the Commission, as part of their annual reports, all available information on interactions with seabirds, including bycatch by fishing vessels carrying their flag or authorised to fish by them. This is to including details of species where available to enable the Scientific Committee to annually estimate seabird mortality in all fisheries within the IOTC area of competence.
IOTC Resolution 08/01: Mandatory statistical requirements for IOTC Members and Cooperating Non-Contracting Parties (CPC's)	Paragraph 3: The provisions, applicable to tuna and tuna-like species, shall also be applicable to the most commonly caught shark species and, where possible, to the less common shark species. CPC.s are also encouraged to record and provide data on species other than sharks and tunas taken as bycatch.
Sea turtles	
IOTC Recommendation 05/08 *On sea turtles*	Paragraph 2: The Commission encourages CPCs to collect and voluntarily provide the Scientific Committee with all available information on interactions with sea turtles in fisheries targeting the species covered by the IOTC Agreement, including successful mitigation measures, incidental catches and other impacts on sea turtles in the IOTC Area, such as the deterioration of nesting sites and swallowing of marine debris.
IOTC Resolution 08/01: *Mandatory statistical requirements for IOTC Members and Cooperating Non-Contracting Parties (CPC's)*	Paragraph 3: The provisions, applicable to tuna and tuna-like species, shall also be applicable to the most commonly caught shark species and, where possible, to the less common shark species. CPC.s are also encouraged to record and provide data on species other than sharks and tunas taken as bycatch.
Marine mammals	
IOTC Resolution 08/01: *Mandatory statistical requirements for IOTC Members and Cooperating Non-Contracting Parties (CPC's)*	Paragraph 3: The provisions, applicable to tuna and tuna-like species, shall also be applicable to the most commonly caught shark species and, where possible, to the less common shark species. CPC.s are also encouraged to record and provide data on species other than sharks and tunas taken as bycatch.

5. With respect to the historical data, the collection and reporting of catches of sharks caught in association with species managed by the IOTC (tuna and tuna-like species) has been very uneven overtime. The information on the bycatch of sharks gathered in the IOTC database is thought, for this reason, to be very incomplete. The catches of sharks, when reported, are thought to represent simply the catches of a group of species that are retained on board. They refer, in many cases, to dressed weights and no indication is given on the type of processing that took place. The weights or numbers of sharks for which only the fins were kept on board are rarely recorded in the vessels' logbooks. This makes it problematic to estimate the total catches of sharks in the Indian Ocean.

6. To date, the IOTC Secretariat has not received any official reports (i.e. in accordance with IOTC resolutions) from members or cooperating parties on the amounts of sea birds, sea turtles or other fauna caught incidentally by their vessels.

7. The WPEB expressed its disappointment and concern about the lack of reporting to-date on bycatch species and further encouraged all IOTC members and cooperating parties to increase the amount of information available in the future.

8. The issue of gillnet fishers from Sri Lanka, Pakistan and Iran extending their operations into high seas was of concern to the WPEB given the likely increase in interactions between these fleets and sharks, sea turtles and marine mammals. The WPEB strongly encouraged these members to improve their level of data reporting and to include data on the incidental catches of sea turtles and marine mammals as a matter of course.

9. The WPEB recommended the following actions be taken to improve the standing of the data on non-tuna species currently available at the Secretariat (Table 2). In general, these recommendations are made over and above the existing obligations and technical specifications relating to the reporting of data.

Table 2a: Steps to improve the certainty of fisheries statistics for SHARKS:

Data / information / work required	Fishery	Major fleets involved
Retained catches		
Historical catch and effort information	Fresh-tuna and/or deep-freezing longliners	Taiwan,China, Indonesia, Japan, China, Seychelles, Malaysia, South Korea and India.
	Longliners targeting swordfish	Spain, France (La Reunion), Seychelles, Mauritius
	Artisanal fisheries with large catches of pelagic sharks	Sri Lanka. Pakistan , Iran, Oman and Yemen
Historical catch level estimates by species and year.	Fresh-tuna and/or deep-freezing longliners	Taiwan,China, Indonesia, Japan, South Korea
	Purse seine	EC and the Seychelles
Ensuring that logbook coverage is appropriate to produce acceptable levels of precision for shark catch and effort statistics.	All fleets	
Research on how to identify shark species from fins and processed body parts.	All fleets	
Discard levels		
Implementing levels of observer coverage that will produce acceptable levels of precision in estimates of discard levels.	All industrial fleets.	
Estimating levels of discards for sharks, at least by large species groups or if possible, by species.	All fleets using sharks for their fins,	
Estimates of historical discard levels for sharks by species and year	All industrial fleets,	
Size frequency data:		
Collecting and reporting size frequency information for the main shark species caught by their fisheries, including all historical data available.	All industrial fleets, notably longline fleets	Industrial fleets monitored through observers
Biological data:		
Collecting data that can be used to derive length-weight keys, ratios of fin-to-body weight, non-standard measurements-fork length keys and processed weight-live weight keys.	All fleets	
Collecting biological information on sharks to the extent possible ,	All fleets	
Research on: • Identification of sharks through fins validated by using DNA techniques • The use of shark fins to derive catch estimates in weight by species/species group and fishery.	All fleets	

• The use of shark fins to derive length frequencies by species.		

Table 2b: Steps to improve the certainty of statistics on incidental catches of SEABIRDS:

Data / information / work required	Fishery	Major fleets involved
Provision of historical data on incidental catches of seabirds, by species and fishing area, indicating the type of mitigation measure/s used in each case.	Industrial longline fisheries operating south of 30°S.,	Taiwan,China, Japan, Indonesia and South Korea,
Estimating total bycatches of seabirds for their fisheries, per species and year, including the precision of such estimates.	Industrial longline fisheries operating south of 30°S.,	Taiwan,China, Japan, Indonesia and South Korea,
Research on the effect of seabird bycatch mitigation measures.	Industrial longline fisheries operating south of 30°S.,	

Table 2c: Steps to improve the certainty of statistics on incidental catches of SEA TURTLES:

Data / information / work required	Fishery	Major fleets involved
Collect data on incidental catches of sea turtles, by species and fishing area, including the condition of the sea turtle at release	Countries having industrial longline fisheries,,	Taiwan,China, Indonesia and Japan
	Gillnet / gillnet-longline	Gillnet fisheries operating in the Arabian Sea (Pakistan, Sri Lanka and Iran) and the gillnet/longline fisheries of Sri Lanka, Yemen and Oman.,
	Industrial purse seine fleets	EC and Seychelles
Research on: • interactions between Fish Aggregating Devices (FAD's) and sea turtles, including mortality rates by species, area and type of FAD's used	Industrial purse seine fleets	
Research on: • sea turtle bycatch mitigation measures for longline fisheries, e.g. examination of setting techniques and hook types.	Countries having industrial longline fisheries,,	
Research on: • sea turtle bycatch mitigation measures for gillnet fisheries	Countries having gillnet fisheries,,	

2.2 REVIEW OF NEW INFORMATION AVAILABLE ON THE INCIDENTAL CATCH OF NON-TARGET SPECIES IN THE INDIAN OCEAN

Scientific estimates of bycatch landed by the Spanish surface longline fleet targeting swordfish (Xiphias gladius) in the Indian Ocean with special reference to the 2004 – 2006 period (IOTC-2008-WPEB-03).

10. This paper presents scientific estimates of the bycatch species landed by the Spanish surface longline fleet targeting swordfish (*Xiphias gladius*) in the Indian Ocean since the beginning of this fishery in 1993, as well as an update for the recent period 2004- 2006. The species classified as bycatch amounted to 46.2% of the total weight landed. The three most prevalent species in the catch, *Xiphias gladius*, *Prionace glauca* and *Isurus oxyrhinchus*, represented 85.2% of the total weight landed during this last period. As far as bycatch species are concerned, large pelagic sharks were the most prevalent group with 76.5% of the bycatch in weight, whereas tunas amounted to 15.0%, billfish to 2.2% and other species to 6.3%. *P. glauca* and *I. oxyrhinchus* are the two most prevalent bycatch species in the group of large pelagic sharks, reaching 84.4% and 12.0% of the landings of this group, respectively.

By-catch and discards of the European purse seine tuna fishery in the Indian Ocean. Estimation and characteristics for the 2003 – 2007 period (IOTC-2008-WPEB-12)

11. By-catch and tuna discards estimation and characteristics for the various species groups are presented for the European purse seine tuna fishery (France and Spain) for the period 2003-2007. Data were collected through French and Spanish observer programs representing a total of 1,958 observed fishing sets. Total by-catch and tuna discards estimation were derived from a stratification based on fishing mode, seasons (quarters) and spatial area. The estimation relied on raising factors calculated based on major commercial tuna catch expressed in tons per 1000 t of tuna landed. Total tuna discards and by-catch was estimated to be about 9,585 t corresponding to 35.5 t per 1000 t of tuna landed. Tuna discards represents 54 % (19.2 t/1000 t) of the total amount, followed by fishes (33.7 %, 12.0 t/1000 t), sharks (10.1, 3.6 t/1000 t), billfishes (1.5 %, 0.5 t/ 1000 t), and rays (0.7 %, 0.2 t/1000 t). By-catch species composition, main species length and sex structure, and percentage of utilization are also presented. Total by-catch estimates and ratios are compared with those previously published in the literature. The issue raised by the choice of a consistent extrapolation method is finally discussed.

The first year of SEALOR : Database of SEA-going observer surveys monitoring the local pelagic LOngline fishery based in La Reunion (IOTC-2008-WPEB-013)

12. This study is a preliminary presentation of the observer program carried out under the French National Database Plan (PNDB). In 2007, from April to December, and from July in 2008, one or two observers of the Institut de Recherche pour le Développement (IRD) embarked on board pelagic longliners based in La Reunion. In order to implement this observer program, sampling forms were developed as well as the database SEALOR. To date, a number of 58 fishing operations totalizing 63525 hooks were observed on different fishing units with an overall length ranging from 9 m to 25 m (10 and 2 cruises were done in 2007 and 2008, respectively). All fishing units target swordfish and then develop a similar fishing strategy regarding the setting time, the hauling time, the type of bait, the deployment of the mainline, the use of lightsticks. A descriptive analysis of a subsample of the data collected in 2007 highlights differences between landings (i.e. logbook data) and catches. If the number of species in landings is less than 10, at least 38 identified species were observed by observers with 1 species of sea turtle and of seabird (1 individual per species for each). The proportion of the weight of swordfish as the target species in major landings concerning tuna (*Thunnus albacares, T. alalunga* and *T. obsesus*) and swordfish is about 33%. For the same assemblage the proportion is about 37.9% from data collected on board (26.7% in number). Now regarding the number of swordfish caught compared to the total number of catches the proportion decreases to 17.1% and 44.6% are tunas. The proportion of bycatch (considering that swordfish and tuna species can be targeted at the same time) in observer samples reaches about 40%. A part of these bycatch such as the dolphinfish and billfishes are landed and commercialized (about 42% of bycatch in number) and the rest (26% of the total number of capture) is discarded alive, exhausted or dead. In our data, 31% of discards were blue sharks.

2.3 DISCUSSIONS AND RECOMMENDATIONS ON DATA

13. The WPEB expressed its disappointment about the little progress made by IOTC CPC's concerning the implementation of recommendations outstanding from previous WPEB meetings. The WPEB stressed the need for IOTC CPC's to implement the recommendations from the WPEB as soon as possible.

14. The WPEB also expressed its disappointment that technical experts from many IOTC member countries did not attend the meeting, especially countries whose fisheries are considered to have major bycatch issues. Therefore, the WPEB strongly recommended that IOTC member countries with major fisheries send trained and knowledgeable scientists to working party on bycatch and ecosystem meetings in the future.

Using observers to collect data on bycatch

15. While the WPEB noted the recent improvements in the observer data from purse seine operations, but that coverage of longline and artisanal fleets remains low (Table 3) and this means that it is unable to provide reliable estimates of the overall total catch of non-target species to the Scientific Committee.

Table 3. Overview of fisheries observer programmes in the Indian Ocean (see also IOTC-2007-WPEB-11)

Observer programme	Coverage
EC France :	Starting in 2005: 2 % of total sets in 2005, 4 % in 2006; and increasing up to 10 % in 2007. Since 2005, some coverage of foreign purse-seiners fishing inside the French EEZ surrounding the Iles Eparses and Mayotte. Since March 2007, some coverage of the longline fleet targeting swordfish from La Réunion.
EC-Spain	Since 2003, 5 % of total sets in 2003, 6 % in 2004, 7 % in 2005, 5 % in 2006, and 10 % coverage of Spanish purse-seiners in 2007. In 2005, 2 Spanish longline vessels observed.
South Africa	100% coverage of foreign fishing vessels fishing in the South African EEZ. Coverage of domestic vessels is low..
Japan	In 2006, 88 longline operations (286,997 hooks) were observed in the period from May 2006 to February 2007..
Taiwan China	There were 23 observer trips from 2002 to 2006 in the Indian Ocean large scale tuna longline fleets. The coverage rate by trips was 1.48% in average. The observed days were 1904.
British Indian Ocean Territory (BIOT) : inside the Fisheries, Conservation and Management Zone surrounding the Chagos Archipelago	Since 1994, around 3% coverage of purse seine and longline operations.
Madagascar, domestic and foreign longliners in the Malagasy EEZ	Since 2002, 30 observers are deployed on various fishing fleets. Coverage rate for the tuna longline fishery is not known.
The Australian Western Tuna and Billfish Fishery (WTBF)	A pilot observer program was initiated in 2003 and concluded in 2006. Observers monitored 18 longline trips, covering 161 daily operations which deployed 217,055 hooks. The observer coverage amounted to 4% of longline fishing effort during the period. The ongoing target level of observer coverage for the WTBF is set at 5% although due to the low levels of effort in the fishery, actual coverage varies each year.

16. The WPEB was pleased by the ongoing implementation of national observer programmes and strongly encourages further collaboration between observer programmes and expansion and implementation of new observer programmes for the Indian Ocean.

17. However, recognising that the only means for obtaining accurate data on bycatch is from observer programmes, the WPEB strongly recommended that IOTC Recommendation 05/07 *Concerning a management standard for the tuna fishing vessels*, to deploy if appropriate, scientific observers on-board the vessels according to the Commission's Resolution (Appendix I-ii), become binding on members.

18. The WPEB reiterated that the following attributes in any such programme are desirable:

- All the major fleets should be covered and the levels of coverage should be such that estimates of total catch have an acceptable precision, including those for rare species.
- Observers should focus on recording information on discards as the windows of opportunity for obtaining this information are much shorter than those for obtaining information on target species (some of which can be collected at the dock).
- Use of digital cameras to record specimens for later identification.

19. Furthermore, the WPEB strongly recommended that the Commission mandate the WPEB (though the Scientific Committee) to develop regional standards covering data collection, data exchange, training and the development of guidelines for the operational aspects of such programmes and use these to assist members, especially those with major bycatch issues, improve their bycatch data collection and reporting.

3. SHARKS

3.1 PAPERS PRESENTED

Round-weight and fin-weight ratios for several species of sharks from data gathered by scientific observers on board Spanish surface longliners in the Indian Ocean during a pilot action (IOTC-2008-WPEB-08)

20. This document reports the results of ratios between wet fin weight (FW), and the round (RW) and dressed weight (DW) of several shark species habitually caught by the Spanish long-line fleet targeting swordfish. Values from scientific observer data are different to those obtained for the various species studied. For the most commonly caught species—the blue shark (*Prionace glauca*)—values for FW/RW and FW/DW, using samples of 1360 and 466 specimens, were 5.7% and 14.9%, respectively. The FW/RW ratios found varied between 4.07% for *Isurus oxyrinchus* and 6.60% for *Carcharhinus longimanus*, while the extreme values for the FW/DW ratio were 6.26% for *I. oxyrinchus* and 16.05% for *C. longimanus*. These values confirm the need to establish a per-species ratio or a mean value according to the most frequently caught species in each fishery. Simultaneously, in order to restrict fin removal and the non utilization of sharks, we propose that resolutions are based on the manner in which sharks are preserved on board, since, in most cases, carcasses are dressed and rarely preserved whole

Biology and status of sharks fishery in Yemen (IOTC-2008-WPEB-05)

21. This paper underlines the importance of fishery resources in general, the shark fisheries in particular in Yemen. In this country, resources from the sea are considered to be important to achieving the following National goals mainly: achieving national food security, raising the national economic revenue, serving socio-economic purposes, fishery production as food resources for the population particularly those in coastal areas.

22. Trade in shark fins in Yemen has had a rapid increase over the last two decades. The ex-vessel price for dry shark fins has reached $60 per kg and this has provided sufficient incentive to harvest sharks. Even dry meat of sharks is marketable in the local markets and in the regional Gulf of Aden. As a consequence, the Yemen shark fishery is under considerable pressure. While sharks have high commercial value for their meat, fins, skin and jaws (valuable to the tourist trade), they are a major component of the diet and income earning potential for many rural fishing communities throughout the Region and their decline or collapse would have catastrophic consequences for the livelihood of many coastal communities in Yemen.

Preliminary analysis of crocodile shark (Pseudocarcharias kamoharai) distribution and abundance trends in pelagic longline fisheries (IOTC-2008-WPEB-09)

23. Crocodile shark (*Pseudocarcharias kamoharai*) has a broad distribution across the world's oceans, but is a rare catch in most commercial fisheries. In some geographic areas, crocodile shark is an abundant bycatch of pelagic longline fisheries. Limited crocodile shark biological and fishery information is available to date. We analyzed worldwide pelagic longline fishery observer and research cruise survey data (1950-2005) to estimate crocodile shark abundance and distribution. Preliminary results suggested the highest crocodile shark catch rates were in the Indian Ocean. Off Western Australia, crocodile sharks were one of the most frequently caught species. Results showed that in addition to ocean basin, target species, moon phase, season, bottom depth, gear fishing depth and deployment time significantly affected crocodile shark catches. In each fishery, encounters and catch rates increased with the number of years since exploitation commenced. Pelagic longline fisheries exploited the entire crocodile shark size range, with the species fully selected above 100 cm fork length and most crocodile shark were longer than the reported size at first maturity. The analysis revealed that the crocodile shark sex ratio varied among pelagic fisheries. Japanese Pacific yellowfin and US Pacific tuna fisheries captured more males, whereas US Atlantic swordfish and Japanese southern bluefin fisheries captured more females.

Silky shark (Carcharhinus falciformis) bycatch in the French tuna purse-seine fishery of the Indian Ocean. (IOTC-2008-WPEB-16)

24. Data collected through 20 observer fishing trips were used to quantify the number of silky sharks taken as bycatch by the French tuna purse seine fishery of the Western Indian Ocean. 1,385 immature silky sharks of which 85% was discarded at sea and 15% retained aboard, were observed as bycatch during 685 fishing sets observed from October 2005 to April 2008. Zero-inflated regression models fitted with Bayesian methods were used to explain silky shark bycatch as a function of fishing mode (free vs. fishing aggregating device-associated (FAD) schools), area, and

season. Model results showed that silky sharks occurred in 24% of the fishing sets with an expected number of sharks per set estimated to be 2.02 ± 0.05. The 3 covariates were found to significantly explain both the presence and number of silky sharks caught by the French purse seiners. FAD was shown to have a strong positive effect on the numbers of silky sharks caught, an expected value of 4.3 sharks being taken in FAD-associated schools versus 0.3 sharks in free schools. There were significant differences in silky shark bycatch between seasons and areas with higher bycatch than average in July-September and in the South-East Seychelles area while fewer sharks were expected to be caught in North Somalia. Results are discussed within the context of the ecosystem approach to fisheries for the analysis of ecosystem effects of fishing.

Preliminary estimates of bycatches in the western equatorial Indian Ocean in the traditional multifilament longline gears (1961-1989) (IOTC-2008-WPEB-10)

25. Historical bycatch trends in the pelagic longline fisheries are analysed based on data collected during long-term research program in the Indian Ocean. More than 70 species/taxa of fish (among them 33 species/taxa of elasmobranchs) were reported from longline catches in the western Indian Ocean. Preliminary results suggest decline in the nominal CPUE and mean weight for elasmobranch species, while the same parameters for lancetfish have an increasing trend. CPUE for swordfish is highly variable while mean weight sharply decreased during 1970s. It was suggested that reconstruction of an historical bycatch data series should be based on CPUE and effort analyses. Ratio of target catch/bycatch is not recommended for this purpose due to its unpredictability.

By-catch and discards of the European purse seine tuna fishery in the Indian Ocean. Characteristics and estimation for the 2003 – 2007 period (IOTC-2008-WPEB-12)

26. The WPEB recalled document IOTC-2008-WPEB-12 that was presented in the data section above noting that the silky shark (*Carcharhinus falciformis*) and the oceanic whitetip shark (*Carcharhinus longimanus*) are the main shark bycatch species captured by EU purse seiners setting on logs.

You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. (IOTC-2008-WPEB-INF01)

27. Fishing spans all oceans and the impact on ocean predators such as sharks and rays is largely unknown. A lack of data and complicated jurisdictional issues present particular challenges for assessing and conserving high seas biodiversity. It is clear, however, that pelagic sharks and rays of the open ocean are subject to high and often unrestricted levels of mortality from bycatch and targeted fisheries for their meat and valuable fins. Oceanic pelagic sharks exhibit a wide range of life-history characteristics, but many have relatively low productivity and consequently relatively high intrinsic vulnerability to over-exploitation. The IUCN World Conservation Union Red List criteria were used to assess the global status of 21 oceanic pelagic shark and ray species.

28. Three-quarters (16) of these species are classified as "Threatened" or "Near Threatened". Eleven species are globally threatened with higher risk of extinction: the giant devilray is "Endangered", ten sharks are "Vulnerable" and a further five species are "Near Threatened". Threat status depends on the interaction between the demographic resilience of the species and intensity of fisheries exploitation.

29. Most threatened species, like the shortfin mako shark, have low population increase rates and suffer high fishing mortality throughout their range. Species with a lower risk of extinction have either fast, resilient life histories (e.g. pelagic stingray) or are species with slow, less resilient life histories but subject to fisheries management (e.g. salmon shark).

30. Recommendations, including implementing and enforcing finning bans and catch limits, are made to guide effective conservation and management of these sharks and rays.

Meeting to identify and elaborate an option for international cooperation on migratory sharks under the Convention on Migratory Species (IOTC-2008-WPEB-INF02)

31. The WPEB was updated on progress of the recent intergovernmental meeting hosted by the Government of the Seychelles and convened by the UNEP Secretariat of the Convention on Migratory Species (CMS) to identify and elaborate an option for international co-operation on migratory sharks under CMS. The meeting agreed upon a series of elements for the instrument. Participants focused their deliberations on those elements of a shark conservation agreement that they believed would be essential irrespective of the precise form of the final instrument. This included key elements related to the geographical scope, species covered, fundamental principles, shark

conservation/management components (including non-consumptive use) and co-operation with other bodies. With regard to geographical scope, participants agreed that for the purpose of this instrument, it should be global in scope with opportunity to incorporate regional or species specific initiatives where required. With regard to species covered there was consensus that the agreement should focus on the three species listed in the Appendices of CMS. In addition there should be an enabling mechanism built into the agreement that allows Parties to add species to the agreement. Three fundamental principles recommended were (i) the need to address the broad range of measures that deal with shark conservation and management; (ii) the need for precautionary and ecosystem approaches to shark conservation; and (iii) the need for cooperation and immediate engagement with the fisheries industry, FAO and Regional Fisheries Management Organizations (RFMOs), if the development of this instrument and shark conservation and management in general is to be successful. Participants were of the view that the CMS instrument could re-invigorate the implementation of the FAO IPOA for sharks by incorporating and building on it.

32. The meeting agreed that shark conservation and management components should include:

- measures to build capacity (e.g., research & monitoring, enforcement, compliance) in developing countries to manage sharks;
- identification and protection of critical shark habitats and migration routes;
- the creation of a standardized species-specific global shark database;
- coordination of stock assessments and research;
- promotion and regulation of non-consumptive use including ecotourism;
- processes to encourage the prohibition or strict control of shark finning;
- active cooperation with the fisheries industries;
- studies of shark aggregation and breeding ground and shark behaviour and ecology;
- strict conservation measures for species listed on Appendix I of CMS in accordance with Article III of the Convention;
- regulation of exploitation of species listed on Appendix II of CMS;
- encouragement of relevant bodies to set targeted fishery quotas, and effort and other restrictions;
- processes to encourage restrictions of shark by-catch in non-directed fisheries; and enforcement and compliance measures, including observers on fishery vessels.
- further consideration should also be given to include within the agreement provisions to encourage
    - global promotion of shark conservation and wise use;
    - reducing pollution, marine debris and ship strikes; and
    - reporting structure on measures taken to comply with the agreement.

33. The meeting recommended that the text of a draft CMS agreement incorporating the conclusions should be prepared by the CMS Secretariat in consultation with an intersessional steering group. This would be circulated to all participants and interested organisations and expected to be finalized at or before CMS COP9 in December 2008;

3.2 DISCUSSIONS AND RECOMMENDATIONS RELATING TO SHARKS

National Plans of Action - sharks

34. The WPEB expressed its disappointment that no National Plans of Action –Sharks were provided from IOTC members at this meeting and urged IOTC CPC's that have a NPA to present it during the next meetings of the WPEB.

Technical discussions on IOTC Resolution 05/05 concerning the conservation of sharks caught in association with fisheries managed by IOTC

35. In response to a request from the Commission for more information on the technical aspects of IOTC Resolution 05/05 *Concerning the conservation of sharks caught in association with fisheries managed by IOTC*, specifically paragraph 4 "CPCs shall require their vessels to not have onboard fins that total more than 5 % of the weight of sharks onboard, up to the first point of landing. CPCs that currently do not require fins and carcasses to be offloaded together at the point of first landing shall take the necessary measures to ensure compliance with the 5 % ratio through

certification, monitoring by an observer, or other appropriate measures", the WPEB recommended the following advice be put forward to the Scientific Committee for its consideration.

Though not specified in Resolution 05/05, the adoption of this management measure appears to be in response to concerns about the threats to shark populations from fishing and the practice of shark fining.

The percentage fins:body weight ratio requirement has no clear scientific basis as a conservation measure for sharks in the Indian Ocean, rather it appears to be a broad brush measure to slow down the rate of fishing or deter fishing on sharks by not allowing fins only to be landed and requiring vessels to return to port more often to unload fins and body parts (and therefore not be fishing so much).

The choice of what percentage fins:body weight to apply is not straight forward. There is a wide range of reported fin to body ratios both within and between species. This may be due to differences in the number and type of fins used in the calculations, the type of carcass weight used, or the kind of processing for dressed carcasses. Variation in fin cutting practices may also lead to differences in calculated ratios. There is currently considerable uncertainty among RFMO's and shark experts about what percentage level is appropriate.

Given the broad brush nature of the ratio measure, it is unlikely to address any sustainability issues that might exist for particular species and it does not necessarily mean that the species most vulnerable to fishing will be better off (to achieve this, species-specific and even fleet-specific ratios would be required, as well as accepted criteria for calculating fin weight to carcass weight ratios). The measure also has limited ability to reduce shark finning practices.

Given the considerable uncertainties associated with deriving an appropriate ratio and the difficulties ensuring fishers comply with it, a wide range of experts, including the IUCN Shark specialist group (IOTC-2008-WPEB-INF01) and the European Elasmobranch Association (IOTC-2008-WPEB-INF04) have recently recommended that sharks should be landed with their fins attached.

The WP is in agreement with these expert opinions. The abandonment of the current measure would remove the need for deriving what would be an arbitrary fin to body weight ratio and enforcing it. The alternative measure of landing sharks with their fins attached could be expected, if fully implemented, to end the practice of finning and also facilitate the collection of data that would be highly beneficial in shark stock assessments (e.g. data on species, sex ratios, numbers and size distributions of catches). The ultimate production of shark stock assessments would then underpin any future conservation and management actions.

In case the current measures are pursued, port sampling of pectoral fins landed (pectoral fins are typically always landed) can provide information on numbers of sharks caught by species groups (pectoral fins can be used to identify species groups).

Issues related to the collection of data on sharks:

36. The current mandatory data requirements (and additional biological sampling from national fisheries research programmes and observer programmes etc) should be adequate to enable simple assessments on the major shark species to begin within 5 years.

Shark identification

37. In case the current management measures (using fin to body weight ratios) are pursued, port sampling of pectoral fins landed (pectoral fins are typically always landed) can provide information on numbers of sharks caught by species groups (pectoral fins can be used to identify species groups).

38. The WPEB recalled that mis-identification of sharks is a major factor affecting the quality of the available shark catch data and that last year it recommended that guidelines on sharks identification and data collection will be developed. The WPEB was disappointed to learn that no progress has been made on this matter.

39. The WPEB was informed that the Secretariat of the Pacific Community has produced a book (individual sheets) to assist fishers to identify sharks and these could be useful for observers and/or national administration to improve the quality of information of data transmitted to the Commission. The WPEB was also informed that IATTC has similar identification sheets. The WPEB requested the Secretariat to follow up on this and use the existing sheets as a basis for the production of shark identification material for the Indian Ocean. .

40. The WPEB also reiterated its recommendation from last year that CPCs, which are conducting research cruises and observer programs, develop digital photo archives of shark species and make it available to IOTC for wider use.

Stock assessment of sharks

41. The WPEB was informed about the shark stock assessment studies carried out by ICCAT this year. ICCAT has an ad hoc working group devoted to shark stock assessments. This year blue shark and shortfin mako were examined. The quality of the fisheries information available for the analyses was poor; however, one of positive points was the relative strong results obtained regarding CPUE trend indicators. The ICCAT scientists noted that, any comprehensive stock assessment of sharks will require data from fisheries other than tuna fisheries and this may be problematic in terms of access to the data (much of the data required will be beyond the mandate of a tuna Commission).

42. The WPEB was informed that the historical time series of shark data held by ICCAT far exceeds that held by IOTC. Notwithstanding this, the WPEB viewed this first attempt at shark assessments as a positive step that needs to be continued. Furthermore, the WPEB recommended stock assessments be initiated for sharks in the Indian Ocean to the extent possible, given the current data limitations.

4. SEABIRDS

4.1 PAPERS PRESENTED

Preliminary estimation of seabird bycatch of Taiwanese longline fisheries in the Indian Ocean (IOTC-2008-WPEB-17)

43. This paper outlines the first attempt to estimate seabird incidental catch of Taiwan longline fisheries in the Indian Ocean. Information on incidental catch species has been collected as part of an observer programme since 2002. There have been 23 observer trips from 2002 to 2006 in the Indian Ocean on large scale tuna longliners comprising 1904 observer days. The seabird incidental catch rate (BPUE) in each 5*5 degree grid square varied from 0 to 0.22 per 1000 hooks with the average BPUE of 0.048 per 1000 hooks. BPUE was the highest in the areas between 30-45 S and 25 E to 35 E and between 25-35 S and 65-95E. By using efforts data from logbooks and the seabird BPUE from observers, the preliminary mean estimate of annual seabird incidental catch was around 1512 birds per year.

44. The WPEB expressed its encouragement to Taiwan,China to continue with its observer programme, and suggested that a digital camera be used to take pictures of the seabirds captured so they can be later identified by experts.

4.2 DISCUSSIONS AND RECOMMENDATIONS RELATING TO SEABIRDS

45. Birdlife International provided some background on activities planned for 2009. These include activities that may contribute to the reduction of seabird bycatch in the Indian and Atlantic Ocean, in particular through the production and distribution of fact sheets describing the best techniques to mitigate the bycatch of seabirds..

46. The WPEB reiterated the importance of observer programs as the only effective means for collecting accurate information on the interactions between fishing and seabirds and noted a minimum of 10% coverage of fishing effort by observers would be necessary south of 30°S.

47. The WPEB expressed its disappointment that no National Plans of Action –Seabirds were provided from IOTC members at this meeting and urged IOTC CPC's that have a NPA to present it during the next meetings of the WPEB.

48. The chair informed the WPEB about the IOTC Resolution 08/03 *On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries* that was adopted at the Commission meeting in June 2008.

49. The WPEB also noted that the Commission has requested that the 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 2011 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 or research on the issue, in order to make the Resolution more effective. The WPEB noted that in order to meet this request, members will have to begin reporting the data as requested as soon as possible. To this end the WPEB requested that the reporting requirements for National Reports at the Scientific Committee be amended to include a request for the data (bycatch data and mitigation measures employed), and that this be undertaken immediately so the first information is received at the 2008 meeting.

50. The WPEB requested that the Secretariat produce a draft Executive Summary document on Seabirds, in collaboration with seabird experts and table this at the WPEB meeting in 2009 with a view to submitting it to the Scientific Committee later that year.

5. SEA TURTLES

5.1 PAPERS PRESENTED

Movement of sea turtle between nesting sites and feeding grounds in the South West Indian Ocean: regional migratory knowledge and interaction with open sea fisheries for management issues (IOTC-2008-WPEB-07)

51. In 2000, countries bordering on the West Indian Ocean requested assistance in the management of the living resources and associated habitats of their shared marine ecosystems. In response, the World Bank initiated the development under the Global Environmental Facility and the Fonds Français pour l'Environnement Mondial, of a multi-national fisheries management and development programme called the South West Indian Ocean Fisheries Project (SWIOFP) involving nine countries: Kenya, Tanzania, Comoros, Mozambique, Seychelles, Madagascar, South Africa, Mauritius and La Reunion (France). Component 5 of this Programme is related to non consumptive resources: Mainstreaming biodiversity in national and regional fisheries management that includes marine turtles.

52. Under this component, France is leading an activity related to sea turtle interaction with open sea fisheries to be coordinated by Ifremer La Réunion. Five species of marine turtles are found in the Western Indian Ocean, including the green turtle (*Chelonia mydas*), the hawksbill (*Eretmochelys imbricata*), loggerheads (Caretta caretta), leatherbacks (*Dermochelys coriacea*) and the olive ridley (*Lepidochelys olivacea*).

53. The aims of the project are:

- Identification of sea turtle 'Hotspots' in the south west Indian Ocean (SWIO) and assessment of the main populations based on existing data
- Identification of regional migration routes of the sea turtles
- Understanding migration behaviour of the sea turtles according to environmental conditions (currents, SST) and available genetic data (haplotypes frequencies and structure)
- Building a migratory map for those population in the South West Indian Ocean
- To set up a classification of risk's areas for the species, according to the interaction with the open sea fishing activities (longline and pure seine).
- To propose local and regional management measures for the mitigation of sea turtles bycatches, according to population abundance and migratory behaviour, which can be compatible with the local lasting development, such as eco-tourism
- To contribute to the IOSEA Marine Turtle MoU and its Marine Turtle Task Force (MTTF) in the creation of a reliable research and application network dedicated to sea turtles. It was foreseen that in accordance with SWIOFP data policy, the project outputs would be provided to IOSEA and the data made publicly available after giving researchers from the region a first opportunity to analyse them.

The Indian Ocean - South-East Asian Marine Turtle Memorandum of Understanding, (IOTC-2008-WPEB-INF05a, b, c, d)

54. Douglas Hykle from IOSEA introduced the work of the Indian Ocean -- South-East Asian Marine Turtle Memorandum of Understanding, an agreement under the Convention on Migratory Species (CMS). With 28 Signatory States bordering the Indian Ocean and contiguous waters, the IOSEA MoU is the world's largest intergovernmental agreement focusing on the conservation of marine turtles and their habitats.

55. The agreement has an advanced Online Reporting Facility, elements of which focus on fisheries-turtle interactions. Member States have provided information on the extent and relative impact of fisheries potentially interacting with marine turtles (e.g. shrimp trawls, gill nets, FADs, purse seines, longlines), as well as a wide range of mitigation measures being implemented (such as training in appropriate handling and release of turtles, excluder devices, alternative gear types etc.). An associated IOSEA database contains information on species occurrence, threats (including incidental capture) and mitigation measures at 700 sites of importance for marine turtles. All of the information presented is available online (www.ioseaturtles.org) and is regularly updated. The system allows users to design queries tailored to their particular interest.

56. While providing a useful overview of fisheries-turtle interactions, much more work was needed to quantify the nature of the threats to marine turtles. Mr Hykle encouraged closer cooperation with the IOTC Secretariat and its

members with a view to complementing and completing the missing information in the database – particularly in relation to fishing effort. As a starting point, the IOSEA Advisory Committee will be invited to formulate a number of key questions in need of IOTC fisheries-related input and these will be transmitted to the WPEB and IOTC Secretariat.

5.2 DISCUSSIONS AND RECOMMENDATIONS RELATING TO SEA TURTLES

57. The WPEB expressed its desire to strengthen its relationship with IOSEA and encouraged members with an interest in sea turtles, in particular those involved in fisheries observer programmes, to collaborate where they can with IOSEA initiatives and technical groups.

58. IOSEA reported that eight IOSEA member States already have national action plans for sea turtles and another ten are currently working toward that goal.

59. The WPEB requested that the Secretariat work with IOSEA and provide relevant fisheries data for its requirements and strongly encouraged the IOSEA Secretariat to provide an update on the status of national action plans at future meetings.

60. The WPEB was informed that the Secretariat of the Pacific Community has produced a book (individual sheets) to assist fishers to identify sea turtles and these could be useful for observers and/or national administration to improve the quality of information of data transmitted to the Commission. The WPEB recommended that the Secretariat to follow up on this and use the existing sheets as a basis for the production of sea turtle identification material for the Indian Ocean.

61. . The WP recommended that a draft Executive Summary be developed by the Secretariat in collaboration with sea turtle experts, in particular IOSEA, and be presented to the Scientific Committee in 2008, if possible, with a view to stimulating further action during the course of 2009.

62. The WPEB expressed its disappointment that no National Plans of Action –Sea turtles were provided from IOTC members at this meeting and urged IOTC CPC's that have a NPA to present it during the next meetings of the WPEB.

63. While acknowledging that work has been undertaken by industry to improving FAD design to reduce incidental mortality of species such as sea turtles, the WPEB reiterated its concerns regarding the use of pieces of net hung below the FADs as they are believed to be a cause of mortality of sea turtles by drowning. Mesh size appeared to be a key contributing factor. The WPEB recommended that net material should be replaced with materials such as non-plastic ropes or non-plastic hoods or straps that will not entangle sea turtles.

64. SEAFDEC informed the WPEB about the use of cheap, poorly constructed FADs by artisanal fishers in south east Asian regions. As these FADs are not well maintained, they are regularly lost at sea and continue to fish and cause sea turtle mortality.

65. The WPEB was informed that gillnet fishers from Pakistan, Iran and Sri Lanka are expanding their traditional fishing grounds to include the high seas areas. The WPEB noted its concern that this might increase the interaction with sea turtles and lead to increased mortality.

66. The WPEB expressed its concerns that no information was provided to the meeting on the use of circle hooks in the longline fisheries to reduce sea turtle mortality and requested members that if they have any new information on this topic, then they should report it in their annual National Reports to the Scientific Committee.

67. The following problems related to sea turtles have been identified in previous years and are ongoing:

- Recording of basic data on incidentally caught turtles (eg. location, carapace size, species ID if possible), with a view to enhancing knowledge of the juvenile life stage.
- Ongoing research to test the efficacy of circle hooks in reducing sea turtle mortality.
- Estimate the levels of sea turtle mortality due to various fishing methods, including long line, gillnets and purse seine.
- Describe the sources and scale of ghost fishing taking place in the Indian Ocean.

6. MARINE MAMMALS

6.1 PAPERS PRESENTED

Marine mammal bycatch in the southwest Indian Ocean: review and need for a comprehensive status assessment (IOTC-2008-WPEB-06)

68. Incidental catch in fishing gears is a serious threat to marine megafauna (sea turtles, sharks and marine mammals) at the global scale. It is critical to assess the extent of this threat, both spatially and quantitatively, to ensure its effective management. In the southwest Indian Ocean (from 0 to 25°S, from eastern Africa to 60°E), there is a paucity of information on marine mammal bycatch. This document reviews the marine mammal bycatch issue in the south west Indian Ocean region for the following countries: Mozambique, Tanzania (including Zanzibar), Kenya, Seychelles, Comoros, Mayotte, Madagascar, Reunion (France) and Mauritius. For each country, the status of marine mammals, fishing effort, bycatch information and mitigation measures are presented. Quantitative information, especially with respect to number of bycatch species and impact on local populations, is limited (except for Zanzibar). However, it is clear that several fisheries incidentally catch marine mammals in the region; most notably, dugongs and coastal dolphins (*Tursiops aduncus* and *Sousa chinensis*) being caught by gillnets in Zanzibar and southwest Madagascar. Mitigation measures are non-existent and there are no efforts being made to reduce the use of these gears. It is now critical to quantify the extent of bycatch in gillnets and its impact on local marine mammal populations and to implement effective mitigation measures where required.

The "SPIDER" anti-depredation device tested on a Seychelles' semi-industrial longline vessels (IOTC-2008-WPEB-15)

69. Depredation is defined as the damage or removal of fish or bait from fishing gear by predators in this case cetaceans or sharks. It occurs throughout the world and has been notably documented in several regions of the Indian Ocean. An analysis of depredation data collected by the Seychelles Fishing Authority since the onset of the semi-industrial fishery targeting swordfish and tuna in 1995 revealed that the overall depredation rate was 21% , representing 4.2 fish lost/1000 hook, and was regarded as one of the highest in the world. The main culprits were identified as short finned pilot whale (*Globicephala macrorhynchus*), false killer whale (*Pseudorca crassidens*) and several pelagic sharks.

70. Given this high depredation rate and the significant economic loss they incur, the Seychelles Fishing Authority prepared an action plan to mitigate and reduce the depredation rate by cetaceans on the Seychelles semi-industrial longline fishery. A research trip was conducted between 21 November and 4 December 2007. The principal objective of this trip was to test the efficiency of the "SPIDER" (a mechanical anti depredation device) at reducing or preventing depredation on fish caught during long lining operations.

71. The result shows that the "SPIDER" was not a very effective anti depredation device. However this experimental test has allowed the designers to better understand the technical parameters of this fishery. Furthermore the various modifications done in situ brought out all the constraints needed to be considered when designing future anti-depredation systems. The ease to handling and set up time are the two major points to be considered in the design. The functioning of the device did not pose any major constraints. Its performance can be considered as adequate. Setting up the device on the branchline however required considerable force. Improvement is required in this area. The polyester legs system failed in its dissuasive purpose. Total physical protection will therefore be required. A conical shaped net system will be considered in future design. A trip is scheduled for October/November 2008 to test a modified version of the "SPIDER" device.

6.2 DISCUSSIONS AND RECOMMENDATIONS RELATING TO MARINE MAMMALS

72. Given the relatively common practice in artisanal fisheries of fishing on marine mammals to catch tuna, the WPEB agreed there was a need to better understand the interactions between marine mammals and tuna.

73. The WPEB also noted that gillnet fisheries are a major contributor to the mortality of marine mammals. Special mention was paid to the threats to dugongs from the coastal gillnet fisheries in the Mozambique Channel. The WPEB was reminded that a MOU (under the CMS) now exists for the conservation of dugongs

74. The WPEB was reminded that gillnet fishers from Pakistan Iran and Sri Lanka are expanding their traditional fishing grounds to include the high seas areas and that this could also pose a threat to a range of mammal species.

75. By contrast there have been no reports of marine mammal mortality due to purse seine fishing in the Indian Ocean.

76. The WPEB was informed that the SWIOFP was planning to have a research programme on marine mammals; however, the species to be covered had not yet been determined.

77. The WPEB was informed about an IOC Cetacean workshop to be held in Seychelles in November 2008. The theme of this workshop is research and conservation on marine mammals in the south west Indian Ocean.

78. The following problems related marine mammals have been identified in previous years and are ongoing:

- Analysis of purse-seine fishery log-books in order to update the original information on marine mammal diversity and distribution within the Indian Ocean whale sanctuary as compiled for baleen whales by Robineau (1991) using data from the period 1982 to 1985
- Review the existing marine mammal data in the IOTC databases
- Encouragement of national scientists to make reports on the sightings made by observers of all marine mammals observed in operations within the IOTC.

7. ECOSYSTEM APPROACHES

7.1 PAPERS PRESENTED

Swimming crab Charybdis smithii of the Indian Ocean: key link in the pelagic trophic web (IOTC-2008-WPEB-INF03)

79. A study on the swimming crab, *Charybdis smithii*, was presented to the WPEB. This crab is an important part in the diet of top pelagic predators and has been reported occurring in swarms off the African, Arabian and Indian coasts. For this study all the historical data that could be retrieved has been gathered and included experimental pelagic trawling data, stomach content data from longline caught fish and from purse-seine caught fish. These data, covering a period of 40 years, shows that this crab is found in the whole Indian Ocean, but that it occurs more in the Western part. The peak of pelagic recruitment observed during south western monsoon is correlated with strength of Somalian-Arabian upwelling. Analysis of the trawling data shows that the crabs gather at the surface during the night, while they are scattered within the water column during the day, and the biomass was estimated in the upper 150 m layer at 459kg.nmi-2. At least 30 species of top predators have been found feeding on this prey, mainly subsurface predators. *C. smithii* seems to be the main prey of yellowfin and bigeye tuna and lancetfish from the south-west monsoon to the north-east monsoon in areas where crabs are present. Silky sharks in particular also seemed to prey actively on this crab, and this is probably due to their strong occurrence around seamount, and in particular around the Travin Bank situated at the Coco-de-Mer underwater ridge. Similar outbursts of another crustacean, *Natosquilla investigatoris*, were also observed in the Indian Ocean. Both species have benthic reproduction but reach definitive stages in pelagic waters. Both species show complex interactions with the abundance of one decreasing with the increase of the abundance of the other.

80. The WPEB recognized that such studies are important to understand the ecosystem dynamics by showing a rapid and efficient transfer of energy from low to top trophic layers in the WIO.

Ecological risk Assessment (ERA) for bycatch monitoring and assessment in a RFMO context (IOTC-2008-WPEB-PRES1)

81. The WPEB was informed about the Ecological Risk Assessment (ERA) project being undertaken in the Pacific Ocean. The purpose of the ERA project is to identify bycatch species at relatively high risk of adverse effects due to fishing, so that the WCPFC can prioritise management actions for such species or further research to quantify in more detail the effects of fishing. ERA is a framework of processes and methods that has developed in recent years in Australia in order to demonstrate compliance with environmental legislation. As a process it is designed to identify natural resource management objectives and to quantify the risk associated with not achieving them. As a suite of methods it is designed to assess the impacts of human activities on ecosystems and their constituents. Productivity-Susceptibility Analysis (PSA) is a particular method developed for the analysis of fisheries catching multiple species. It is designed to identify the susceptibility of species to fisheries interactions and the consequence of those interactions for the species, as inferred from their condition- and fate-at-capture, and their biological productivity.

82. PSAs have been used to assess >30 fisheries in Australia and have been applied to the tuna longline and purse seine fisheries of the western and central Pacific at both regional and national scales. The results have been used to identify key shark species for further research and potential stock assessment. It should be noted that the quality of such analyses can be constrained by the availability of observer data. All the activities associated with establishing and maintaining a good regional observer program (e.g. training of observers in species identification, debriefing and quality control, data management) will therefore lead to more robust and informative ERA. Finally, SPC-OFP has also analysed the effectiveness of existing WCPFC Conservation and Management Measures designed to mitigate the effects of fishing on sharks and seabirds, providing the results to the WCPFC Scientific Committee and Technical & Compliance Committee, so that any potential revisions of the CMMs can be based on the best available science. Collectively, these activities represent best practice in the field of bycatch monitoring, analysis and management in an RFMO context. An overview of these activities will be provided so that the IOTC Ecosystems & Bycatch WP can determine to what extent ERA is applicable to the IOTC context.

83. The WPEB expressed considerable interest in the ERA and agreed that such an analysis should be undertaken for the Indian Ocean in the near future. The WPEB recognized that the available observer data is of limited coverage. Notwithstanding these matters, the WPEB agreed that an ERA would assist the Commission identify, in the first instance, the key species of sharks to be focused on by the Commission, and recommended that the Secretariat examine the possibility of undertaking an ERA and report on this to the working party next year.

84. The WPEB considered the work carried out by other tuna RFMOs, such as WCPFC and ICCAT, in relation to ERA was important and valuable to the WPEB, and recommended that close collaboration and collaborative work should be pursued with these organisations in this area.

MADE: preliminary information on a new EC project to propose measures to mitigate adverse impacts of open ocean fisheries targeting large pelagic fish (IOTC-2008-WPEB-14)

85. A new EU funded project (7th EC Framework Programme) called 'MADE', Mitigating ADverse Ecological impacts of open ocean fisheries (www.made-project.eu), was presented to the group. Its primary objective is to propose measures to mitigate adverse impacts of fisheries targeting large pelagic fish in the open ocean, through appropriate knowledge on the biology and ecology of species, and of the fisheries.

86. Particular attention has been paid worldwide to longline fisheries as they catch considerable amounts of bycatch (seabirds, turtles, sharks). Seabird and turtles bycatch mitigation methods have now been established in many fisheries worldwide, but similar efforts must be put to reduce bycatch of sharks. In the same ecosystems, another issue attracts the attention of RFMO's: the use of drifting fish aggregating devices (FADs). These FADs are responsible for major catches of juvenile tuna and non target pelagic species (mainly sharks). Finally, the effects of thousands of FADs released regularly in the tropical oceans are unknown and must be studied to estimate the level of impacts on the ecology and the abundance of pelagic species.

87. MADE is designed as a cooperative research project carried out under the coordination of IRD, including 13 scientific institutions belonging to 6 European countries and 2 ICPC countries in three different oceanographic area (Mediterranean Sea, Atlantic Ocean and Indian Ocean)..

88. The target fisheries of the project are the longline and the purse-seine fisheries for which the discard rates are respectively 22% and 5%. The project will focus on 'highly vulnerable' bycatch species of the marine megafauna – sharks and turtles, on undersized target species – small tunas and swordfish, and on habitat modification – deployment of FADs. The project will involve the deployment of more than 200 popup tags (about 1/3 for PS and 2/3 for LL) and 150 acoustic tags (for PS), experimental fishing to test improvements on fishing gear, biological and socio-economic data. The main concept of MADE is to follow a multi-disciplinary and comparative approach, combining behavioral studies, biological studies, analysis of fisheries activities, technical and technological developments as well as socio-economic studies, with a particular effort to closely associate fishers. MADE should end in April 2012 with some proposals of measures to reduce the negative impacts of those fisheries.

89. The project is not studying the impact of the fisheries on seabirds as it will be conducted in tropical areas where very low interactions with seabirds are observed. The WPEB welcomed this new project and will follow its development and first results during the coming years.

Biodiversité des Milieux Pélagiques marins de l'ocean indien BIOPS funded by Institut Français de la Biodiversité (IFB)

90. The WPEB was informed about the 3 year BIOPS project funded by Institut Français de la Biodiversité (IFB). The primary goal of the BIOPS project is characterizing the marine pelagic biodiversity in different ecosystems of the western Indian Ocean. The main objectives are:

- To combine different data sets and varying sources of information to better grasp and monitor the complexity of pelagic fish diversity;
- To define a set of complementary indices of pelagic fish biodiversity with respect to the properties of each kind of data bases;
- To assess the spatial and temporal variability of these indices at several scales;
- To provide an inventory of the pelagic biodiversity in the western Indian Ocean on the basis of several scientific data sets;
- To develop protocols to survey biodiversity (including data collection and data analyses) with partners of the countries of the Indian Ocean Islands.

91. The pelagic biodiversity will be investigated from by-catches of large pelagic fishes (billfish, sharks and other species) from both scientific longline cruises and data collected by observers onboard longliners; the forage fauna recovered in the stomach contents of top predators (top predators being used as biological samplers of the diversity of the micronekton fauna); and fish communities associated to anchored and drifting Fish Aggregating Devices (FADs).

92. BIOPS will primarily use two historical databases obtained from the Soviet tuna longline research conducted in the Indian Ocean from the early 1960s until 1990. These cover scientific surveys onboard longliners carried out in the western Indian Ocean; and data on prey from stomach content analyses of predators caught by longlines and purse seines. Additional data from surveys with longliners carried out in La Réunion and in the Seychelles area and on stomach contents (collected from 2000 to 2006 by IRD research team) will be also analysed.

93. BIOPS will benefit from data on the fauna associated to drifting FADs in the Seychelles area. These data were collected during the European FADIO project (Fish Aggregating Devices as Instrumented Observatories of pelagic ecosystems, 5th FP, www.fadio.ird.fr) from 2003 till 2005. Additional information will be collected during BIOPS on fauna associated to anchored FADs in 4 sites of the western Indian Ocean: Seychelles, Maldives, Mayotte and Mauritius.

94. The eight institutional partners are involved in BIOPS: IRD – France, IFREMER – France, Université de la Méditerranée – France, IHSM – Madagascar, SFA – Seychelles, MRC – Maldives, Direction de l'Agriculture et des Forêts – Mayotte, Department of Marine Sciences – Mauritius. A meeting of the project was held 28-30 April 2008 in Mauritius (Albion Centre) and project outlines and activities covering the next three years were developed.

8. SUMMARY OF WPEB RECOMMENDATIONS IN 2008

DATA
That the actions in Table 2 be taken to improve the standing of the data on non-tuna species currently available at the Secretariat (Paragraph 9).
That IOTC member countries with major fisheries send trained and knowledgeable scientists to working party on bycatch and ecosystem meetings in the future (Paragraph 14).
That IOTC Recommendation 05/07 *Concerning a management standard for the tuna fishing vessels*, to deploy if appropriate, scientific observers on-board the vessels according to the Commission's Resolution (Appendix I-ii), become binding on members (Paragraph 17).
That the Commission mandate the WPEB (though the Scientific Committee) to develop regional standards covering data collection, data exchange, training and the development of guidelines for the operational aspects of such programmes and use these to assist members, especially those with major bycatch issues, improve their bycatch data collection and reporting (Paragraph 19).
SHARKS
In response to a request from the Commissions for more information on the technical aspects of IOTC Resolution 05/05 *Concerning the conservation of sharks caught in association with fisheries managed by IOTC*, the WPEB recommended the advice relating to Paragraph 34 be put forward to the Scientific Committee for its consideration (Paragraph 35).

That CPCs that are conducting research cruises and observer programs, develop digital photo archives of shark species and make it available to IOTC for wider use (Paragraph 40).
That stock assessments be initiated for sharks in the Indian Ocean to the extent possible, given the current data limitations (Paragraph 42).
SEA TURTLES
That the Secretariat to follow up the book written by SPC on sea turtle identification and use this as a basis for the production of sea turtle identification material for the Indian Ocean (Paragraph 60).
That a draft Executive Summary be developed by the Secretariat in collaboration with sea turtle experts, in particular IOSEA, and be presented to the Scientific Committee in 2008 (Paragraph 61).
That net material used on FADs should be replaced with materials such as non-plastic ropes or non-plastic hoods or straps that will not entangle sea turtles (Paragraph 63).
ECOSYSTEM APPROACHES
That the Secretariat examines the possibility of undertaking an ERA and report on this to the working party next year (Paragraph 83).
That close collaboration and collaborative work should be pursued with WCPFC and ICCAT with respect to ERA (Paragraph 84).
That interested scientists keep abreast of CLIOTOP activities and collaborate to the extent possible (Paragraph 98).

95. In order to evaluate the efficiency and effectiveness of the working party, the WPEB agreed that a review of WPEB recommendations become a permanent item on the WPEB meeting agenda each year.

9. ITEMS PUT FORWARD BY THE WPEB FOR CONSIDERATION BY THE SCIENTIFIC COMMITTEE IN 2008

96. Technical recommendations relating to IOTC Resolution 05/05 *Concerning the conservation of sharks caught in association with fisheries managed by IOTC* for consideration (Paragraph 35).

97. Items of research, analysis and followup (Section 8) for endorsement

10. OTHER BUSINESS

98. The WPEB was updated about the work of the CLIOTOP project (Climate Impacts on Top Predators), a ten-year program started in 2005 designed to coordinate research effort at a global scale, notably by organising and providing financial support for scientific meetings. The WPEB recommended that interested scientists keep abreast of CLIOTOP activities and collaborate to the extent possible.

11. ADOPTION OF THE REPORT

99. The Report of the Fourth Session of the Working Party on Ecosystems and Bycatch was adopted by correspondence up to Friday 7 November 2008.

APPENDIX I
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APPENDIX II

AGENDA OF THE MEETING

1. REVIEW OF THE DATA ON BYCATCH

- Review of the data available in the IOTC database (Secretariat)
- Data from other sources

2. SHARKS

- Papers as provided by participants
- Review of any National Plans of Action for the reduction of shark bycatch in tuna fisheries
- Report on the outcomes of the meeting of the Convention on Migratory Species (Sharks) in December 2007.
- IUCN report on the global status of oceanic pelagic sharks and rays
- Advice on interactions between sharks and tuna fisheries in the Indian Ocean

3. SEABIRDS

- Papers provided by participants
- Review of any National Plans of Action for Reducing Incidental Catches of Seabirds in Longline Fisheries
- Update from Birdlife International
- Advice on interactions between seabirds and tuna fisheries in the Indian Ocean

4. TURTLES

- Papers provided by participants
- Review of any National Plans of Action for the reduction of turtle bycatch in tuna fisheries
- Update from IOsea
- Advice on interactions between sea turtles and tuna fisheries in the Indian Ocean

5. MAMMALS

- Papers provided by participants

6. ECOLOGICAL RISK ASSESSMENT FOR BYCATCH MONITORING, ANALYSIS AND MANAGEMENT, IN AN RFMO CONTEXT

7. RESEARCH RECOMMENDATIONS AND PRIORITIES

8. OTHER BUSINESS

APPENDIX III

LIST OF DOCUMENTS PRESENTED TO THE MEETING

Document	Title
IOTC-2008-WPEB-01	Draft agenda of the Working Party on Ecosystems and Bycatch
IOTC-2008- WPEB-02	WPTDA List of documents
IOTC-2008- WPEB-03	Scientific estimates of bycatch landed by the Spanish surface longline fleet targeting swordfish (*Xiphias gladius*) in the Indian Ocean with special reference to the 2004 – 2006 period. *A. Ramos-Cartelle, B. García-Cortés, J. Mejuto*
IOTC-2008- WPEB-04	Status of the IOTC databases for bycatch species – *IOTC Secretariat*
IOTC-2008- WPEB-05	Biology and status of the shark fishery in Yemen. *Saeed Shaher*
IOTC-2008- WPEB-06	Marine mammal bycatch in the southwest Indian Ocean: review and need for a comprehensive status assessment. *Jeremy Kiszka, Catharine Muir, Omar A. Amir, Tara M. Cox, Jérôme Bourjea, Chris Poonian, Yvette Razafindrakoto, Nina Wambiji & Nanet Bristol.*
IOTC-2008- WPEB-07	Movement of sea turtle between nesting sites and feeding grounds in the South West Indian Ocean: regional migratory knowledge and interaction with open sea fisheries for management issues. *Jérôme Bourjea*
IOTC-2008- WPEB-08	Round-weight and fin-weight ratios for several species of sharks from data gathered by scientific observers on board Spanish surface longliners in the Indian Ocean during a pilot action. *Ariz, J, A. Delgado de Molina, M. L. Ramos and J.C. Santana*
IOTC-2008- WPEB-09	Preliminary analysis of crocodile shark (*Pseudocarcharias kamoharai*) distribution and abundance trends in pelagic longline fisheries. *Evgeny V. Romanov, Peter Ward, Juan C. Levesque, Emma Lawrence*.
IOTC-2008- WPEB-10	Preliminary estimates of bycatches in the western equatorial Indian Ocean in the traditional multifilament longline gears (1961-1989). *Evgeny Romanov, Pascal Bach, Natal'ya Romanova*.
IOTC-2008- WPEB-11	Stomach content of the large pelagic fishes in the bay of bengal. *Praulai Nootmorn, Montri Sumontha, Pornanan Keereerut, Rangkiri P.P. Krishantha Jayasingh, Nalla Jagannath and Manas Kumar Sinha*
IOTC-2008- WPEB-12	Bycatch and discards of the European purse seine tuna fishery in the Indian Ocean.characteristics and estimation for the 2003-2007 period. *AMANDE Justin Monin, ARIZ Javier, CHASSOT Emmanuel, CHAVANCE Pierre, DELGADO de Molina Alicia, GAERTNER Daniel, MUROA Hilario, PIANET Renaud, RUIZ Jon.*
IOTC-2008- WPEB-13	The first year of SEALOR : Database of SEA-going observer surveys monitoring the local pelagic longline fishery based in La Reunion. *Bach Pascal, Njaratiana Rabearisoa, Theo Filippi & Séverine Hubas*
IOTC-2008- WPEB-14	MADE: preliminary information on a new ec project to propose measures to mitigate adverse impacts of open ocean fisheries targeting large pelagic fish. *Dagorn L., Bach P., Robinson J., Deneubourg J.L., Moreno G., Di Natale A., Tserpes G., Travassos P., Dufossé L., Taquet M., Robin J.J., Bruna Valettini, Afonso P., Koutsikopoulos C.*
IOTC-2008- WPEB-15	The "SPIDER" anti-depredation device tested on a Seychelles' semi-industrial longline vessels. Short Note: Trip report Summary (Mission 21 November 2007 to 04 December 2007) on R/V Albacore
IOTC-2008- WPEB-16	Silky shark bycatch in the French purse seine fishery of the Indian Ocean. *Amandé M.J., Chassot, E., Chavance, P., Pianet, R.*
IOTC-2008-WPEB-17	Preliminary estimation of seabird bycatch of Taiwanese longline fisheries in the Indian Ocean. *Hsiang-Wen Huang, Ke-Yang Chang and Ju-Ping Tai*
IOTC-2008-WPEB-PRES01	Ecological Risk Assessment (ERA) for bycatych monitoring and assessment in an RFMO context. *David Kirby.*
IOTC-2008- WPEB –INF01	You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays. Dulvey et al
IOTC-2008- WPEB –INF02	Three documents on the outcomes of the meeting to identify and elaborate an option for international cooperation on migratory sharks under the convention on migratory species held in Seychelles, 11-13 December 2007. 1. General statement on the purpose and process of the meeting. 2. Statement on the outcome of the meeting agreed by participants. 3. A report on the meeting by Earth Negotiations Bulletin, Published by the International Institute for Sustainable Development.
IOTC-2008- WPEB –INF03	Swimming crab Charybdis smithii of the Indian Ocean: key link in the pelagic trophic web. *Evgeny Romanov, Michel Potier, Veniamin Zamorov, Frederic Menard.*
IOTC-2008- WPEB –INF04	European Shark Fisheries: a preliminary investigation into fisheries, conversion factors, trade products, markets and management measures. *Hareide, N.R., J. Carlson, M. Clarke, S. Clarke, J. Ellis, S. Fordham, S. Fowler, M. Pinho, C. Raymakers,F. Serena, B. Seret, and S. Polti. 2007*. European Elasmobranch Association
IOTC-2008- WPEB –INF05a, b, c, d	*IOSea documents on sea turtles: a: Fisheries, fishing effort and interactions; b: Perceived fisheries impacts; c: Methods to minimise incidental capture; d: Programmes to Minimise Incidental Capture*