Report of the 20th Session of the IOTC Scientific Committee

Seychelles, 30 November – 4 December 2017

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BIBLIOGRAPHIC ENTRY

IOTC–SC20 2017. Report of the 20th Session of the IOTC Scientific Committee. Seychelles, 30 November – 4 December 2017. *IOTC–2017–SC20–R[E]: 232 pp.*

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ACRONYMS

ACAP	Agreement on the Conservation of Albatrosses and Petrels
aFAD	Anchored fish aggregation device
ASPIC	A Stock-Production Model Incorporating Covariates
B	Biomass (total)
B_{MSY}	Biomass which produces MSY
CBD	Convention on Biological Diversity
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CE	Catch and effort
CI	Confidence interval
CMM	Conservation and Management Measure (of the IOTC; Resolutions and Recommendations)
CoC	Compliance Committee
CPCs	Contracting Parties and Cooperating Non-Contracting Parties
CPUE	catch per unit effort
current	Current period/time, i.e. $F_{current}$ means fishing mortality for the current assessment year
EEZ	Exclusive Economic Zone
ERA	Ecological Risk Assessment
EU	European Union
F	Fishing mortality; F_{2010} is the fishing mortality estimated in the year 2010
FAD	Fish Aggretation device
FAO	Food and Agriculture Organization of the United Nations
FL	Fork Length
F_{MSY}	Fishing mortality at MSY
GLM	Generalised Linear Model
HCR	Harvest control rule
HBF	Hooks between floats
HS	Harvest strategy
HSF	Harvest strategy framework
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
IO	Indian Ocean
IOTC	Indian Ocean Tuna Commission
IOSEA	Indian Ocean - South-East Asian Marine Turtle Memorandum
IPA	International Plan of Action
IPNLF	International Pole and Line Foundation
ISSF	International Seafood Sustainability Foundation
IUCN	International Union for the Conservation of Nature
IUU	Illegal, unregulated and unreported (fishing)
LJFL	Lower-jaw fork length
LRP	Limit reference point
LL	Longline
LSTLV	Large-scale tuna longline fishing vessel
M	Natural mortality
MEY	Maximum economic yield
MOU	Memorandum of Understanding
MP	Management Procedure
MPA	Marine Protected Area
MSPEA	Maldives Seafood Processors and Exporters Association
MPF	Meeting Participation Fund
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
n.a.	Not Spplicable
NGO	Non-Governmental Organization
NPOA	National Plan of Action
OFCF	Overseas Fishery Cooperation Foundation of Japan
OM	Operating Model
OT	Oversears Territory
PS	Purse seine
PSA	Productivity Susceptibility Analysis
q	Catchability
RBC	Recommended biological catch
RFMO	Regional fisheries management organisation
ROS	Regional Observer Scheme
RTTP-IO	Regional Tuna Tagging Project of the Indian Ocean

SB	Spawning biomass (sometimes expressed as SSB)
SB_{MSY}	Spawning stock biomass which produces MSY
SC	Scientific committee
SCAF	Standing Committee on Administration and Finance
SE	Standard error
SWIOFC	South West Indian Ocean Fisheries Commission
SWIOFP	South West Indian Ocean Fisheries Project
SS3	Stock Synthesis III
SSB	Spawning stock biomass
TAC	Total allowable catch
TAE	Total allowable effort
Taiwan,China	Taiwan, Province of China
TCAC	Technical Committee on Allocation Criteria
TCMP	Technical Committee on Management Procedures
tRFMO	tuna Regional Fishery Management Organization
TRP	Target reference point
TrRP	Trigger reference point
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNGA	United Nations General Assembly
VMS	Vessel Monitoring System
WP	Working Party of the IOTC
WPB	Working Party on Billfish
WPEB	Working Party on Ecosystems and Bycatch
WPDCS	Working Party on Data Collection and Statistics
WPFC	Working Party on Fishing Capacity
WPM	Working Party on Methods
WPNT	Working Party on Neritic Tunas
WPTmT	Working Party on Temperate Tunas
WPTT	Working Party on Tropical Tunas

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.

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EXECUTIVE SUMMARY

The following are a subset of the complete recommendations from the 20th Session of the Scientific Committee, which are provided in Appendix XXXIX.

STATUS OF TUNA AND TUNA-LIKE RESOURCES IN THE INDIAN OCEAN AND ASSOCIATED SPECIES

Tuna – Highly migratory species

SC20.01 (para. 176) The SC **RECOMMENDED** that the Commission note the management advice developed for each tropical and temperate tuna species as provided in the Executive Summary for each species, and the combined Kobe plot for the four species assigned a stock status in 2017 (Fig. 4):

- Albacore (*Thunnus alalunga*) – Appendix VIII
- Bigeye tuna (*Thunnus obesus*) – Appendix IX
- Skipjack tuna (*Katsuwonus pelamis*) – Appendix X
- Yellowfin tuna (*Thunnus albacares*) – Appendix XI

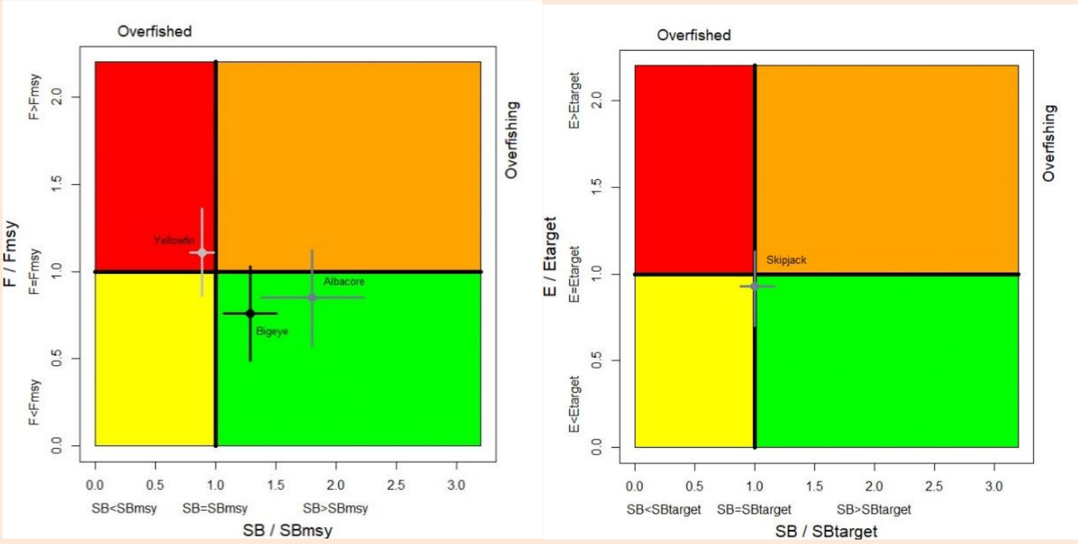


Fig. 4. (Left) Combined Kobe plot for bigeye tuna (black: 2015), yellowfin tuna (grey: 2015), and albacore tuna (dark grey: 2014) showing the estimates of current spawning stock size (SB) and current fishing mortality (F) in relation to SBtarget and Ftarget. (Right) Kobe plot for skipjack tuna (2016) showing the estimates of the current spawning stock status (SB) and exploitation rate in relation to SBtarget and Etarget. Numbers in brackets indicate the last year of data available at the time of the assessment. Cross bars illustrate the range of uncertainty from the model runs with 80% CI.

Billfish

SC20.02 (para. 179) The SC **RECOMMENDED** that the Commission note the management advice developed for each billfish species under the IOTC mandate, as provided in the Executive Summary for each species, and the combined Kobe plot for the five species assigned a stock status in 2017 (Fig. 6):

- Swordfish (*Xiphias gladius*) – Appendix XII
- Black marlin (*Makaira indica*) – Appendix XIII
- Blue marlin (*Makaira nigricans*) – Appendix XIV
- Striped marlin (*Tetrapturus audax*) – Appendix XV
- Indo-Pacific sailfish (*Istiophorus platypterus*) – Appendix XVI

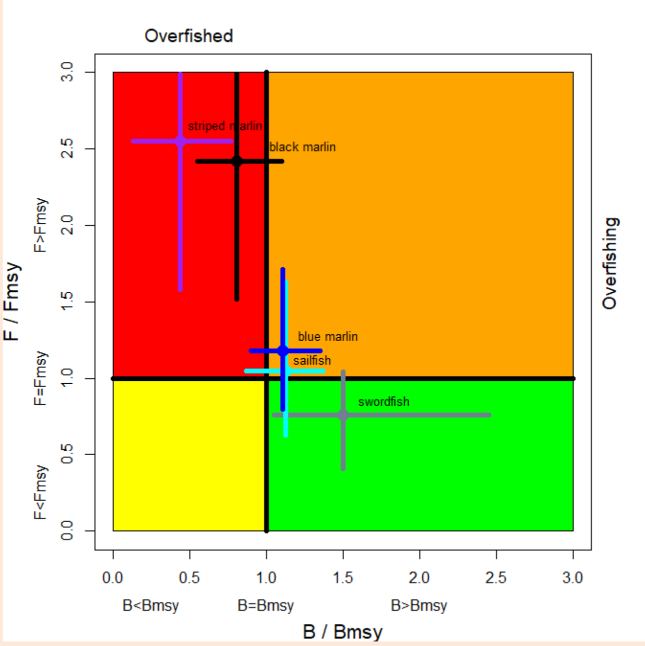


Fig. 6. Combined Kobe plot for swordfish (grey: 2015), indo-pacific sailfish (cyan: 2014), black marlin (black: 2015), blue marlin (blue: 2015) and striped marlin (purple: 2015) showing the estimates of stock size (SB or B, species assessment dependent) and fishing mortality (F) in relation to MSY-based reference points. Numbers in brackets indicate the last year of data available at the time of the assessment. Cross bars illustrate the range of uncertainty from the model runs.

Tuna and seerfish – Neritic species

SC20.03 (para. 178) The SC **RECOMMENDED** that the Commission note the management advice developed for each neritic tuna (and mackerel) species under the IOTC mandate, as provided in the Executive Summary for each species, and the combined Kobe plot for the three species assigned a stock status in 2017 (Fig. 5):

- Bullet tuna (*Auxis rochei*) – Appendix XVII
- Frigate tuna (*Auxis thazard*) – Appendix XVIII
- Kawakawa (*Euthynnus affinis*) – Appendix XIX
- Longtail tuna (*Thunnus tonggol*) – Appendix XX
- Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix XXI
- Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix XXII

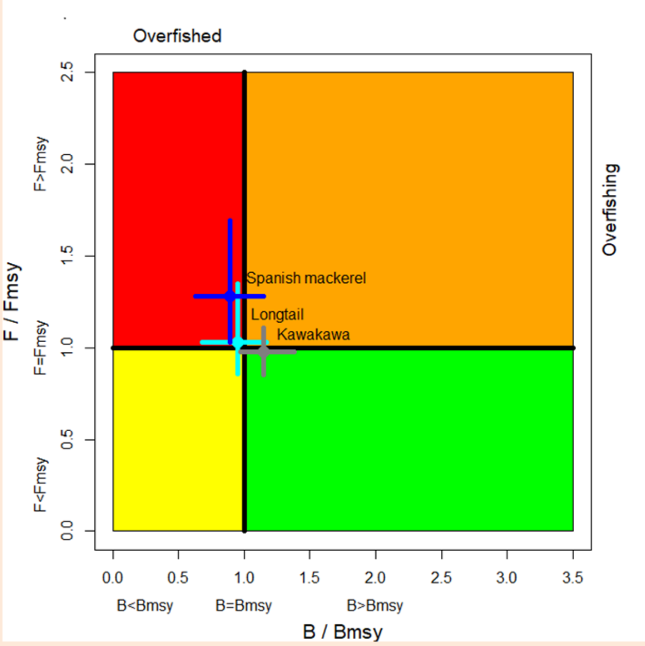


Fig. 5. Combined Kobe plot for longtail tuna (cyan: 2016), narrow-barred Spanish mackerel (dark blue: 2016), and kawakawa (white: 2015) showing the estimates of stock size (B) and current fishing mortality (F) in relation to MSY-based reference points. Numbers in brackets indicate the last year of data available at the time of the assessment. Cross bars illustrate the range of uncertainty from the model runs.

Sharks

SC20.04 (para. 180) The SC **RECOMMENDED** that the Commission note the management advice developed for a subset of shark species commonly caught in IOTC fisheries for tuna and tuna-like species:

- Blue shark (*Prionace glauca*) – Appendix XXIII
- Oceanic whitetip shark (*Carcharhinus longimanus*) – Appendix XXIV
- Scalloped hammerhead shark (*Sphyrna lewini*) – Appendix XXV
- Shortfin mako shark (*Isurus oxyrinchus*) – Appendix XXVI
- Silky shark (*Carcharhinus falciformis*) – Appendix XXVII
- Bigeye thresher shark (*Alopias superciliosus*) – Appendix XXVIII
- Pelagic thresher shark (*Alopias pelagicus*) – Appendix XXIX

Marine turtles

SC20.05 (para. 181) The SC **RECOMMENDED** that the Commission note the management advice developed for marine turtles, as provided in the Executive Summary encompassing all six species found in the Indian Ocean:

- Marine turtles – Appendix XXX

Seabirds

SC20.06 (para. 182) The SC **RECOMMENDED** that the Commission note the management advice developed for seabirds, as provided in the Executive Summary encompassing all species commonly interacting with IOTC fisheries for tuna and tuna-like species:

- Seabirds – Appendix XXXI

Cetaceans

SC20.07 (para. 183) The SC **RECOMMENDED** that the Commission note the management advice developed for cetaceans, as provided in the newly developed Executive Summary encompassing all species commonly interacting with IOTC fisheries for tuna and tuna-like species:

- Cetaceans – Appendix XXXII

GENERAL RECOMMENDATIONS TO THE COMMISSION

PREVIOUS DECISIONS OF THE COMMISSION

SC20.08 (para. 13) The SC **RECOMMENDED** that Resolution 15/02 *Mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)* be reviewed to include the mandatory reporting of zero catches for all species under the mandate of IOTC, in order to support the implementation of IOTC Resolution 16/06 *On measures applicable in case of non fulfilment of reporting obligations in the IOTC*.

REPORT OF THE 15TH SESSION OF THE WORKING PARTY ON BILLFISH (WPB15)

SC20.16 (para. 44) The SC recalled its previous **RECOMMENDATION** that on the next revision of the IOTC Agreement, the shortbill spearfish (*Tetrapturus angustirostris*) be included as an IOTC species.

SC20.18 (para. 55) The SC noted that the next step of the swordfish MSE is to finalize the OM and present the results to the TCMP02 within the current resource constraints (e.g., staff time and travelling). **NOTING** that the Commission considers the development of an MSE for swordfish to be a high priority activity, the SC **RECOMMENDED** that this is reflected in the 2019 budget of the Commission.

SC20.19 (para. 58) The SC noted that catches for Black Marlin, Blue Marlin, and Striped Marlin have increased in 2016 (and 2015) from the average level of 2009-2014 as observed in Appendix VIa. The catch in 2016 for Blue marlin was 3,510 t higher (27 % larger) than the average 2009-2014, 4,286 t larger (32 %) for Black marlin and 1,398 (36 %) for Striped marlin. Considering the status of these stocks the SC urgently **RECOMMENDED** that measures are agreed to recover the status of the stock of the three marlin species covered by Resolution 15/05 as per the management advice given in the Executive Summaries.

REPORT OF THE 13TH SESSION OF THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH (WPEB13)

SC20.20 (para. 61) The SC noted the ongoing compliance issue for those CPCs reporting nominal catch of oceanic whitetip sharks and **RECOMMENDED** that the Compliance Committee investigate these reported catches further and report the findings to the Commission.

SC20.23 (para. 67) Noting the findings of the Pacific workshop regarding the effectiveness of large circle hooks, finfish bait and the removal of the first and/or second hooks next to the floats for mitigating sea turtle interactions and mortalities in Pacific longline fisheries, the SC **AGREED** that further consideration of these mitigation techniques for Indian Ocean fisheries is warranted. Such a study should attempt to develop findings regarding the consequences of various mitigation techniques, primarily with regard to impacts on target and non-turtle bycatch species catch rates, to the extent possible based on data availability and quality. The SC therefore **RECOMMENDED** that the potential for a similar workshop to be held in the Indian Ocean is explored with potential funding from the Commission and/or from the Common Oceans ABNJ Tuna Project. The SC noted this is included in the WPEB workplan and **REQUESTED** the WPEB Chairperson work with the Secretariat to pursue this idea further with potential participants and funding sources.

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

SC20.25 (para. 70) The SC noted the need for training and capacity building as the first step to moving forward with developing goals and strategies for the implementation of EBFM and therefore **RECOMMENDED** that a workshop is held to explain the key elements of EBFM so that a plan for implementation of EBFM in the IOTC Area of Competence can be developed by 2019.

REPORT OF THE 19TH SESSION OF THE WORKING PARTY ON TROPICAL TUNAS (WPTT19)

Skipjack stock assessment

SC20.28 (para. 88) The SC noted that catches of skipjack in recent years are close to the recommended annual catch limit from the HCR, and **RECOMMENDED** that the Commission encourage CPCs to closely monitor catches of skipjack tuna to ensure that the integrity of the catch limit is maintained.

REPORT OF THE 6TH SESSION OF THE WORKING PARTY ON TEMPERATE TUNAS (WPTMT6)

Review of data available at the IOTC Secretariat for temperate tuna species

SC20.29 (para. 91) The SC **RECOMMENDED** that funding be allocated for the further development of the combined joint CPUE series which incorporates the standardized indices of abundance for Japan, Republic of Korea, and Taiwan,China, and that an update is provided at the next WPTmT meeting prior to the next stock assessment of albacore.

REPORT OF THE 8TH SESSION OF THE WORKING PARTY ON METHODS (WPM08)

Update on the status of the joint CPUE indices (yellowfin tuna, bigeye tuna & albacore)

SC20.31 (para. 100) The SC recognised the importance of normalizing these procedures and approaches into the various Working Party stock assessments making use of longline catch rate indices, **ENDORSED s**uch joint analyses and **RECOMMENDED** these continue into the future as a normal course of business. It was noted that additional time for more detailed analysis is still needed and SC **REQUESTED** that methods to increase analysis time, such as the use of secure, cloud-based data exchange and increased use of electronic communication between analysts be investigated.

Priorities for future development of the joint CPUE indices

SC20.33 (para. 102) The SC noted that a substantial amount of work has already been completed for the tropical tunas and that it may be more worthwhile to focus on some other species for which this approach would be useful. The SC therefore **RECOMMENDED** that a similar joint analysis approach is explored for key IOTC billfish and shark species.

Presentation of stock status advice for data limited stocks

SC20.34 (para. 106) The SC **AGREED** that work on the presentation of stock status advice for data limited stocks will need to be carried out inter-sessionally, and that this will require some level of preparation and planning. The SC **REQUESTED** the WPM Chairperson liaise with the Chairs of the species WPs (WPNT and WPB) in order to draft a study proposal on this issue and **RECOMMENDED** the Commission allocates funding to this project.

ROS E-reporting and E-monitoring projects

SC20.36 (para. 115) Resolution 11/04 On a Regional Observer Scheme requests the submission of a report after each trip but the SC **RECOMMENDED** that on the next revision of the Resolution, this should be amended to request the submission of data in an electronic format suitable for automated data extraction (including historic data) with a given deadline so that information from multiple trips can be provided.

Outcomes of the IOTC and joint t-RFMO FAD Working Group

SC20.45 (para. 150) Noting that Resolution 17/08 provides a start date for the implementation of non-entangling FADs, but no end date, the SC **RECOMMENDED** that this Resolution is revised to include a date by which non-entangling FADs should be fully implemented.

"*To reduce the entanglement of sharks, marine turtles or any other species, the design and deployment of FADs shall be based on the principles set out in Annex III, which will be applied gradually from 2014*" (Resolution 17/08, para. 13).

Implementation of the Regional Observer Scheme

SC20.47 (para. 197) The SC therefore **RECOMMENDED** that the EMS standards presented for purse seine fisheries (IOTC-2016-SC19-15) are adopted and **REQUESTED** that draft standards are similarly proposed for the longline fleets by CPCs currently trialling and implementing EMS on these vessels and that draft standards are also developed for gillnet fleets through the ROS Pilot Project.

Other Business

Template for Invited Experts

SC20.50 (para. 237) Noting the recommendation of the IOTC Performance Review (PRIOTC02.02d), the SC **AGREED** that a comprehensive, formal external peer review is sometimes important for important or contentious assessments. Thus, the SC **RECOMMENDED** that a process is established and that the Commission allocates funding for external peer review of stock assessments to take place periodically, based on priorities identified by the SC, and **REQUESTED** that the Secretariat develop ToRs for these, with input from the SC Chair and Vice-Chair, and potentially based on a framework similar to that established for the Center for Independent Experts.

Table 1. Status summary for species of tuna and tuna-like species under the IOTC mandate, as well as other species impacted by IOTC fisheries.

Temperate and tropical tuna stocks: main stocks being targeted by industrial, and to a lesser extent, artisanal fisheries throughout the Indian Ocean, both on the high seas and in the EEZ of coastal states.

Stock	Indicators		2012	2013	2014	2015	2016	2017	Advice to the Commission
Albacore *Thunnus alalunga*	Catch 2016: Average catch 2012–2016: MSY (1000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1000 t) (80% CI): F_{2014}/F_{MSY} (80% CI): SB_{2014}/SB_{MSY} (80% CI): SB_{2014}/SB_{1950} (80% CI):	35,996 t 35,150 t 38.8 (33.9–43.6) - 30.0 (26.1–34.0) 0.85 (0.57–1.12) 1.80 (1.38–2.23) 0.37 (0.28–0.46)							Although considerable uncertainty remains in the SS3 assessment, particularly due to the lack of biological information on Indian Ocean albacore tuna stocks, a precautionary approach to the management of albacore tuna should be applied by capping total catch levels to MSY levels (38,800 t). Click here for full stock status summary: Appendix VIII
Bigeye tuna *Thunnus obesus*	Catch 2016: Average catch 2012–2016: MSY (1,000 t) (80%): F_{MSY} (80%): SB_{MSY} (1,000 t) (80%): F_{2015}/F_{MSY} (80%): SB_{2015}/SB_{MSY} (80%): SB_{2015}/SB_0 (80%):	86,586 t 100,455 t 104 (87-121) 0.17 (0.14-0.20) 525 (364-718) 0.76 (0.49-1.03) 1.29 (1.07-1.51) 0.38 (n.a. – n.a.)						83.7%	The stock status determination did not qualitatively change in 2017. If catches remain below the estimated MSY levels estimated for the current mix of fisheries, then immediate management measures are not required. However, increased catch or increases in the mortality on immature fish will likely increase the probabilities of breaching reference levels in the future. Continued monitoring and improvement in data collection, reporting and analysis is required to reduce the uncertainty in assessments. Click here for full stock status summary: Appendix IX

Stock	Indicators		2012	2013	2014	2015	2016	2017	Advice to the Commission
Skipjack tuna *Katsuwonus pelamis*	Catch 2016: Average catch 2012–2016: $Yield_{40\%SSB}$ (1000 t) (80% CI): $E_{40\%SSB}$ (80% CI): $C_{2016}/C_{40\%SSB}$ (80% CI): SB_{2016} (1000 t) (80% CI): $SB_{2016}/SB_{40\%SSB}$ (80% CI): SB_{2016}/SB_0 (80% CI): $E_{40\%SSB}$ (80% CI): SB_0 (1000 t) (80% CI):	446,723 t 407,456 t 510.1 (455.9–618.8) 0.59 (0.53–0.65) 0.88 (0.72-0.98) 796.66 (582.65-1,059.29) 1.00 (0.88–1.17) 0.40 (0.35–0.47) 0.59 (0.53-0.65) 2,015 (1,651–2,296)						**47%**	The catch limit will be calculated applying the Harvest Control Rule specified in Resolution 16-02. Following Resolution 16/02, the catch limit is calculated as [Imax x Etarg x Bcurr] = 1 * 0.59 * 796,660 t. which results in an annual overall catch limit of 470,029 t. for the period 2018-2020. Click here for full stock status summary: Appendix X
Yellowfin tuna *Thunnus albacares*	Catch 2016: Average catch 2012–2016: MSY (1000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2015}/F_{MSY} (80% CI): SB_{2015}/SB_{MSY} (80% CI): SB_{2015}/SB_0 (80% CI):	412,679 t 407,985 t 422 (406-444) 0.151 (0.148-0.154) 947 (900-983) 1.11 (0.86-1.36) 0.89 (0.79-0.99) 0.29 (n.a.-n.a.)						**67.6%**	As no stock assessment was conducted in 2017, the stock status determination has not changed since 2016, and gives a somewhat more optimistic estimate of stock status than the 2015 assessment as a result of the use of more reliable information on catch rates of longline fisheries and catches updated to 2016. The stock status is driven by unsustainable catches of yellowfin tuna taken over the last five (5) years, and the relatively low recruitment levels estimated by the model in recent years. The Commission has an interim plan for the rebuilding of this stock (Resolution 17/01, which is yet to be evaluated and superseded Resolution 16/01) to achieve the recovery of yellowfin stock, with catch limitations based on 2014/2015 levels. The projections produced to advise on future catches are, in the short term, driven by the below average recruitment estimated for in recent years since these year classes have yet to reach maturity and contribute to the spawning biomass. Click here for full stock status summary: Appendix XI

Billfish: The billfish stocks are exploited by industrial and artisanal fisheries throughout the Indian Ocean, both on the high seas and in the EEZ of coastal states. While marlins and sailfish are not usually targeted by most fleets, they are caught and retained as byproduct by the main industrial fisheries, and are are also important for localised small-scale and artisanal fisheries or as targets in sports and recreational fisheries.

Stock	Indicators	2012	2013	2014	2015	2016	2017	Advice to the Commission
Swordfish *Xiphias gladius*	Catch 2016: 31,407 t Average catch 2012–2016: 31,463 t MSY (1,000 t) (80% CI): 31.59 (26.30–45.50) F_{MSY} (80% CI): 0.17 (0.12–0.23) SB_{MSY} (1,000 t) (80% CI): 43.69 (25.27–67.92) F_{2015}/F_{MSY} (80% CI): 0.76 (0.41–1.04) SB_{2015}/SB_{MSY} (80% CI): 1.50 (1.05–2.45) SB_{2015}/SB_{1950} (80% CI): 0.31 (0.26–0.43)						83%	The most recent catches (31,407 t in 2016) are at the MSY level (31,590 t). However, given the uncertainty of most recent catches from Indonesian fresh tuna longline fisheries there is a possibility that total catches could already be 39,777 t. The catches should not be increased beyond the MSY level (31,590 t). Click here for full stock status summary: Appendix XII
Black marlin *Makaira indica*	Catch 2016: 17,829 t Average catch 2012–2016: 16,638 t MSY (1,000 t) (80% CI): 9.932 (6.963-12.153) F_{MSY} (80% CI): 0.211 (0.089-0.430) B_{MSY} (1,000 t) (80% CI): 47.430 (27.435-100.109) F_{2015}/F_{MSY} (80% CI): 2.42 (1.52-4.06) B_{2015}/B_{MSY} (80% CI): 0.81 (0.55-1.10) B_{2015}/B_{1950} (80% CI): 0.30 (0.20-0.41)						80%	The current catches are considerably higher than MSY (9,932 t) and the stock is overfished (B_{2015}< B_{MSY} and currently subject to overfishing (F_{2015}> F_{MSY}). Even with a 40% reduction in current catches, it is very unlikely (less than 5%) to achieve the Commission objectives of being in the green zone of the Kobe Plot by 2025. Current catch levels are not sustainable and there is a need for urgent actions to decrease these catch levels. In order to enable the stock to start rebuilding, the Commission should consider a reduction of substantially greater than 40% from the current catches. Click here for full stock status summary: Appendix XIII
Blue marlin *Makaira nigricans*	Catch 2016: 16,353 t Average catch 2012–2016: 15,859 t MSY (1,000 t) (80% CI): 11.926 (9.232–16.149) F_{MSY} (80% CI): 0.109 (0.076 –0.160) B_{MSY} (1,000 t) (80% CI): 113.012 (71.721 – 161.946) F_{2015}/F_{MSY} (80% CI): 1.18 (0.80–1.71) B_{2015}/B_{MSY} (80% CI): 1.11 (0.90–1.35) B_{2015}/B_{1950} (80% CI): 0.56 (0.44 – 0.71)						46.8 %	The current catches (average of 15,859 t in the last 5 years, 2012-2016) are higher than MSY (11,926 t) estimated for 2015 and the stock is currently subject to overfishing ($F_{2015} > F_{MSY}$). If catches of blue marlin are reduced to a maximum value of 11,704 t. (24 % reduction from average catch 2013-2015 at the time of the assessment), then the stock is expected to recover to the green zone of the Kobe Plot by 2025 ($F_{2025} < F_{MSY}$ and $B_{2025} > B_{MSY}$) with at least a 50% probability. Click here for full stock status summary: Appendix XIV

Striped marlin *Tetrapturus audax*	Catch 2016: 5,299 t Average catch 2012–2016: 4,854 t MSY (1,000 t) (80% CI): (3.26–5.40) F_{MSY} (80% CI): (0.05–0.9) B_{MSY} (1,000 t) (80% CI): (1.82–61.0) F_{2015}/F_{MSY} (80% CI): (1.32–3.40) B_{2015}/B_{MSY} (80% CI): (0.24–0.62) B_{2015}/B_{1950} (80% CI): (0.09–0.32)					60%		Current or increasing catches have a very high risk of further decline in stock status. In order to enable the stock to start rebuilding, the Commission should consider a substantial reduction of catches. Quantitative advice will be provided after the next stock assessment which will be carried out in 2018. Click here for full stock status summary: Appendix XV
Indo-Pacific Sailfish *Istiophorus platypterus*	Catch 2016: 27,975 t Average catch 2012–2016: 28,498 t MSY (1,000 t) (80% CI): 25.00 (16.18–35.17) F_{MSY} (80% CI): 0.26 (0.15–0.39) B_{MSY} (1,000 t) (80% CI): 87.52 (56.30–121.02) F_{2014}/F_{MSY} (80% CI): 1.05 (0.63–1.63) B_{2014}/B_{MSY} (80% CI): 1.13 (0.87–1.37) B_{2014}/B_{1950} (80% CI): 0.56 (0.44–0.67)							The same management advice for 2017 (catches below a MSY of 25,000 t) is kept for the next year (2018). Click here for full stock status summary: Appendix XVI

Neritic tunas and mackerel: These six species have become as important or more important as the three tropical tuna species (bigeye tuna, skipjack tuna and yellowfin tuna) to most IOTC coastal states. Neritic tunas and mackerels are caught primarily by coastal fisheries, including small-scale industrial and artisanal fisheries, and are almost always caught within the EEZs of coastal states. Historically, catches were often reported as aggregates of various species, making it difficult to obtain appropriate data for stock assessment analyses.

Stock	Indicators	2012	2013	2014	2015	2016	2017	Advice to the Commission
Bullet tuna *Auxis rochei*	Catch 2016: 8,900 t Average catch 2012–2016: 9,099 t MSY (1,000 t) (80% CI): unknown F_{MSY} (80% CI): unknown B_{MSY} (1,000 t) (80% CI): unknown $F_{current}/F_{MSY}$ (80% CI): unknown $B_{current}/B_{MSY}$ (80% CI): unknown $B_{current}/B_0$ (80% CI): unknown							For assessed species of neritic tunas in Indian Ocean (longtail tuna, kawakawa and narrow barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both F_{MSY} and B_{MSY} were breached thereafter. Therefore, in the absence of a stock assessment of bullet tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (8,870 t). This catch advice should be maintained until an assessment of bullet tuna is available. Considering that MSY-based reference points for assessed species can change over time, 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 requirements, so as to better inform scientific advice. Click here for full stock status summary: Appendix XVII
Frigate tuna *Auxis thazard*	Catch 2016: 83,300 t Average catch 2012–2016: 91,844 t MSY (1,000 t) (80% CI): unknown F_{MSY} (80% CI): unknown B_{MSY} (1,000 t) (80% CI): unknown $F_{current}/F_{MSY}$ (80% CI): unknown $B_{current}/B_{MSY}$ (80% CI): unknown $B_{current}/B_0$ (80% CI): unknown							For assessed species of neritic tunas in Indian Ocean (longtail tuna, kawakawa and narrow barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both F_{MSY} and B_{MSY} were breached thereafter. Therefore, in the absence of a stock assessment of frigate tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (94,921 t).. This catch advice should be maintained until an assessment of frigate tuna is available. Considering that MSY-based reference points for assessed species can change over time, 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 requirements, so as to better inform scientific advice. Click here for full stock status summary: Appendix XVIII

Kawakawa *Euthynnus affinis*	Catch 2016: 156,831 t Average catch 2012–2016: 158,990 t MSY (1,000 t) (80% CI): 152 [125 –188] F_{MSY} (80% CI): 0.56 [0.42–0.69] B_{MSY} (1,000 t) (80% CI): 202 [151–315] F_{2013}/F_{MSY} (80% CI): 0.98 [0.85–1.11] B_{2013}/B_{MSY} (80% CI): 1.15 [0.97–1.38] B_{2013}/B_{1950} (80% CI): 0.58 [0.33–0.86]							Although the stock status is classified as not overfished and not subject to overfishing, the Kobe strategy II matrix developed in 2015 showed that there is a 96% probability that biomass is below MSY levels and 100% probability that $F>F_{MSY}$ by 2016 and 2023 if catches are maintained at the 2013 levels. There is a 55 % probability that biomass is below MSY levels and 91 % probability that $F>F_{MSY}$ by 2023 if catches are maintained at around 2016 levels. The modelled probabilities of the stock achieving levels consistent with the MSY reference points (e.g. $SB > SB_{MSY}$ and $F<F_{MSY}$) in 2023 are 100% for a future constant catch at 80% of 2013 catch levels. If catches are reduced by 20% based on 2013 levels at the time of the assessment (170,181 t), the stock is expected to recover to levels above MSY reference points with a 50% probability by 2023. Click for a full stock status summary: Appendix XIX
Longtail tuna *Thunnus tonggol*	Catch 2016: 133,334 t Average catch 2012–2016: 149,224 t MSY (1,000 t) (80% CI): 140 (103–184) F_{MSY} (80% CI): 0.43 (0.28–0.69) B_{MSY} (1,000 t) (80% CI): 319 (200–623) F_{2015}/F_{MSY} (80% CI): 1.04 (0.84–1.46) B_{2015}/B_{MSY} (80% CI): 0.94 (0.68–1.16) B_{2015}/B_{1950} (80% CI): 0.48 (0.34–0.59)						**67%**	There is a substantial risk of exceeding MSY-based reference points by 2018 if catches are maintained at current (2015) levels (63% risk that $B_{2018}<B_{MSY}$, and 55% risk that $F_{2018}>F_{MSY}$). If catches are reduced by 10% this risk is lowered to 33% probability $B_{2018}<B_{MSY}$ and 28% probability $F_{2018}>F_{MSY}$). If catches are capped at current (2015) levels at the time of the assessment (i.e. 136,849 t), the stock is expected to recover to levels above MSY reference points with at least a 50% probability by 2025. Click for a full stock status summary: Appendix XX
Indo-Pacific king mackerel *Scomberomorus guttatus*	Catch 2016: 45,978 t Average catch 2012–2016: 45,819 t MSY (1,000 t) (80% CI): 46 [38.9–54.4] F_{MSY} (80% CI): 0.52 [0.40–0.69] B_{MSY} (1,000 t) (80% CI): 66.0 [45.9–107.9] $F_{current}/F_{MSY}$ (80% CI): 0.98 [0.85–1.14] $B_{current}/B_{MSY}$ (80% CI): 1.10 [0.84–1.29] $B_{current}/B_{1950}$ (80% CI): 0.55 [0.42–0.64]							For assessed species of neritic tunas in Indian Ocean (longtail tuna, kawakawa and narrow barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both F_{MSY} and B_{MSY} were breached thereafter. Therefore, in the absence of a stock assessment of Indo-Pacific king mackerel a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (46,787 t). This catch advice should be maintained until an assessment of Indo-Pacific king mackerel is available. Considering that MSY-based reference points for assessed species can change over time, 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 requirements, so as to better inform scientific advice. Click for a full stock status summary: Appendix XXI

Narrow-barred Spanish mackerel *Scomberomorus commerson*	Catch 2016: 168,350 t Average catch 2012–2016: 161,951 t MSY (1,000 t) (80% CI): 131 [96–180] F_{MSY} (80% CI): 0.35 [0.18–0.7] B_{MSY} (1,000 t) (80% CI): 371 [187–882] F_{2015}/F_{MSY} (80% CI): 1.28 [1.03–1.69] B_{2015}/B_{MSY} (80% CI): 0.89 [0.63–1.15] B_{2015}/B_{1950} (80% CI): 0.44 [0.31–0.57]					89%	There is a continued high risk of exceeding MSY-based reference points by 2025, even if catches are reduced to 80% of the 2015 levels (73% risk that $B_{2025}<B_{MSY}$, and 99% risk that $F_{2025}>F_{MSY}$). The modelled probabilities of the stock achieving levels consistent with the MSY reference levels (e.g. B > B_{MSY} and F<F_{MSY}) in 2025 are 93% and 70%, respectively, for a future constant catch at 70% of current catch level. If catches are reduced by 30% of the 2015 levels at the time of the assessment, which corresponds to catches below MSY, the stock is expected to recover to levels above the MSY reference points with at least a 50% probability by 2025. Click for a full stock status summary: Appendix XXII

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.

Stock	Indicators	2012	2013	2014	2015	2016	2017	Advice to the Commission
Blue shark *Prionace glauca*	Reported Catch 2016: 32,312 t Estimated catch 2015: 54,735 t Not elsewhere included (nei) sharks 2016: 54,495 t Average reported catch 2012-16: 30,563 t Average estimated catch 2011–15: 54,993 t Ave. not elsewhere included (nei) 2012-16 49152 t MSY (1,000 t) (80% CI): 33.0 (29.5 - 36.6) F_{MSY} (80% CI): 0.30 (0.30 - 0.31) SB_{MSY} (1,000 t) (80% CI): 39.7 (35.5 - 45.4) F_{2015}/F_{MSY} (range): 0.86 (0.67 - 1.09) SB_{2015}/SB_{MSY} (range): 1.54 (1.37 - 1.72) SB_{2015}/SB_0 (range): 0.52 (0.46 - 0.56)						72.6 %	Even though the blue shark in 2017 is assessed to be not overfished nor subject to overfishing, maintaining current catches is likely to result in decreasing biomass and the stock becoming overfished and subject to overfishing in the near future. If the catches are reduced at least 10%, the probability of maintaining stock biomass above MSY reference levels (B>B_{MSY}) over the next 8 years will be increased. The stock should be closely monitored. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission, so as to better inform scientific advice in the future. Click for a full stock status summary: Appendix XXIII

Oceanic whitetip shark *Carcharhinus longimanus*	Reported Catch 2016: 503 t Not elsewhere included (nei) sharks 2016: 54,495 t Average reported catch 2012–2016: 303 t Not elsewhere included (nei) sharks 2012–2016: 49,152 MSY (range): Unknown							A cautious 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. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission, so as to better inform scientific advice. 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. Click for a full stock status summary: Appendix XXIV
Scalloped hammerhead shark *Sphyrna lewini*	Reported catch 2016: 77 t Not elsewhere included (nei) sharks 2016: 54,495 t Average reported catch 2012–2016: 69 t Not elsewhere included (nei) sharks 2012–2016: 49,152 t MSY (range): unknown							Despite the absence of stock assessment information, the Commission should consider taking a cautious approach by implementing some management actions for scalloped hammerhead sharks. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission so as to better inform scientific advice. Click for a full stock status summary: Appendix XXV
Shortfin mako *Isurus oxyrinchus*	Reported Catch 2016 : 1,631 t Not elsewhere included (nei) sharks 2016: 54,495 t Average reported catch 2012–2016: 1,503 t Not elsewhere included (nei) sharks 2012–2016: 49,152 t MSY (range): unknown							Despite the absence of stock assessment information, the Commission should consider taking a cautious approach by implementing some management actions for shortfin mako sharks. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission so as to better inform scientific advice.. Click for a full stock status summary: Appendix XXVI
Silky shark *Carcharhinus falciformis*	Reported Catch 2016 : 2,189 t Not elsewhere included (nei) sharks 2016: 54,495 t Average reported catch 2012–2016: 3,278 t Not elsewhere included (nei) sharks 2012–2016: 49,152 MSY (range): unknown							Despite the absence of stock assessment information, the Commission should consider taking a cautious approach by implementing some management actions for silky sharks. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission so as to better inform scientific advice. Click for a full stock status summary: Appendix XXVII

Bigeye thresher shark *Alopias superciliosus*	Reported Catch 2016 : 0 t Not elsewhere included (nei) sharks 2016: 54,495 t Average reported catch 2012–2016: 93 t Not elsewhere included (nei) sharks 2012–2016: 49,152 MSY (range): unknown							The prohibition on retention of bigeye thresher shark should be maintained. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission, so as to better inform scientific advice. 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. Click for a full stock status summary: Appendix XXVIII
Pelagic thresher shark *Alopias pelagicus*	Reported Catch 2016 : 0 t Not elsewhere included (nei) sharks 2016: 54,495 t Average reported catch 2012–2016: 66 t Not elsewhere included (nei) sharks 2012–2016: 49,152 MSY (range): unknown							The prohibition on the retention of pelagic thresher shark should be maintained. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission s, so as to better inform scientific advice. 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. Click for a full stock status summary: Appendix XXIX

*Estimated probability that the stock is in the respective quadrant of the Kobe plot (shown below), derived from the confidence intervals associated with the current stock status. ** Range of plausible model runs.

Colour key	Stock overfished(SB_{year}/SB_{MSY}< 1)	Stock not overfished (SB_{year}/SB_{MSY}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)		
Not assessed/Uncertain		

1. OPENING OF THE SESSION

1. The 20th Session of the Indian Ocean Tuna Commission's (IOTC) Scientific Committee (SC) was held in Seychelles, from 30 November to 4 December 2017. A total of 63 delegates and other participants (65 in 2016) attended the Session, comprised of 53 delegates (51 in 2016) from 21 Contracting Parties (21 in 2016), and no delegates from Cooperating Non-Contracting Party (1 in 2016), and 10 observers, including 2 invited experts (13 observers in 2016). The list of participants is provided at Appendix I. The meeting was opened on 30 November 2017 by the Chairperson (Dr Hilario Murua – EU,Spain) and the IOTC Secretariat. The SC noted the warm welcome from the new IOTC Executive Seretary, Dr Chris O'Brien.

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

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

3. The SC noted the first and second statements from Mauritius, and the associated responses from France (OT), and United Kingdom (OT) as provided in Appendix IVa.

3. ADMISSION OF OBSERVERS

4. The SC noted that the applications by new Observers should continue to follow the procedure as outlined in Rule XIV of the IOTC Rules of Procedure (2014).

3.1 Intergovernmental Organisations (IGO)

5. In accordance with Rule VI.1 and XIV.4 of the IOTC Rules of Procedure (2014), the SC admitted the following Inter-governmental organisations (IGO) as observers to the 20th Session of the SC:
   - SWIOFC
   - Agreement on the Conservation of Albatross and Petrels (ACAP)

3.2 Non-governmental Organisations (NGO)

6. In accordance with Rule VI.1 and XIV.5 of the IOTC Rules of Procedure (2014), the SC admitted the following Non-governmental organisations (NGO) as observers to the 20th Session of the SC:
   - International Seafood Sustainability Foundation (ISSF)
   - BirdLife International (BI)
   - Sustainable Fisheries Partnership (SFP)
   - WWF Mozambique

3.3 Invited experts

7. In accordance with Rules VI.1 and XIV.9 of the IOTC Rules of Procedure (2014), which state that the Commission may invite experts, in their individual capacity, to enhance and broaden the expertise of the SC and of its Working Parties, the SC admitted the invited experts from Taiwan,China to the 20th Session of the SC.

4. DECISIONS OF THE COMMISSION RELATED TO THE WORK OF THE SCIENTIFIC COMMITTEE

4.1 Outcomes of the 21st Session of the Commission

8. The SC noted paper IOTC–2017–SC20–03 which outlined the decisions and requests made by the Commission at its 21st Session, held in May 2017, specifically relating to the IOTC science process, including the 8 Conservation and Management Measures (consisting of 8 Resolutions and no Recommendations), as detailed below:

Resolutions

- Resolution 17/01 *On an interim plan for rebuilding the Indian Ocean yellowfin tuna stock in the IOTC Area of Competence*
- Resolution 17/02 *Working party on the implementation of Conservation and Management Measures (WPICMM).*

- Resolution 17/03 *On establishing a list of vessels presumed to have carried out illegal, unreported and unregulated fishing in the IOTC Area of competence.*
- Resolution 17/04 *On a ban on discards of Bigeye tuna, Skipjack tuna, Yellowfin tuna, and non-targeted species caught by purse seine vessels in the IOTC Area of Competence*
- Resolution 17/05 *On the conservation of sharks caught in association with fisheries managed by the IOTC.*
- Resolution 17/06 *On establishing a programme for transhipment by large-scale fishing vessels*
- Resolution 17/07 *On the prohibition to use large-scale driftnets in the IOTC Area*
- Resolution 17/08 *Procedures on a fish aggregating devices (FADs) management plan, including a limitation on the number of FADs, more detailed specifications of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species*

9. The SC noted that pursuant to Article IX.4 of the IOTC Agreement, most of the above mentioned Conservation and Management Measures became binding on Members, 120 days from the date of the notification communicated by the IOTC Secretariat in IOTC Circular Circular 2017–061 (i.e. 3 October 2017). The updated *Compendium of Active Conservation and Management Measures for the Indian Ocean Tuna Commission* may be downloaded from the IOTC website at the following link, dated 3 October 2017:
   - English: http://iotc.org/cmms
   - French: http://iotc.org/fr/mcgs

10. Noting that the Commission also made a number of general comments and requests on the recommendations made by the Scientific Committee in 2016 that were listed in the report of the 21st Session of the Commission, the SC **AGREED** that any advice to the Commission would be provided in the relevant sections of this report, in particular on the statements below from the report:

    The Commission noted the status summaries (2011-2015) for species of tuna and tuna-like species under the IOTC mandate, as well as other species impacted by IOTC fisheries (Appendix 6) and considered the recommendations made by the SC19 in its 2016 report (IOTC–2016–SC19–R, Appendix XXXVII) that related specifically to the Commission. The Commission ***ENDORSED*** *the list of recommendations as its own, while taking into account the range of issues outlined in this Report (S21) 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.*

    The Commission ***AGREED*** *that when establishing a catch limit for skipjack tuna using the Harvest Control Rule (HCR) adopted in Resolution 16/02, the following procedure will be applied: after the review of the assessment of skipjack tuna by the SC, the result of the assessment will be used by the SC in the calculation of a catch limit using the adopted HCR. The Secretariat will then notify to CPC's of the new catch limit for skipjack tuna that will apply for 2018.*

    The Commission acknowledged that there was little information available in 2016 for the SC to fully review the effectiveness of the mitigation measures outlined in Resolution 12/06, and ***AGREED*** *to extend the due date until such a time that more information is available.*

    The Commission noted the presentation by Australia on the schedule of work for the development of management procedures for key species in the IOTC Area (IOTC-2017-S21-14). The schedule provides information on when and how the Commission ought to be engaged in the management procedures process, and was developed with inputs from CPC's, relevant IOTC working parties, the Scientific Committee, and uses, as its basis, the work plan of the Scientific Committee.

    The Commission ***ENDORSED*** *the schedule that was revised during S21 (provided in Appendix 9), noting it is a 'living document' to guide the work of the Commission and its subsidiary bodies in the future. The Commission also* ***REQUESTED*** *that a budget for implementation of the schedule be reviewed by the SCAF in 2018.*

4.2 Previous decisions of the Commission

11. The SC noted paper IOTC–2017–SC20–04 which outlined a number of Commission decisions, in the form of previous Resolutions that require a response from the SC in 2017, or for the SC to include the requested elements into its Program of Work, and **AGREED** to develop advice to the Commission in response to each request during the current Session.

12. The SC noted paper IOTC-2017-SC20-14 which provides scientific advice to support the implementation of IOTC Resolution 16/06 *On measures applicable in case of non fulfilment of reporting obligations in the IOTC.*

13. The SC **RECOMMENDED** that Resolution 15/02 *Mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)* be reviewed to include the mandatory reporting of zero catches for all species under the mandate of IOTC, in order to support the implementation of IOTC Resolution 16/06 *On measures applicable in case of non fulfilment of reporting obligations in the IOTC*.

14. The SC **REQUESTED** the Secretariat distribute a circular requesting that zero catches (for 2016 data) are submitted prior to the next Compliance Committee meeting in 2018, and **REQUESTED** that the IOTC Secretariat also liaise with other RFMOs, and in particular ICCAT, to exchange common practices on the reporting of zero catches by CPCs.

5. Science Related Activities of the IOTC Secretariat in 2017

5.1 Report of the Secretariat – Activities in support of the IOTC science process in 2017

15. The SC noted paper IOTC-2017-SC20-05 which provided an overview of the work undertaken by the IOTC Secretariat in 2017, and thanked the IOTC Secretariat for the contributions to the science process in 2017, in particular via support to the Working Parties and Scientific Committee meetings, facilitation of the IOTC Meeting Participation Fund, improvements in the quality of the data sets being collected and submitted to the IOTC Secretariat, capacity building activities, and through the facilitation of consultants and invited experts to raise the standard of IOTC meetings.

16. The SC thanked the IOTC Secretariat for their efforts and work conducted in 2017, including capacity building, data collection and management, stock assessment, and facilitation of the IOTC Working Parties, particularly given the current staffing issues within the IOTC Secretariat (e.g., the current vacancy of the Science Manager, and vacancy of the Executive Secretary until August 2017).

17. The SC noted that the recruitment of the Science Manager is in progress, and that the selection process will be finalized in early 2018.

18. The SC further noted that even if fully staffed, the IOTC Secretariat will require additional staff to ensure the successful delivery of the many and various requests made upon its time by the Commission and its subsidiary bodies (e.g., implementation of the Regional Observer Scheme Pilot Project, and assistance for implementation of Resolution of 17/01 On an interim plan for rebuilding the Indian Ocean yellowfin tuna stock in the IOTC area of competence). Thus, in Section 7.7 the SC will propose additional staffing requirements to the Commission for its consideration.

6. National Reports from CPCs

6.1 National Reporting to the Scientific Committee: overview

19. The SC noted that 22 National Reports were submitted to the IOTC Secretariat in 2017 by CPCs (21 Contracting Parties and 1 Cooperating Non-Contracting Parties), the abstracts of which are provided at Appendix IVb.

20. The SC reminded CPCs that the purpose of the National Reports is to provide relevant information to the SC on fishing activities of Contracting Parties (Members) and Cooperating Non-Contracting Parties (collectively termed CPCs) operating in the IOTC area of competence. The report should include all fishing activities for species under the IOTC mandate as well as sharks and other byproduct / bycatch species as required by the IOTC Agreement and decisions by the Commission.

21. The SC reminded CPCs that the submission of a National Report is mandatory, irrespective of whether a CPC intends on attending the annual meeting of the SC or not and shall be submitted no later than 15 days prior to the SC meeting. In 2017, of the 22 National Reports submitted, 4 were submitted after the deadline. The National Report does not replace the need for submission of data according to the IOTC Mandatory Data Requirements listed in the relevant IOTC Resolubtion [currently Resolution 15/02 *On mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)*].

22. The SC noted the importance of consistency and standardisation in the format of reporting on fisheries in National Reports and **REQUESTED** that CPCs follow the reporting template agreed by the Commission.

23. The SC **AGREED** that if required, interested CPCs should seek assistance from the IOTC Secretariat in the development of National Reports. Requests should be made as early as possible so that the IOTC Secretariat may be able to better coordinate the resources available.

24. Noting that the Commission, at its 15th Session, expressed concern regarding the limited submission of National Reports to the SC, and stressed the importance of providing the reports by all CPCs, the SC **RECOMMENDED**

that the Commission note that in 2017, 22 reports were provided by CPCs (23 in 2016, 26 in 2015, 26 in 2014) (Table 2).

25. The SC **RECOMMENDED** that the Compliance Committee and Commission note the lack of compliance by 10 Contracting Parties (Members) and 2 Cooperating Non-Contracting Parties (CNCPs) that did not submit a National Report to the Scientific Committee in 2017, noting that the Commission agreed that the submission of the annual reports to the Scientific Committee is mandatory.

Table 2. CPC submission of National Reports to the SC from 2005 to 2017.

CPC	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Contracting Parties (Members)													
Australia													
China													
Comoros													
Eritrea													
European Union													
France (OT)													
Guinea													
India													
Indonesia	n.a.	n.a.											
Iran, Islamic Rep. of													
Japan													
Kenya													
Korea, Republic of													
Madagascar													
Malaysia													
Maldives, Rep. of	n.a.	n.a.	n.a.	n.a.									
Mauritius													
Mozambique	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.							
Oman, Sultanate of													
Pakistan													
Philippines													
Seychelles, Rep. of													
Sierra Leone	n.a.	n.a.	n.a.										
Somalia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.				
Sri Lanka													
South Africa, Rep. of													
Sudan													
Tanzania, United Republic of	n.a.	n.a.											
Thailand													
United Kingdom (OT)													
Yemen	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.						
Cooperting Non-Contracting Parties													
Bangladesh	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.			
Djibouti	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.				
Liberia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.			
Senegal													

Green = submitted. Red = not submitted. n.a. = not applicable (not a CPC in that year). Green hash = submitted as part of EU report.

6.2 Contracting Parties (Members)

26. Noting the 22 National Reports submitted to the IOTC Secretariat in 2017 by Contracting Parties (Members), the SC expressed concern about the difference between the catches submitted in National Reports and total catches, by fleet, in the IOTC database. The IOTC Secretariat uses the information from the National Report to update estimates of nominal catches, in the case of revisions to the data or when CPCs have not submitted any catch data; however, the time available between submission of the National Reports and the Scientific Committee makes it difficult to update the IOTC nominal database prior to the annual Session. The quality of the National Reports is highly variable and interested CPCs should contact the IOTC Secretariat prior to the report deadline to ensure their reports are compliant with the guidelines. The following matters were raised in regard to the content of specific reports:
    - **Australia**: The SC noted that Australia had a relatively low number of active vessels operating in the IOTC area in 2016, and has implemented compulsory e-monitoring on all longline vessels, with the additional deployment of on-board observers on vessels fishing in international waters.
    - **China**: The SC noted that there has been a significant improvement in the implementation of observer coverage on Chinese vessels since 2016, which achieved the minimum 5% coverage rate. The SC futher noted that there is currently no observer data, or vessels fishing in the southern Indian Ocean, and hence no reports of seabird interactions. The SC noted that Birdlife have provided training in seabird mitigation measures for Chinese stakeholders and that this collaborative work will continue. The SC also noted that China is currently considering developing an NPOA for sharks.
    - **Comoros:** The SC noted the sharp increase in billfish catches reported to the IOTC Secretariat in 2017, and **REQUESTED** that the IOTC Secretariat liaise with Comoros to investigate the reason for the increase and determine whether catches in the IOTC database should be revised for previous years in order to ensure consistency in the historical time series.
    - **Eritrea**: The SC expressed its disappointment that Eritrea did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjunction with the Chairpersons of the Compliance Committee and Commission, remind Eritrea to fulfil its reporting obligations to the IOTC. Eritrea became a Contracting Party of the IOTC in 1994 and as such it is a requirement to comply with the National Report obligation to the Scientific Committee.
    - **European Union (EU):** The SC noted that the number of purse seine and longline EU-flagged vessels declined by around 20% in 2017.
    - **France (OT)**: The SC recalled that the fleet flagged in Mayotte, formerly included in the France (OT) report, joined the EU fleet in 2014 and that France (OT) no longer has any fishing fleet. The SC also noted that France (OT) has an ongoing observer programme for the fleets that are licensed to operate in its waters and that the deployment of drifting FADs or fishing on drifting FADs in the EEZ of Glorieuses is prohibited due to its marine park status.
    - **Guinea**: The SC expressed its disappointment that Guinea did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjunction with the Chairpersons of the Compliance Committee and Commission, remind Guinea to fulfil its reporting obligations to the IOTC. Guinea became a Contracting Party of the IOTC in 2005 and as such it is a requirement to comply with the National Report obligation to the Scientific Committee.
    - **India**: The SC expressed its disappointment that India did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjunction with the Chairpersons of the Compliance Committee and Commission, remind India to fulfil its reporting obligations to the IOTC. India became a Contracting Party of the IOTC in 1995 and as such it is a requirement to comply with the National Report obligation to the Scientific Committee.
    - **Indonesia**: The SC noted that despite the positive progress in developing logbooks, implementation on VMS, port sampling, and deployment of observers on-board longline and purse seine fleet, Indonesia has not reported time-area catches to the IOTC Secretariat, and strongly **ENCOURAGED** Indonesia to comply with IOTC Resolution 15/02 mandatory data reporting requirements.
    - **Iran, Islamic Rep.**: The SC noted that, following a Data Compliance and Support mission by the IOTC Secretariat in November 2017, I.R. Iran has agreed to submit future data in a format and template agreed with the IOTC Secretariat, in accordance with the reporting requirements of Resolution 15/02, which lead to improvements in the availability of time-area catches for the Iranian fisheries.
    - **Japan**: Nil comments.
    - **Kenya:** The SC noted the progress made by Kenya during 2017, with the support of the IOTC Secretariat, in the evaluation of the new Catch Assessment Survey and data collection of sports fishery data. The SC further noted that the IOTC Secretariat is planning a further visit to Kenya in December 2017 to also provide

an appraisal of the new fisheries database developed by Kenya, which aims to incorporate the data for the Catch Assessment Survey and sports fishing.

- **Korea, Rep. of**: The SC noted the program of new FAD designs to reduce the entanglement of sharks and turtles which started in 2016, the results of which will be presented to the WPTT in 2018.
- **Madagascar**: The SC expressed its disappointement that Madagascar did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjuction with the Chairpersons of the Compliance Committee and Commission, remind Madagascar to fufil its reporting oblications to the IOTC. Madagascar became a Contracting Party of the IOTC in 1996 and as such it is a requirement to comply with the National Report oblication to the Scientific Committee.
- **Malaysia**: Nil comments.
- **Maldives, Republic of**: Nil comments.
- **Mauritius**: The SC noted the increase in total catches for purse seiners (from 9,700 t in 2015 to 11,700 t in 2016), despite the descrease in number in active purse seine vessels (from 7 vessels in 2015 to 2 vessels in 2016), and **REQUESTED** the IOTC Secretariat liaise with Mauritius to confirm that information for 2016 (or earlier years) is correct.
- **Mozambique**: The SC noted that Mozambique has been collaborating with WWF to improve the sampling of artisanal fishery in coastal areas, and also that observer data have been submitted to the IOTC Secretariat.
- **Oman, Sultanate of**: The SC expressed its disappointment that Oman did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjunction with the Chairpersons of the Compliance Committee and Commission, remind Oman to fulfil its reporting obligations to the IOTC. Oman became a Contracting Party of the IOTC in 2000 and as such it is a requirement to comply with the National Report obligation to the Scientific Committee.
- **Pakistan**: The SC noted that the IOTC Secretariat has proposed a visit to Pakistan in 2018 to provide, amongst other issues, an evaluation of the revised catches submitted to the IOTC Secretariat in 2017. The SC also noted that the Pakistan intends to continue the WWF-Pakistan funded crew-based observer pilot project, following the end of funding from the Common Oceans ABNJ Tuna Project.
- **Philippines**: The SC expressed its disappointment that Philippines did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjunction with the Chairpersons of the Compliance Committee and Commission, remind Philippines to fulfil its reporting obligations to the IOTC. Philippines became a Contracting Party of the IOTC in 2004 and as such it is a requirement to comply with the National Report obligation to the Scientific Committee.
- **Seychelles, Republic of**: The SC noted an increase in both catch and effort by Seychelles purse seiners, with catches of skipjack increasing by 40% in 2016; and large increases also noted by the EU fleet – although no obvious changes in fishing operation explain the increase. The SC also noted the Seychelles has completed a review of their National Plan of Action for sharks, with a 5-year new plan scheduled for 2016-2020, and that Seychelles is also in the process a developing a NPOA for seabirds.
- **Sierra Leone**: The SC expressed its disappointment that Sierra Leone did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjunction with the Chairpersons of the Compliance Committee and Commission, remind Sierra Leone to fulfil its reporting obligations to the IOTC. Sierra Leone became a Contracting Party of the IOTC in 2008 and as such it is a requirement to comply with the National Report obligation to the Scientific Committee.
- **Somalia**: The SC noted that Somalia is making efforts to improve its capacity for data collection and reporting of catches to the IOTC Secretariat, and is expected to develop systems to enable Somalia to submit estimates of catches to the IOTC Secretariat in early 2019.
- **South Africa:** The SC noted the potential difficulties in reporting catches fishing grounds intersected by the ICCAT/IOTC boundary, and that the decrease of the catches of yellowfin tuna reported to IOTC Secretariat in 2016, and the significant increase of Mako sharks, are not due to change in the fishery operation but most likely due to fish movement in the straddling area.
- **Sri Lanka:** The SC noted the difficulties in placing observers on-board gillnet and coastal longline vessels, due to issues of space and safety at sea, and that Sri Lanka is currently exploring possibilities of trialling Electronic Monitoring Systems as part of the implementation of Resolution 16/04 Regional Observer Scheme pilot project.
- **Sudan:** The SC expressed its disappointment that Sudan did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjunction with the Chairpersons of the Compliance Committee and Commission, remind Sudan to fulfil its reporting obligations to the IOTC. Sudan became a Contracting Party of the IOTC in 1996 and as such it is a requirement to comply with the National Report obligation to the Scientific Committee.

- **Tanzania, United Republic of**: The SC expressed its disappointment that Tanzania did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjunction with the Chairpersons of the Compliance Committee and Commission, remind Tanzania to fulfil its reporting obligations to the IOTC. Tanzania became a Contracting Party of the IOTC in 2007 and as such it is a requirement to comply with the National Report obligation to the Scientific Committee.
- **Thailand**: The SC noted none of the six tuna longline vessels flagged by Thailand are currently operating in the Indian Ocean due to a two-year ban in fishing operations following malpractices from the vessel owners, and which explained the lack of seabird interactions.
- **United Kingdom (OT)**: The SC noted that were no commercial catches of tunas in 2017, although there is a small recreational fisheries sector.
- **Yemen**: The SC expressed its disappointment that Yemen did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjunction with the Chairpersons of the Compliance Committee and Commission, remind Yemen to fulfil its reporting obligations to the IOTC. Yemen became a Contracting Party of the IOTC in 2012, and as such it is a requirement to comply with the National Report obligation to the Scientific Committee.

6.3 Cooperating Non-Contracting Parties (CNCP)

27. The SC noted that only one National Report was submitted to the IOTC Secretariat in 2017 by Cooperating Non-Contracting Parties (CNCPs). The following matters were raised in regard to the content of specific reports:
    - **Bangladesh**: The SC noted the National Report from Bangladesh and thanked them for their contribution to the meeting.
    - **Djibouti**: The SC expressed its disappointment that Djibouti did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjunction with the Chairpersons of the Compliance Committee and Commission, remind Djibouti to fulfil its reporting obligations to the IOTC. Djibouti was granted Cooperating Non-Contracting Party status for the first time by the Commission at its 18th Session (2014), and as such it is a requirement of CNCP status to comply with the National Report obligation to the Scientific Committee.
    - **Senegal**: The SC expressed its disappointment that Senegal did not provide a National Report and **REQUESTED** that the SC Chairperson, in conjunction with the Chairpersons of the Compliance Committee and Commission, remind Senegal to fulfil its reporting obligations to the IOTC. Senegal is a long standing CNCP and as such it is a requirement of CNCP status to comply with the National Report obligation to the Scientific Committee.

28. The SC noted that National Reports are currently submitted in either English or French but, as no translation is provided, this can present difficulties for the meeting participants that are not bilingual (French-English). Thus, the SC **REQUESTED** that an executive summary (of no more than 3 pages in length) is included in each National Report highlighting key information which will be translated into French and English as necessary (the official languages of the IOTC) by the IOTC Secretariat, unless the CPC is able to provide the summary in both languages.

6.4 Invited Experts

29. The SC noted the information provided by the Invited Experts from Taiwan,China which outlined fishing activities in the IOTC Area of Competence. The report from the Invited Experts is available from the IOTC Secretariat upon request.

7. REPORTS OF THE 2017 IOTC WORKING PARTY MEETINGS

7.1 Report of the 7th Session of the Working Party on Neritic Tunas (WPNT07)

30. The SC noted the report of the 7th Session of the Working Party on Neritic Tunas (IOTC–2017–WPNT07–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 26 participants (20 in 2016), including 13 recipients of the MPF (8 in 2016).

7.1.1 Data quality issues

31. The SC noted the unusually high proportion of nominal catches of neritic tuna species that were either partially or fully estimated by the IOTC Secretariat in 2016 (e.g., ranging from 41% to 85% of catches depending on species), mainly due to issues with the recent data submissions from India which were submitted late, and also reported inconsistencies with catches compared to previous years.

32. The SC noted that compliance with data reporting obligations is particularly low for neritic tuna species, despite the importance of scientific data for stock assessment, and **REQUESTED** CPCs do their best to collect data and comply with data reporting requirements adopted by the IOTC. The SC further **RECOMMENDED** that

mechanisms are developed by the Commission to improve current scientific advice by encouraging CPCs to comply with their data recording and reporting requirements.

33. Noting a number of long-standing data reporting or data quality issues that severely impact the assessment of neritic species, the SC **RECOMMENDED** that funds be made available to the IOTC Secretariat (either through the IOTC Regular Budget or from external sources) dedicated to capacity building activities, or data compliance and support missions, aimed at improving the availability of data for those countries identified as a priority for neritic species in terms of importance of catches. Specifically:

    i. when sufficient data is recovered, or made available, that the IOTC Secretariat allocates funds to assist with the development of a standardized CPUE series for gillnets, in collaboration with IOTC members, including organization of a joint-workshop or hiring of an international consultant;

    ii. that the IOTC Secretariat formally communicates to India requesting the submission of mandatory datasets according to the requirements of IOTC Resolution 15/02 and, if necessary, conducts a Data Compliance and Support mission to facilitate the reporting of data to the IOTC;

    iii. that the IOTC Secretariat continues to support the work of WWF-Pakistan and the Government of Pakistan in the evaluation and reporting of the crew-based observer program, and facilitate the reporting of length data and catch-and-effort collected by the observer log-books.

34. The SC **AGREED** that a new item on data mining and collation of historical and current catch data for these species should be added as a fundamental piece of work to be undertaken as a priority and **RECOMMENDED** that this work is supported by the IOTC Secretariat.

7.1.2 CPUE standardisation

35. Ackowledging the importance of indices of abundance for future stock assessments, the SC **RECOMMENDED** that the development of standardised CPUE series is explored, based on the guidelines developed by the SC in 2015 (*Guidelines for the presentation of CPUE standardisations and stock assessment models*[1]), with priority given to fleets which account for the largest catches of neritic tuna and tuna-like species (e.g., I.R. Iran, Indonesia, India, Pakistan, and Sri Lanka).

7.1.3 Meta-analysis of growth parameters

36. The SC noted the workshop on meta-analysis and population parameters that was held back-to-back with the WPNT07 meeting and provided new estimates of growth parameters for neritic species in the Indian Ocean.

7.1.4 Neritic tuna stock assessments and management advice

37. The SC noted that all of the neritic tuna stock assessments that have been used for management advice are based on data limited catch-only methods. These methods include information on growth but no abundance indices. MSY-based reference points are thus estimated under the assumption of a symmetric production curve (Schaefer).

38. The SC noted the large uncertainties involved when assessing stocks based on highly uncertain catch data with no abundance indices.

39. The SC noted that management advice was also provided for three species for which a stock assessment was not undertaken (three species were assessed and three species were not assessed). The management advice, suggests that catches are restricted to an average of the 2009-2015 reference period. This period was chosen based on the period in time in which other neritics tunas species were estimated to have reached MSY, however, the SC noted that in the period 2009-2015 the catches reached and breached MSY and, therefore, the SC **AGREED** to use the period 2009-2011 where the MSY was reached.

40. The SC noted that the assumption of a single stock structure under which these assessments are undertaken and that this is quite fundamental for these species and **AGREED** on the importance of the stock structure project for these species.

41. The SC noted the limited progress in updating a catch-only method each year and **AGREED** that a stock assessment should be conducted every three years while the intermediate years should be focussed on improving biological data and developing abundance indices. This is reflected in the updated plan of work in Appendix XXXVII.

[1] http://iotc.org/documents/guidelines-presentation-cpue-standardisations-and-stock-assessment-models-1

7.1.5 Working party attendance and the MPF

42. The SC **RECOMMENDED** that the Commission note the following:

    1) The participation of developing coastal state scientists to the WPNT has been consistently high following the adoption and implementation of the IOTC Meeting Participation Fund adopted by the Commission in 2010 (Resolution 10/05 On the establishment of a Meeting Participation Fund for developing IOTC Members and Non-Contracting Cooperating Parties), now incorporated into the IOTC Rules of Procedure (2014), as well as though the hosting of the WPNT in developing coastal State Contracting Parties (Members) of the Commission.

    2) The continued success of the WPNT, at least in the short term, appears heavily reliant on the provision of support via the MPF which was established primarily for the purposes of supporting scientists to attend and contribute to the work of the Scientific Committee and its Working Parties.

    3) The MPF should be utilised so as to ensure that all developing Contracting Parties of the Commission are able to attend the WPNT meeting, as neritic tunas are very important resources for many of the coastal countries of the Indian Ocean.

7.2 Report of the 15th Session of the Working Party on Billfish (WPB15)

43. The SC noted the report of the 15th Session of the Working Party on Billfish (IOTC–2017–WPB15–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 18 participants (18 in 2016) including 6 recipients of the MPF (6 in 2016).

44. The SC recalled its previous **RECOMMENDATION** that on the next revision of the IOTC Agreement, the shortbill spearfish (*Tetrapturus angustirostris*) be included as an IOTC species.

7.2.1 Review of the statistical data available for billfish

45. Due to on-going uncertainties with the reliability of catches reported by Indonesia, particularly in the case of swordfish, the SC **REQUESTED** that the IOTC Secretariat, in collaboration with Indonesia, review the current methods for estimating catches of billfish for Indonesia in the IOTC database and provide an update at the next meeting of the WPB.

7.2.2 New information on sport fisheries

46. The SC noted paper IOTC-2017-SC20-INF04 describing the outcomes of a pilot project to collect catch-and-effort and size data from sports fisheries in four countries of the western Indian Ocean, including the following abstract provide by the authors:

    "*Gaps in information on sport fishing catches of IOTC species have long been an issue affecting comprehensive data collection in the Indian Ocean. Some countries such as Mauritius and Kenya have reported sport fishing data periodically to the IOTC Secretariat in the past, while for others, no data has been reported, data may be misreported or catches are known to be underestimated (e.g., Seychelles, La Réunion, Mozambique, and Oman). In many cases, this is due to the non-mandatory nature of reporting of sport fishing catches, often exacerbated by lack of technical and physical resources within National Fisheries Institutions to gather the data. A Project was developed in response to recommendations from the 9th IOTC Working Party on Billfish (WPB), endorsed by the IOTC Scientific Committee, aimed at enhancing data recovery from sports and other recreational fisheries in the region by facilitating the acquisition of catch, effort and size data from sport fisheries, by developing and disseminating reporting forms to Sport Fishing Centres in the region*."

47. The SC Acknowledged the importance of reporting data on sports/recreational fishing to the IOTC, which is a mandatory data reporting requirement of Resolution 15/02, but noted that IOTC Secretariat resources dedicated to supporting data capacity building for this fishery should be apportioned relative to the importance of cacthes of sports fishing in the Indian Ocean, which contributes to less than 1% of the total catches of IOTC species.

48. The SC **AGREED** on the importance in supporting improvements in the data collection and reporting of sports fishing data to the IOTC, within the context of capacity building within national fisheries institutions, but that a full evaluation of the outcomes of the pilot project (which concluded in September 2017) are required before further resources are considered for follow-up activities.

7.2.3 Billfish species identification

49. The SC **AGREED** on the importance of the hard, waterproof copies of the billfish IOTC species identification guides for observers and port samplers, and again **RECOMMENDED** that funds are allocated for further printing of the species ID guides for distribution to sports fishing clubs and recreational fisheries to improve the quality

of data reported, and that additional funds be provided for the translation of these into the priority languages identified by the SC.

7.2.4 Swordfish stock assessment and MSE

50. The SC noted the way in which uncertainties were included in the swordfish assessment through exploring data conflicts, the reliability of different data sources, evaluating fit to the data through standard diagnostics, the running of models with different assumption configurations to incorporate structure uncertainty. The final projections were based on a grid run of equally weighted options.

51. The SC noted that the current stock assessment of swordfish shows a stock in the green zone of the Kobe plot, given the current value of B/B_{MSY} ratio, while the stock is estimated to be at around 30% of virgin biomass.

52. The SC noted that the protocols for the assessment of species where data are relatively limited, as well as the presentation of the results of these assessments, is a medium priority item in the Programme of Work of the WPM and will be developed further in 2018.

53. The SC noted paper IOTC-2017-SC20-11 which provided an update on the development of the MSE for swordfish, including the following abstract provided by the authors:

"This document presents the first steps towards the development of an Operating Model for the Indian Ocean swordfish (Xiphias gladius) stock. It explores the role of the structural uncertainty in the current stock assessment by means of a grid of SS3 model fits. Each population model run, carried out using the same input data, has a different combination of assumed parameters and variables. The current grid, still missing some elements, results in 864 alternative population trajectories and productivity estimates, which are briefly explored."

54. The SC noted that the OM model grid will consist of 1,296 model runs, of which 864 models have been carried out so far. Around 75% of those were retained after excluding models that have estimated implausibly high virgin biomass levels. The SC noted that the development of the OM extended the range of assumptions explored during the assessment. The SC further noted that alternative scenarios of stock structure have not been considered in the current OM, but suggested they are considered in future iterations, where there is sufficient information available.

55. The SC noted that the next step of the swordfish MSE is to finalize the OM and present the results to the TCMP02 within the current resource constraints (e.g., staff time and travelling). Noting that the Commission considers the development of an MSE for swordfish to be a high priority activity, the SC **RECOMMENDED** that this is reflected in the 2019 budget of the Commission.

7.2.5 Swordfish: Grid-rNTP model

56. The SC noted that the current grid of OM runs already includes alternative scaling procedures, but their effect on the results is still to be explored. The SC **AGREED** that this should be more formally addressed using a structured approach within a Management Strategy Evaluation framework.

7.2.6 Resolution 15/05 conservation measures for billfish

57. The SC noted that Resolution 15/05 On Conservation Measures for Striped Marlin, Black Marlin and Blue Marlin encourages CPCs to *"...make any possible effort to reduce in 2016 the level of catches of their vessels...*". Moreover, Resolution 15/05 also **REQUESTS** the SC to *"...annually review the information reported by CPCs on these species*".

58. The SC noted that catches for Black Marlin, Blue Marlin, and Striped Marlin have increased in 2016 (and 2015) from the average level of 2009-2014 as observed in Appendix VIa. The catch in 2016 for Blue marlin was 3,510 t higher (27 % larger) than the average 2009-2014, 4,286 t larger (32 %) for Black marlin and 1,398 (36 %) for Striped marlin. Considering the status of these stocks the SC urgently **RECOMMENDED** that measures are agreed to recover the status of the stock of the three marlin species covered by Resolution 15/05 as per the management advice given in the Executive Summaries.

7.2.7 Revision of the WPB Program of work

59. The SC **REQUESTED** that future work continues on the stock assessment of marlins in order to improve current models and that other approaches, such as delay-difference or age-structured production models, are also explored.

7.3 Report of the 13th Session of the Working Party on Ecosystems and Bycatch (WPEB13)

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

60. **NOTING** the highly aggregated nature of information requested on discards, the SC **AGREED** that the discard reporting form (Form 1DI) is updated to include seasonal (month) and spatial information (5 x 5 or 1 x 1) in a similar format to the catch and effort data reporting forms.

7.3.2 Evaluation of the mitigation measures contained in Resolution 13/06 for Oceanic whitetip shark

61. The SC noted the ongoing compliance issue for those CPCs reporting nominal catch of oceanic whitetip sharks and **RECOMMENDED** that the Compliance Committee investigate these reported catches further and report the findings to the Commission.

7.3.3 Longline hook identification guide

62. **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 SC reiterated its previous **RECOMMENDATION** (SC19.16; para. 55 of IOTC-2016-SC19-R) that the Commission allocate funds in the 2018 IOTC Budget to develop an identification guide for fishing hooks and pelagic fishing gears used in IOTC fisheries.

7.3.4 CPUE Collaborative study of shark CPUE from multiple Indian Ocean longline fleets

63. Noting the conflicting patterns in blue shark CPUE derived from different Indian Ocean longline fleets and considering the success of using joint analysis of operational catch and effort data to resolve such conflicts in other Working Parties, the SC **RECOMMENDED** initiating work on joint analysis of operational catch and effort data from multiple fleets, to further develop methods and to provide indices of abundance for sharks of interest to the IOTC. A consultant should be considered to conduct such work for a budget of around EUR45,000.

7.3.5 Future format of WPEB

64. The SC noted the issues with the format of WPEB meetings given the increasing scope of work to cover, and particularly high workload in assessment years and **AGREED** that the current approach has not proved successful, particularly in years when a stock assessment has been undertaken as the large number of papers submitted (~60) cannot be fully considered in the time available. The SC therefore **AGREED** that in future years when a stock assessment is planned, the meeting duration is extended by two days to more adequately accommodate the workplan, with some of the days dedicated exclusively to the stock assessment work.

65. The SC further **AGREED** that when a stock assessment is planned, some of the agenda in the year prior to the meeting should be dedicated to data preparation and review.

7.3.6 Review of mitigation measures in Resolution 12/04

66. The SC noted paper IOTC-2017-SC20-INF03 and **REQUESTED** the IOTC Secretariat to send out the version of IOTC-2017-SC20-INF03 Rev_1 revised by the SC as a data call to inform a review of the mitigation measures for marine turtles in Resolution 12/04 as requested by the Commission.

67. Noting the findings of the Pacific workshop regarding the effectiveness of large circle hooks, finfish bait and the removal of the first and/or second hooks next to the floats for mitigating sea turtle interactions and mortalities in Pacific longline fisheries, the SC **AGREED** that further consideration of these mitigation techniques for Indian Ocean fisheries is warranted. Such a study should attempt to develop findings regarding the consequences of various mitigation techniques, primarily with regard to impacts on target and non-turtle bycatch species catch rates, to the extent possible based on data availability and quality. The SC therefore **RECOMMENDED** that the potential for a similar workshop to be held in the Indian Ocean is explored with potential funding from the Commission and/or from the Common Oceans ABNJ Tuna Project. The SC noted this is included in the WPEB workplan and **REQUESTED** the WPEB Chairperson work with the Secretariat to pursue this idea further with potential participants and funding sources.

7.3.7 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

68. The SC noted paper IOTC–2017–SC20–06 which provided the SC with the opportunity to consider, update and comment 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 each IOTC CPC.

69. The SC **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 in 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.

7.3.8 Update: Ecosystem Based Fisheries Management (EBFM) joint meeting of tRFMOs in 2016

70. The SC noted the need for training and capacity building as the first step to moving forward with developing goals and strategies for the implementation of EBFM and therefore **RECOMMENDED** that a workshop is held to explain the key elements of EBFM so that a plan for implementation of EBFM in the IOTC Area of Competence can be developed by 2019.

71. The SC noted the limited extent to which ecosystem considerations have so far been analysed by the WPEB. Work on topics such as climate change and socio-economic considerations are yet to begin and will likely be extremely challenging, however, progress has begun with the development of a template for an ecosystem report card (IOTC-2016-SC19-12). Noting that this work is ongoing, the SC **REQUESTED** that the authors provide an update to the WPEB14 in 2018.

72. The SC noted the presentation of the report of the joint tRFMO meeting on EBFM that took place in December 2016 and was attended by the SC Chair, the WPEB Chair and the IOTC Secretariat (IOTC-2017-SC20-INF02).

73. The SC discussed the importance of developing a long term strategy for the operationalisation of EBFM. While the IOTC is currently making progress in some areas such as the development of management advice for target species as well as for some bycatch species, holistic ecosystem analyses such as the use of ecosystem models have not been undertaken. Nevertheless, there is consideration of environmental influence on stock assessments and some work is undertaken on high risk topics, such as sensitive species, despite the lack of an overall EBFM framework.

74. The SC noted that the difficulties of operationalising EBFM within the current institutional setting where management advice is considered through the provision of HCRs in which it is difficult to incorporate ecosystem considerations.

75. The SC **AGREED** that the development of the ecosystem report card is a first step in developing the approach. Initiating the process with the development and monitoring of simple indicators and then linking these to management objectives and actions is an iterative process where the data collection and research activities are based on higher level guidance from the Commission. The SC noted that the consideration of socioeconomic dimensions are specifically mentioned in the IOTC Agreement and so the scientific subsidiary bodies are therefore mandated to work on these issues as well.

76. The SC **AGREED** that the WPEB is the best forum to initiate the detailed technical discussions and **AGREED** that the item should be given a higher priority in the programme of work and agenda.

7.4 Report of the 19th Session of the Working Party on Tropical Tunas (WPTT19)

77. The SC noted the report of the 19th Session of the Working Party on Tropical Tunas (IOTC–2017–WPTT19–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 49 participants (45 in 2016), including 10 recipients of the MPF (6 in 2016).

7.4.1 Review of new information on the status of bigeye tuna: Nominal and standardised CPUE indices

78. The SC acknowledged the efficiency value of making the operational logbook data available to appropriate analysts outside of the responsible CPCs, and **RECOMMENDED** that high level arrangements for sharing and confidentiality should be pursued. Noting the confidentiality issues with some of the datasets, the SC **REQUESTED** that the IOTC Secretariat and main stakeholders explore options to facilitate future data sharing agreements which, once in place, may not necessitate face-to-face meetings and could instead include remote processes.

79. The SC **RECOMMENDED** that the joint longline CPUE standardization for tropical tunas should continue, and that further development work should be assigned a high priority. Acknowledging that the law of diminishing returns will affect similar future analyses, the SC suggested that immediate priorities should focus on the following areas:
    - develop joint CPUE indices for other IOTC species (i.e., billfish and sharks);

- explore possibilities for including CPUE data provided by other IOTC CPCs (particularly coastal fisheries);
- identify a unified approach for species targeting using simulation testing (for example, the value of cluster analysis is clear in the temperate regions, but less so in tropical regions);
- recover vessel identification details from historical data;
- further develop the work on time-area interactions. Include a detailed examination of catch rates and related data in the piracy area, comparing pre-piracy and post-piracy effects. Potentially also consider the effects of localised depletion and renewal processes on catch rates;
- conduct further analyses to explore 1977 discontinuity (other oceans);
- develop an Indian Ocean CPUE reference manual for practitioners to use;
- explore other density probability functions to improve model fit.

7.4.2 Skipjack stock assessment

80. The SC congratulated the WPTT for the comprehensive skipjack assessment in which a wide range of uncertainty in parameters was explored.

81. The SC noted the anual 1% increase in fishing effort that was used to represent the effort creep in the purse seine CPUE analysis since 1995, and **REQUESTED** that the WPTT explore alternative methods of incorporating effort creep in future.

82. The SC noted the current skipjack assessment grid used the steepness values of 0.7, 0.8, and 0.9, and **AGREED** to review whether the low value (i.e. 0.7) is appropriate for skipjack in the next assessment.

83. The SC noted the grid approach used in the stock assessment may include combination of parameters that are biologically incompatible given that many are correlated. The SC noted that the original grid for skipjack included a large number of models, but the final assessment grid was reduced to 36 models with more plausible assumption combinations.

84. The SC noted paper IOTC-2017-SC20-12, including the following abstract provided by the authors:

> *"The application of the skipjack Harvest Control Rule to calculate the skipjack total annual catch limit for the period 2018-2020, using the parameters estimated at the 2017 skipjack stock assessment as defined in Resolution 16/02 On Harvest Control Rules for Skipjack Tuna in the IOTC Area of Competence*."

85. The SC noted that the Resolution 16/02 has included the following exceptional clause for HCR:

> "*The recommended total annual catch produced by the HCR will be applied continuously as set forth in paragraph 11 above, except in case of exceptional circumstances, such as caused by severe environmental perturbations. In such circumstances, the Scientific Committee shall advise on appropriate measures*."

86. The SC noted the Recommendation from TCMP01, which was subsequently **ENDORSED** by the Commission (S21) that:

> "*When establishing a catch limit for skipjack tuna using the Harvest Control Rule (HCR) adopted in Resolution 16/02, the following procedure will be applied: after the review of the assessment of skipjack tuna by the SC, the result of the assessment will be used by the SC in the calculation of a catch limit using the adopted HCR. The Secretariat will then notify CPCs of the new catch limit for skipjack tuna that will apply for 2018*" (IOTC-2017-S21-R, Para. 56).

87. The SC noted the HCR has been established to provide an annual catch limit for the next three years based on the 3 year stock assessment cycle, and that there are measures in place in case of exceptional circumstances, such as a poor recruitment year, whereby the Commission can intervene and override the existing HCR.

88. The SC noted that catches of skipjack in recent years are close to the recommended annual catch limit from the HCR, and **RECOMMENDED** that the Commission encourage CPCs to closely monitor catches of skipjack tuna to ensure that the integrity of the catch limit is maintained.

7.4.3 Parameters for future analyses: Yellowfin tuna CPUE standardisation and stock assessments

89. The SC **AGREED** that development of the next stock assessment of yellowfin tuna should include, or be associated with, a detailed review of the existing data sources, including:
    i. Size frequency data: Evaluation of the reliability of length composition from the longline fisheries (including recent and historical data), incorporation of unraised samples in addition to the already provided extrapolated EU purse seiners, thorough review of the other size frequency data held by IOTC, in

collaboration with the fleets involved, to improve the utilization of these data in tropical tuna stock assessments.

ii. Tagging data: Further analysis of the tag release/recovery data set.

iii. Alternative CPUE series: a review of the available data from the Indian tuna longline survey data.

7.5 Report of the 6th Session of the Working Party on Temperate tunas

90. The SC noted no meeting of the Working Party on Temperate tunas was held in 2017, and that an update on the status and priorities for temperate tuna species was provided by the WPTmT Vice-Chair.

7.5.1 Review of data available at the IOTC Secretariat for temperate tuna species

91. The SC **RECOMMENDED** that funding be allocated for the further development of the combined joint CPUE series which incorporates the standardized indices of abundance for Japan, Republic of Korea, and Taiwan,China, and that an update is provided at the next WPTmT meeting prior to the next stock assessment of albacore.

7.5.2 New information on biology, ecology, fisheries and environmental data relating to temperate tunas

92. Noting the general paucity of biological indicators available from the Indian Ocean, and particularly the lack of age-specific maturity as a primary source of uncertainty in the stock assessment of albacore tuna, the SC recalled its previous **RECOMMENDATION** that a study on the growth curve of albacore tuna in the Indian Ocean be given a high priority in the SC Program of Work and that the study is completed prior to the next meeting of the WPTmT scheduled for 2019.

7.6 Report of the 8th Session of the Working Party on Methods (WPM08)

93. The SC noted the report of the 8th Session of the Working Party on Methods (IOTC–2017–WPM08–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 28 participants (29 in 2016), including 5 recipients of the MPF (9 in 2016).

94. The SC noted that the various MSE exercises for different IOTC species are constructing OMs with a focus on structural uncertainty, evaluated through a grid of model runs with alternative assumptions.

95. The SC noted the high number of performance indicators agreed by the TCMP (16) and the issues with the correlation between these, due to the tradeoff amongst management objectives. Therefore the SC acknowledged the difficulty of developing a structured approach to integrating the performance indicators for evaluating the MPs. The SC further noted that an objective function to evaluate MP performance based on the weighting of different performance indicators is not currently used in IOTC since this would need an agreement on the weighting criteria by Managers. The SC noted that the tuning criteria for the main objectives is used to fine tune the selection of MPs and then SC agreed figures to present the tradeoff between different objectives (eg sustainability vs. yield) and performance statistics are shown so as the manager can select the preferred MP.

96. The SC acknowledged that the 2017 Joint longline CPUE workshop led by the consultant included a capacity building component to provide training to participating national scientists to develop the standardised CPUE indices for individual fleets. The SC **AGREED** that national scientists should play more active roles in future joint CPUE analyses.

7.6.1 Presentation of MSE results

97. The SC **ENDORSED** the proposed revisions to the standardised protocol for the presentation of MSE results (Appendix VIb). This should still be considered a living document that will benefit from revision based upon feedback received from the TCMP.

7.6.2 Bigeye and yellowfin tuna MSE

98. Due to the project funding delays, the SC noted that there was no opportunity for scientific review of the Bigeye MSE work before the SC20 meeting in November 2017 so the informal technical MSE workshop represents the only review opportunity before the TCMP02 in 2018. Therefore, the SC **AGREED** the next informal technical MSE workshop takes place between March-April 2018 to facilitate review ahead of the TCMP02.

7.6.3 Swordfish MSE: update

99. The SC noted a number of independent CPUE indices are available for this stock, and **AGREED** that it would be useful to undertake a joint analysis to develop a joint CPUE series based on operational data. This should increase spatio-temporal coverage, as well as better handle changes in targeting. The SC therefore **AGREED** that future stock assessments of swordfish are based on a joint standardised CPUE series.

7.6.4 Update on the status of the joint CPUE indices (yellowfin tuna, bigeye tuna & albacore)

100. The SC recognised the importance of normalizing these procedures and approaches into the various Working Party stock assessments making use of longline catch rate indices, **ENDORSED s**uch joint analyses, and **RECOMMENDED** these continue into the future as a normal course of business. It was noted that additional time for more detailed analysis is still needed and SC **REQUESTED** that methods to increase analysis time, such as the use of secure, cloud-based data exchange and increased use of electronic communication between analysts be investigated.

101. The SC congratulated the WPM for the investigation of catchability/selectivity changes and spatial size patterns of bigeye and yellowfin tuna in the early years of the Japanese longline fishery and **AGREED** that this work is important in terms of improving understanding of the trends in CPUE. Noting that various issues have been identified that could be explored further, the SC **RECOMMENDED** that this work is continued.

7.6.5 Priorities for future development of the joint CPUE indices

102. The SC noted that a substantial amount of work has already been completed for the tropical tunas and that it may be more worthwhile to focus on some other species for which this approach would be useful. The SC therefore **RECOMMENDED** that a similar joint analysis approach is explored for key IOTC billfish and shark species.

103. The SC noted the ongoing confidentiality issues with some of the datasets, and that, based on the request of the WPM, CPCs are currently seeking permission from the relevant authorities to make this available for future joint analyses.

104. The SC further noted that the joint analysis work cannot rely on independent consultants indefinitely, and that instead the IOTC Secretariat might be able to directly assist with providing capacity which ultimately needs to be transferred to CPCs so that national scientists can take on the work themselves.

105. The SC noted the request to develop and present both annual-based and quarterly-based CPUE to facilitate communications with mangers.

7.6.6 Presentation of stock status advice for data limited stocks

106. The SC **AGREED** that work on the presentation of stock status advice for data limited stocks will need to be carried out inter-sessionally, and that this will require some level of preparation and planning. The SC **REQUESTED** the WPM Chairperson liaise with the Chairs of the species WPs (WPNT and WPB) in order to draft a study proposal on this issue and **RECOMMENDED** the Commission allocates funding to this project.

7.7 Report of the 13th Session of the Working Party on Data Collection and Statistics (WPDCS13)

107. The SC noted the report of the 13th Session of the Working Party on Data Collection and Statistics (IOTC–2017–WPDCS13–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 45 participants (32 in 2016), including 10 recipients of the MPF (6 in 2016).

7.7.1 Resolution 17/01 On an interim plan for rebuilding the Indian Ocean yellowfin tuna stock

108. The SC noted that, although no scientific papers were presented at the WPDCS13 directly addressing discussions of definitions of Alternative Management Measures, these were discussed as a possible way to address the issue of correctly monitoring yellowfin tuna catches during periods close to the end of the year, as described by EU-France and EU-Italy PS fleets in document IOTC–2017–WPDCS13–21.

109. The SC **REQUESTED** that collaborative work is carried out by different purse seine fleets active in the Indian Ocean, so as to increase the frequency of production of corrected estimates of yellowfin tuna catches to monitor yellowfin quota consumption and **REQUESTED** the WPTT and WPM to investigate additional or complementary management measures (e.g., input control measures) for purse seiners and other gears that will facilitate the control and monitoring of the management measures adopted by IOTC.

7.7.2 Resolution 17/08 Procedures on a fish aggregating devices (FADs) management plan, including a limitation on the number of FADs, more detailed specifications of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species

110. The SC noted the lack of consensus from participants of the WPDCS13 regarding the classifications to model FAD types and FAD activity types for data reporting purposes, following suggestions presented by IOTC–2017–WPDCS13–27 and the IOTC Secretariat’s comments reported in IOTC-2017-WPDCS13-INF03, and **REQUESTED** that the issue be addressed intersessionally between members of the scientific community, the industry and the IOTC Secretariat in order to submit a revised form to be dicussed at the next WPTT and WPDCS.

111. The SC acknowledged the request that, in the interim period, data providers continue to submit FAD activity data using the existing IOTC Form 3_FA and its current categories, and **REQUESTED** that the IOTC Secretariat provide clarifications on definitions of FAD activity in the context of the IOTC classifications to ensure consistency in the data submissions.The SC **REQUESTED** the addition of a *FAD ownership* field to the list of mandatory information to be collected by IOTC Form 3_FA, as this was considered necessary to model and report the tracking status of all FADs (*i) monitored and owned, ii) not monitored, iii) monitored and not owned*), subject to a recorded activity.

7.7.3 ROS E-reporting and E-monitoring projects

112. The SC **RECOMMENDED** that a data exchange be implemented between existing software formats used for the collection of observer data by CPCs (e.g., *ObServe*), and the IOTC Regional Observer Database, to facilitate the transfer of historical observer data to the IOTC database for future dissemination and analysis.

113. The SC noted that EMS are intended to complement human observer programs and also collect other useful information, and encouraged that different – but mutually compatible EMS systems – conform to harmonized standards in terms of installation, data collection and reporting, and **REQUESTED** that purse seine fleets or CPCs wishing to voluntarily implement EMS in purse seiners follow the guidelines described in document IOTC–2017–WPDCS13–26 and IOTC-2016-SC19-15.

114. The SC noted that the feasibility and range of data collected by Electronic Monitoring Systems varies according to type of fishing gear, and **REQUESTED** that the IOTC Secretariat, in collaboration with CPCs, develop standards for data collection and reporting applicable to different gear types.

115. Resolution 11/04 On a Regional Observer Scheme requests the submission of a report after each trip but the SC **RECOMMENDED** that on the next revision of the Resolution, this should be amended to request the submission of data in an electronic format suitable for automated data extraction (including historic data) with a given deadline so that information from multiple trips can be provided.

7.7.4 General discussion on data issues

116. The SC noted with concern the lack of information submitted by CPCs on total catches, catch and effort and size data for various IOTC species, despite their mandatory reporting status. For many IOTC stocks the IOTC Secretariat is required to estimate the level of catches, which increases the uncertainty of the stock assessment results using this data.

117. The SC **REQUESTED** that CPCs comply with IOTC data requirements as requested per Resolution 15/01 and 15/02, given the gaps in available information in the IOTC database and the importance of basic fishery data in order to assess the status of stocks and for the provision of sound management advice, and noted the adoption of Resolution 16/06 *On measures applicable in case of non-fulfilment of reporting obligations in the IOTC* and possibility of penalty measures for non-compliance of Resolutions 15/01 and 15/02.

118. Acknowledging the substantial gaps in reporting of mandatory IOTC datasets by many CPCs to the IOTC Secretariat, which increases the uncertainty of stock assessments and management advice based on these data, the SC strongly **RECOMMENDED** the Commission strengthen the penalty mechanisms adopted in *Resolution 16/06 On measures applicable in case of non-fulfilment of reporting obligations in the IOTC* to improve compliance by CPCs in terms of the submission of basic fishery data in accordance with Resolution 15/01 and 15/02.

119. The SC noted the issues with the lack of data and problems of poor data quality that were identified throughout the Working Party reports and strongly **RECOMMENDED** that these issues are addressed through improved compliance with Resolutions 15/01 *On the recording of catch and effort data by fishing vessels in the IOTC area of competence*, and 15/02 *Mandatory statistical reporting requirements for IOTC contracting parties and cooperating non-contracting parties*.

7.7.5 The Consolidated List of Authorized Vessels (CLAV)

120. The SC acknowledged the importance of the CLAV (Consolidated List of Authorized Vessels) as a tool to combat and deter IUU fishing, and noted that funds from Common Oceans/GEF are due to expire in March 2018, and **REQUESTED** that participants from CPCs that also belong to other tRFMOs reiterate the importance of the CLAV to ensure future support to the initiative from the five major tRFMOs.

7.8 *Summary discussion of matters common to Working Parties (capacity building activities; stock assessment course; connecting science and management, etc.)*

7.8.1 Data collection and capacity building

121. The SC noted that the recorded success of any management measure adopted by IOTC will depend on the availability of the necessary monitoring information. This relates not only to the types of data being collected, but also their spatio-temporal resolution and the ability of CPCs to report these data in a timely manner.

122. The SC **AGREED** that, while external funding is helping the work of the Commission, funds allocated by the Commission to capacity building are still too low, considering the range of issues identified by the SC and its Working Parties, particularly in relation to the implementation of the Regional Observer Scheme and data collection and reporting for artisanal fisheries and **RECOMMENDED** that the Commission further increases the IOTC Capacity Building budget to fund these activities in the future.

123. The SC thanked the IOTC-OFCF Project for its continued support to the enhancement of data collection and processing systems in developing countries of the IOTC, and noted the extension of OFCF support, in particular related to capacity building in the area of data collection, management, and reporting to address socio-economic aspects of tuna resource use.

7.8.2 Invited Expert(s) at the WP meetings

124. Given the importance of external peer review for working party meetings, the SC **RECOMMENDED** that the Commission continues to allocate sufficient budget for an invited expert to be regularly invited to all scientific WP meetings.

7.8.3 Meeting participation fund

125. Noting the various comments made by many of the developing CPCs in attendance at the meeting, that the IOTC MPF was crucial for the success of all IOTC Working Parties, and that the benefits are clearly being seen in terms of increased active engagement at each meeting by recipients, as well as the rapidly increasing quality of the scientific papers being submitted, the SC **REQUESTED** that the funding of national scientists from developing Contracting Parties be considered a higher priority.

126. The SC reiterated its **RECOMMENDATION** 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, and that the full Draft paper be submitted no later than 45 days before the start of the relevant meeting. The aim is to allow the Selection Panel to 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.

7.8.4 IOTC species identification guides: Tuna and tuna-like species

127. The SC reiterated its **RECOMMENDATION** that the Commission allocates budget towards continuing the translation and printing of the IOTC species ID guides so that hard copies of the identification cards can 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.

7.8.5 IOTC Secretariat staffing

128. Noting the very heavy workload at the IOTC Secretariat and the ever increasing demands by the Commission and the Scientific Committee, and also the capacity to respond to requests for assistance by countries, the SC **RECOMMENDED** that the recommendation from the Performance Review PRIOTC02.07(g) is implemented, and that permanent staff of the IOTC Data and Science Section be increased by two (2) (1 x P4 and 1 x P3 level positions), supplemented by additional short-term consultants, to commence work by late-2018 or earlier, and that funding for these new positions should come from both the IOTC regular budget and from external sources to reduce the financial burden on the IOTC membership.

7.8.6 IOTC Stock structure project

129. The SC noted the presentation of the update on progress of the IOTC Stock Structure project, funded by the EU and IOTC (IOTC-2017-SC20-INF08), highlighting that the preliminary literature search has been completed and submitted and that the detailed plan for the genotyping analysis has been developed.

130. The SC noted that geographic locations have been selected for the sampling by species and the SC encouraged interested CPCs to provide a focal point to liaise with project partners to articulate their participation in the project both in the collections and analysis of samples.

131. The SC noted that the scalloped hammerhead is listed in CITES Appendix II and so has specifiec requirements for transportation to labs, requiring certification. For samples taken from the High Seas, these are more problematic as they are classified as 'introductions from the sea'. The SC encouraged the project team to explore these issues more fully with CITES and to request assistance from the IOTC Secretariat if necessary.

7.8.7 Chairpersons and Vice-Chairpersons of the SC and its subsidiary bodies

132. The SC **RECOMMENDED** that the Commission note and endorse the Chairpersons and Vice-Chairpersons for the SC and its subsidiary bodies for the coming years, as provided in Appendix VII.

7.8.8 Development of management advice

133. The SC **REQUESTED** that the agreed IOTC *Guidelines for the presentation of CPUE standardisations and stock assessment models* are used in future by all authors presenting CPUE analyses to the WPs.

134. The SC noted that although the stock assessments for IOTC species are conducted periodically (e.g., 3 years), the management advice is reviewed every year to account for the potential for exceptional circumstances (e.g., large increase in catches, or revisions to data, between assessment years)

135. The SC noted the recommendation from the WPTT to review the approach used to provide management advice, particularly in relation to how the outcomes from stock assessments are reported against target and limit reference points, and in particular the following issues related to the current reference points:

    i. **Status determination** – Currently IOTC stocks are considered to be overfished and subject to overfishing when stocks experience B<Bmsy and F>Fmsy according to the KOBE plot, and there is no change to stock status determination when limit reference points (if defined) are breached. This may not always be consistent with the intended application of target and limit reference points, as stocks can breach the target in some years due to natural fluctuations in stock abundance or other sources of variability. In these years, the stock would be assessed as being overfished and/or subject to overfishing.
    ii. **Level at which LRPs and TRPs are set** – Current values of target and limit reference points for IOTC species may equate to low levels of biomass relative to the biomass in the absence of fishing. Consideration should be given to the correspondence between MSY-based and depletion-based RPs when reporting stock status for each stock.
    iii. **The types of LRPs and TRPs** – Current guidance in Resolution 15/10 is to use depletion-based reference points when MSY-based reference points cannot be estimated robustly. The term 'robustly' can be subjective, and it would be helpful to articulate more precisely the circumstances under which depletion-based or MSY-based reference points should be used.

136. The SC **REQUESTED** that WPM and TCMP address the issues referred to in para. 135 and report the outcomes to the SC in 2018.

137. The SC **AGREED** that analysis should be carried out to evaluate potential retrospective patterns in stock assessments, noting that this can have a great impact on the stock assessment quality and is already part of the advice in the IOTC Guidelines for the presentation of CPUE standardisations and stock assessment models which states:

    *"Alternative scenarios and retrospective analyses should ideally be carried and, if included, a description of the motivation for the selection of base and alternative cases should be added, giving detail of how the alternative case assumptions differ from those of the base case" (Appendix I, IOTC–2014–SC17–06)***.**

138. The SC noted the current fomat of the KOBE II Strategy Matrix can provide information that is of very coarse resolution and **AGREED** that the projections are based on catches which vary in intervals of 5% instead of the current 10%, especially around the values close to the 50% probability. The SC further **REQUESTED** that the tables are extended to ensure that an appropriate range is covered to enable management advice to be provided based on a 50% probability. The SC **REQUESTED** that the performance of catch projection be evaluated retrospectively to ensure the quality of risk analysis in developing management advice.

139. The SC further **REQUESTED** that IOTC Working Parties ensure that the advice in paras. 137 and 138 is followed for future assessments and **REQUESTED** that the WPM update the guidelines for stock assessment[2] developed by the SC in 2015 to reflect this**.**

[2] http://iotc.org/documents/guidelines-presentation-cpue-standardisations-and-stock-assessment-models-1

140. The SC noted the lack of target/limit reference points for species other than the main five species in Resolution 15/10, although the SC also noted the management decision framework objective held therein to maintain and/or rebuild stocks to the KOBE green quadrant in a "short" timeframe with "high" probability.

141. The SC noted that there is currently no structured protocol for establishing base case scenarios and that this may be difficult given that the data varies greatly among species, in terms of availability and quality, and decisions need to be made that are specific to each particular case. The SC **REQUESTED** the WPM develop guidelines for the selection of the grid based approach and/or base case for the provision of management advice.

8. OUTCOMES OF THE FIRST TECHNICAL COMMITTEE ON MANAGEMENT PROCEDURES (TCMP)

142. The SC noted the presentation of the Report of the First Technical Committee on Management Procedures (IOTC-2017-TCMP01-R).

143. The SC noted the suggestion that the presentations of MSE to the Commission should include caveats related to the MSE procedures in terms of the possible violation of model assumptions which may have an impact on management advice.

144. The SC **REQUESTED** the SC Chairperson, the WPM Chair and Vice-Chairpersons work with the IOTC Secretariat to develop a budget to accompany the workplan ageed by the Commission in S21 (IOTC-2017-S21-14).

145. The SC noted that the Commission (SC21) meeting agreed to extend the duration of the TCMP to 2 days and, therefore the SC **REQUESTED** that IOTC Secretariat liaise with Commission chair to ensure that TCMP meeting lasts for 2 days.

9. OUTCOMES OF THE IOTC AND JOINT T-RFMO FAD WORKING GROUP

9.1 IOTC Working Group on FADs

146. The SC noted paper IOTC-2017-WGFAD01-R which summarized the outcomes of the 1st IOTC Working Group on FADs.

147. The SC noted that the effectiveness of FADs is measured in terms of the number of positive sets following a recorded FAD activity, and that the stratification (i.e., monthly records by 1 degree grids) follows the requirements for surface fisheries in Resolution 15/02 and 12/02.

148. The SC acknowledged the inherent complexity of correctly identifying all aspects of FAD-related operations, and for this reason it might not be yet possible to use data currently available to determine the maximum number of FADs to be recommended, **NOTING** that a number of studies by EU,FRA and EU,ESP are currently trying to address this issue.

149. The SC **ENDORSED** all recommendations from the 1st Working Group on FADs, and also all FAD related recommendations from WPDCS13.

150. Noting that Resolution 17/08 provides a start date for the implementation of non-entangling FADs, but no end date, the SC **RECOMMENDED** that this Resolution is revised to include a date by which non-entangling FADs should be fully implemented.

*"To reduce the entanglement of sharks, marine turtles or any other species, the design and deployment of FADs shall be based on the principles set out in **Annex III**, which will be applied gradually from 2014"* (Resolution 17/08, para. 13).

151. Noting the differing levels of entanglement potential of FADs, the SC **AGREED** on the need for a definition of non-entangling FADs.

152. The SC also noted that ISSF is supporting further studies on the analysis of environmental impact of FAD operations and also endorsed the recommendations from the 1st Working Group on FADs.

9.2 Joint t-RFMO FAD Working Group

153. The SC noted paper IOTC-2017-SC20INF01 which provided a summary the outcomes of the 1st Joint Tuna RFMO FAD Working Group, including proposals for key areas for future actions and work plan, including the call for a technical Working Group on FADs to be created under the Kobe process, to continue the work initiated during the 1st joint t-RFMO FAD meeting inter-sessionally and by correspondence. The SC **SUPPORTED** the

creation of and participation of IOTC in this inter-sessional technical working group as well as IOTC participation in any joint-tuna RFMO FAD WGs in the future.

154. The SC welcomed the joint meeting of the t-RFMOs, especially the work on best handling practices and biodegradable FADs, non-entangling FADs, **NOTING** that this is an area in which the IOTC is looking to progress.

155. The SC acknowledged the full support from EU, South Africa and ISSF to the outcomes of the joint FAD Working Group, and noted the importance of FAD best practices and how these are already implemented by the EU PS fleet.

156. The SC acknowledged that it might be difficult to establish a timeframe for the assessment of the research project outputs due to their complexity, and noted that a number of research priorities in the same field have been discussed and agreed during other IOTC Working Parties, also noting that CPCs priorities are being addressed by CPCs themselves.

9.3 Biodegradable FAD (BIOFAD) Project

157. The SC noted the presentation on the EU-BIOFAD project (IOTC-2017-SC20-INF07), which is also being supported by ISSF and the Common Oceans ABNJ Tuna Project including the active participation of the fishing sector. The SC noted the study will provide criteria and guidelines to identify options to mitigate drifting FADs impacts on the ecosystem. Additionally, the SC recalled the tests of biogradable materials to be used in the BIOFAD project that were conducted in the Maldives as part of a collaborative study between MRC and ISSF.

158. The SC noted that the Consortium, in order to obtain sufficient data to conduct reliable scientific research, has planned a large-scale experiment with the deployment of 1000 BIO FADs (250 in each quarter to analyse temporal effects) in 2018. The SC noted that the project counts on the active collaboration of Seychelles, Mauritius and European purse seines with a participation of 42 purse seine vessels operating in the Indian Ocean. The SC noted that in total, each vessel will deploy around 24 BIOFADs, 6 BIOFADs by trimester (2 per month).

159. The SC **REQUESTED** CPCs to collaborate with the project to allow better coordination and collection of data.

160. The SC noted that the construction, deployment, monitoring and data collection and reporting of experimental BIO FADs will be oversee by the consortium members

161. The SC noted that fishing information on experimental FADs (i.e., biodegradable test or monitored FADs) is critical to the scientists coordinating the deployments of such FADs in the frame of dedicated research programme. Therefore, fishers visiting or fishing on FADs clearly identified as experimental should be encouraged to specifically report to their national scientists FAD (and devices) status and activities on this FAD (including catch data if so).

162. The SC noted the issue of FAD beaching and welcomed the work on the construction of biodegradable FADs with a lower impact. The SC further noted the new project IRD have initiated involving the development of maps highlighting potential risk areas associated with any FAD deployment.

163. The SC noted the challenges in conducting studies on biodegradable FADs (for example the limit on the number of active FADs per purse seine vessel in the Indian Ocean that may hinder the deployment of BIOFADs following experimental sampling designs, and also engagement with the fleet to deploy BIOFADs that may not be successful for fishing). Thus, the SC **RECOMMENDED** the Commission consider special allocations for experimental FADs deployed for the collection of scientific data for vessels willing to participate in biodegradable FAD testing under protocols reviewed and endorsed by the Scientific Committee.

164. Noting that IOTC, along with other tuna RFMOs, recommended and adoped resolutions to promote reduction of the amount of synthetic marine debris by the use of natural or biodegradable materials for drifting FADs, the SC **ENDORSED** this large-scale project to test the use of biodegradable materials and designs for the construction of drifting FADs in natural environmental conditions. The SC **REQUESTED** the project to present the outcomes of the at sea trials to the next WPEB, WPTT and SC meetings.

165. The SC also noted that a similar study has recently been initiated in the Atlantic under sponsorship of ISSF and the Common Oceans ABNJ Tuna Project which also aims at incorporation of biodegradable materials into FAD construction in order to further mitigate impacts of this gear. As in the Indian Ocean BIOFAD project, the Atlantic project aims to have wide participation from the various fleets fishing with drifting FADs in the tropical Atlantic.

10. EXAMINATION OF THE EFFECT OF PIRACY ON FLEET OPERATIONS AND SUBSEQUENT CATCH AND EFFORT TRENDS

166. The SC noted that the Commission, at its:

- 15th Session '*recognized that piracy activities in the western Indian Ocean, have had substantial negative consequences on the activities of some fleets, as well as the level of observer coverage in these areas. The Commission requests that the Scientific Committee assess the effect of piracy on fleet operations and subsequent catch and effort trends*' (para. 40 of the S15 report).
- 16th Session, further '*recognised the severe impact of piracy acts on humanitarian, commercial and fishing vessels off the coast of Somalia and noted that the range of the attacks extended towards almost all of the western Indian Ocean, notably toward Kenya and Seychelles, with attacks being reported in their respective EEZ.*' (para. 124 of the S16 report).

167. The SC noted the update provided on the on-going impacts of piracy on fisheries in the Indian Ocean, particularly the reduction or relocation of fishing effort in the western Indian Ocean (Somali basin) and other areas in the Indian Ocean (Figs. 1a and 1b).

168. The SC noted that the number of active longline vessels (and associated fishing effort) in the IOTC area of competence declined substantially from 2008 until 2011 (Fig. 2a, b), as did the number of active purse seine vessels, albeit to a lesser extent (Fig. 2c), and that the decline was likely due to the impact of piracy activities in the western Indian Ocean. Fishing effort by purse seine fleets shifted eastwards by at least 100 miles during 2008–11, compared to the historic distribution of fishing effort (Fig. 1b), although some vessels remained in the area impacted by piracy due to the presence of onboard military personnel.

169. The SC noted that the reported increase in the catches of albacore in recent years by the longline fleets (e.g., from around 30,000 t in 2006 to 44,000 t in 2010) was likely related to the increase in piracy activity in the western Indian Ocean, which resulted in the displacement of longline vessels towards traditional albacore fishing grounds in the southern Indian Ocean.

170. The SC noted that, since 2011, some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to increased security on-board vessels – with the exception of the Japanese fleet, which still has not returned to the levels seen before the start of piracy (Table 3). Similarly, since 2011, there has been an overall increase in the number of active purse seine vessels in the Indian Ocean for all purse seine fleets combined (Fig. 2c).

Table 3. Number of active (deep-freezing) longline and purse seine vessels, for selected fleets in the Indian Ocean (2011–16).

Longline fleets	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Japan	72	75	57	53	52	45
Rep. of Korea	7	7	9	10	14	13
China	15	36	36	39	50	61
Taiwan,China	132	138	148	122	119	132
Philippines	2	14	19	4	0	0
Purse seine fleets	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
European Union	26	29	27	28	30	27
Seychelles	8	7	7	8	13	13
Indonesia	10	19	19	19	19	19
I.R. Iran	5	4	4	5	5	5
Japan	1	1	1	1	1	3
Rep. of Korea	0	3	4	4	5	5
Mauritius	0	0	2	7	7	2
Sri Lanka	0	0	8	8	0	0

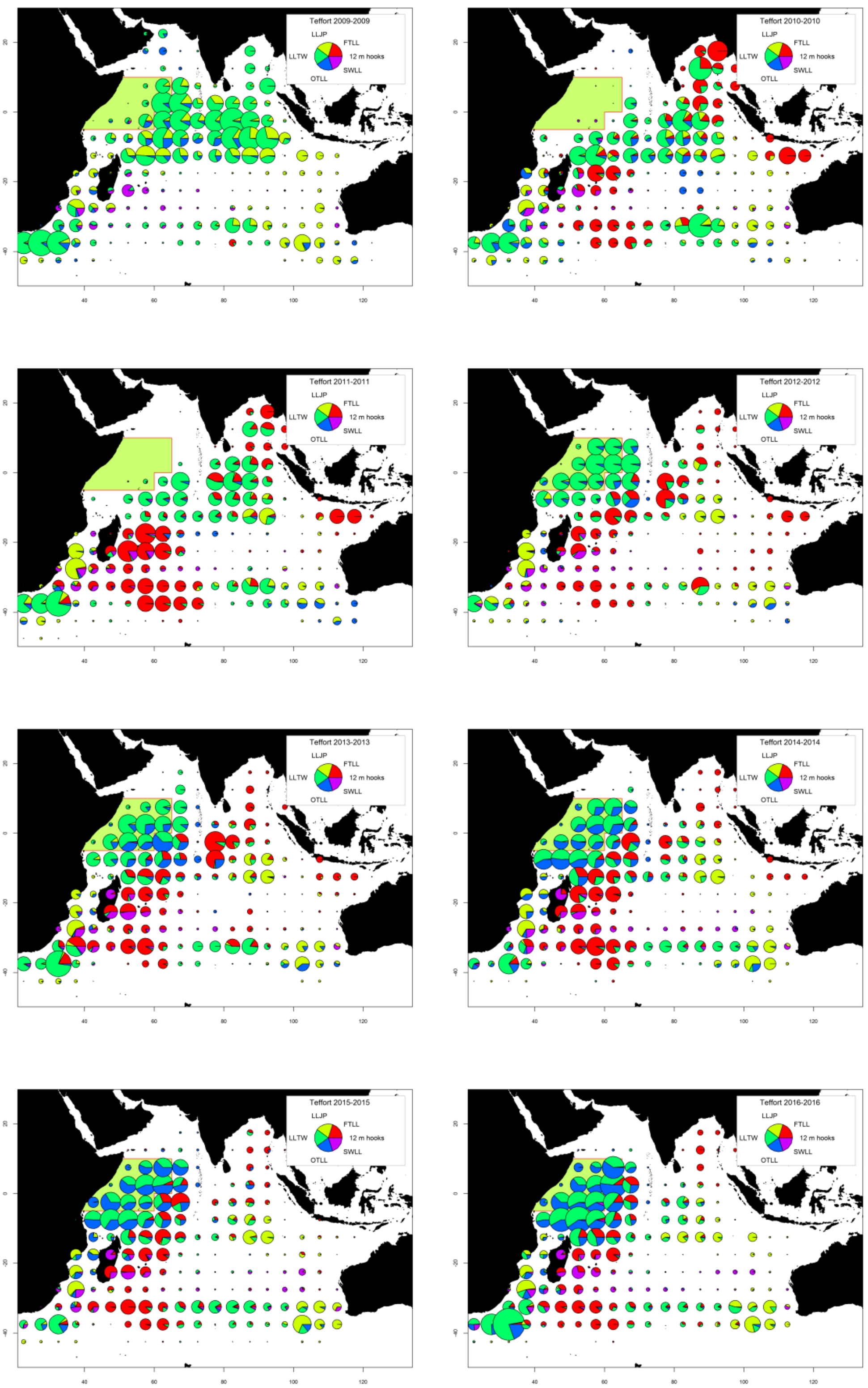


Fig. 1a. Effort exerted by longline fleets in the Indian Ocean, in millions (M) of hooks set, by main fleet and 5° grid (2009-2016): **LLJP** (light green): deep-freezing longliners from Japan; **LLTW** (dark green): deep-freezing longliners from Taiwan,China; **SWLL** (turquoise): swordfish longliners (Australia, EU, Mauritius, Seychelles and other fleets). **FTLL** (red) : fresh-tuna longliners (China, Taiwan,China and other fleets); **OTLL** (blue): Longliners from other fleets (includes Belize, China, Philippines, Seychelles, South Africa, Rep. of Korea and various other fleets). The area shaded in green is where piracy activities are considered highest.

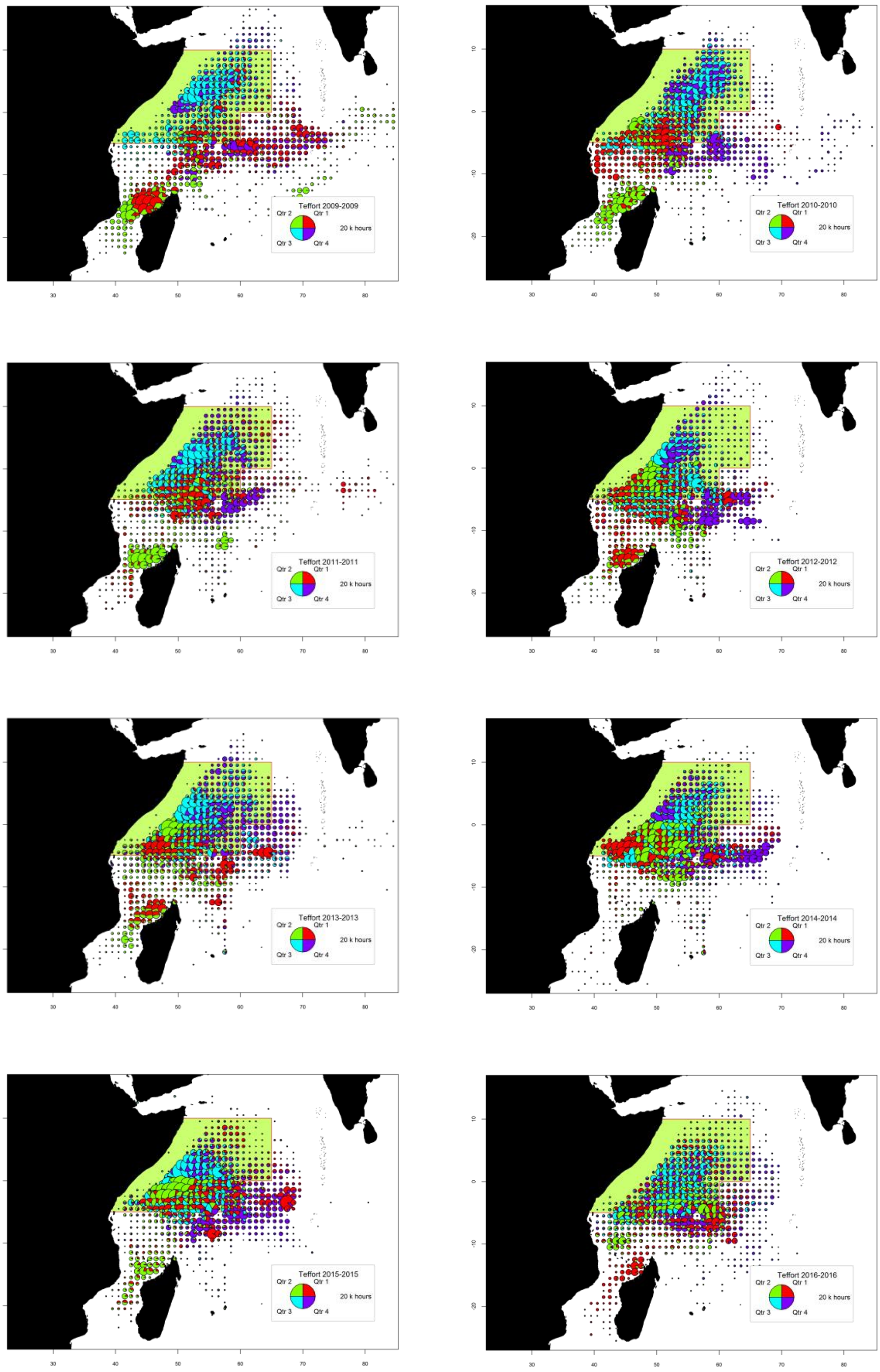
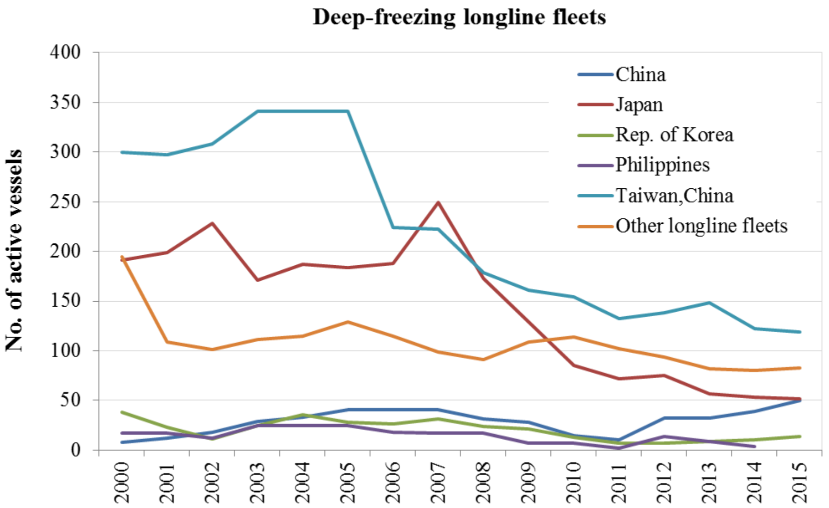
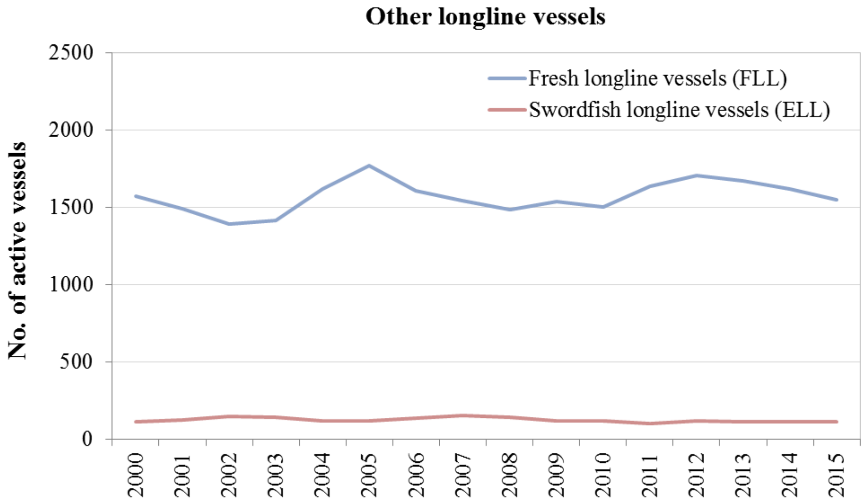


Fig. 1b. Effort exerted by purse seine fleets in the Indian Ocean, in thousands (k) of fishing hours (Fhours), by main fleet and 1° grid and quarter (for 2009-16). The area shaded in green is where the risk of piracy activities is considered to be highest.



(a)



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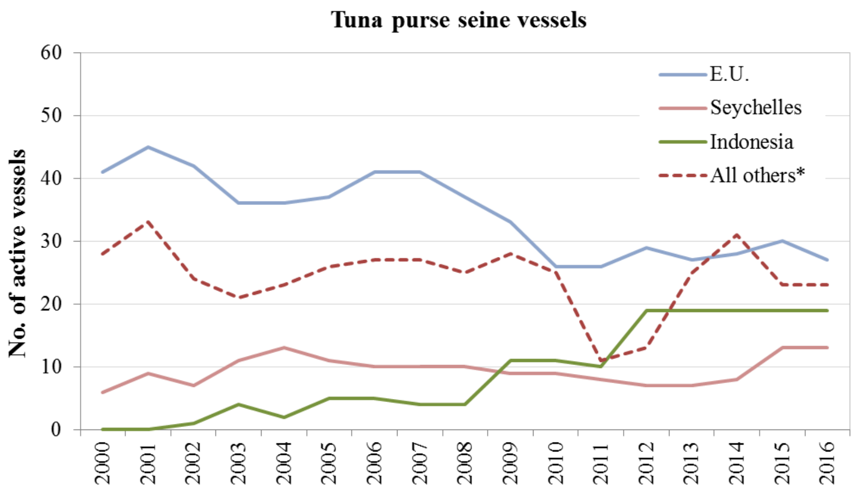

(c)

Figs. 2(a-c). Number of active vessels in the Indian Ocean 2000-2016 for: a) deep-freezing longline vessels b) other longline vessels (FLL & ELL), and c) tuna purse seine (PS) fleets. Notes: All other purse seine fleet includes I.R. Iran, Japan, Rep. of Korea, Mauritius, Malaysia, and Thailand (with the exception of Australia whose purse seine fleet fishes exlusively for southern Bluefin tuna).

171. The SC recalled that in the first half of 2011, 11 longline vessels from Taiwan,China, moved to the Atlantic Ocean and 2 to the Pacific Ocean; while in the second half of 2011, 5 longline vessels returned from the Atlantic Ocean, and 1 longline vessel returned from the Pacific Ocean. The departure of the vessels from the Indian Ocean is reflected in the total effort deployed throughout not only the area of the western Indian Ocean impacted by

piracy, but also the entire Indian Ocean (Fig. 3a for longline and Fig. 3b for purse seine). In 2012, the trend was reversed, with a total of 15 longline vessels being transferred from the Atlantic Ocean back to the Indian Ocean, resulting in an overall increase in longline effort, particularly in the western Indian Ocean. Similarly, 6 longline vessels from Taiwan,China have been transferred from the Pacific Ocean back to the Indian Ocean in 2012. The Taiwanese fleet continues to account for the majority of longline effort in the Indian Ocean, and while total levels of effort for this fleet in the Indian Ocean have remained relatively low since 2011, fishing effort in waters off Somalia have increased markedly in recent years (i.e., from 2012 onwards) (Figs. 1a and 3a).

172. The SC **AGREED** that despite the evidence that longline and purse seine vessels from some fleets have begun to move back to the western Indian Ocean since 2011, fishing effort has still not returned to levels before the onset of piracy – particularly for the Japanese longline fleet – and fishing effort in the north-western Indian Ocean should continue be closely monitored and reported at the SC and the Working Party meetings in 2018.

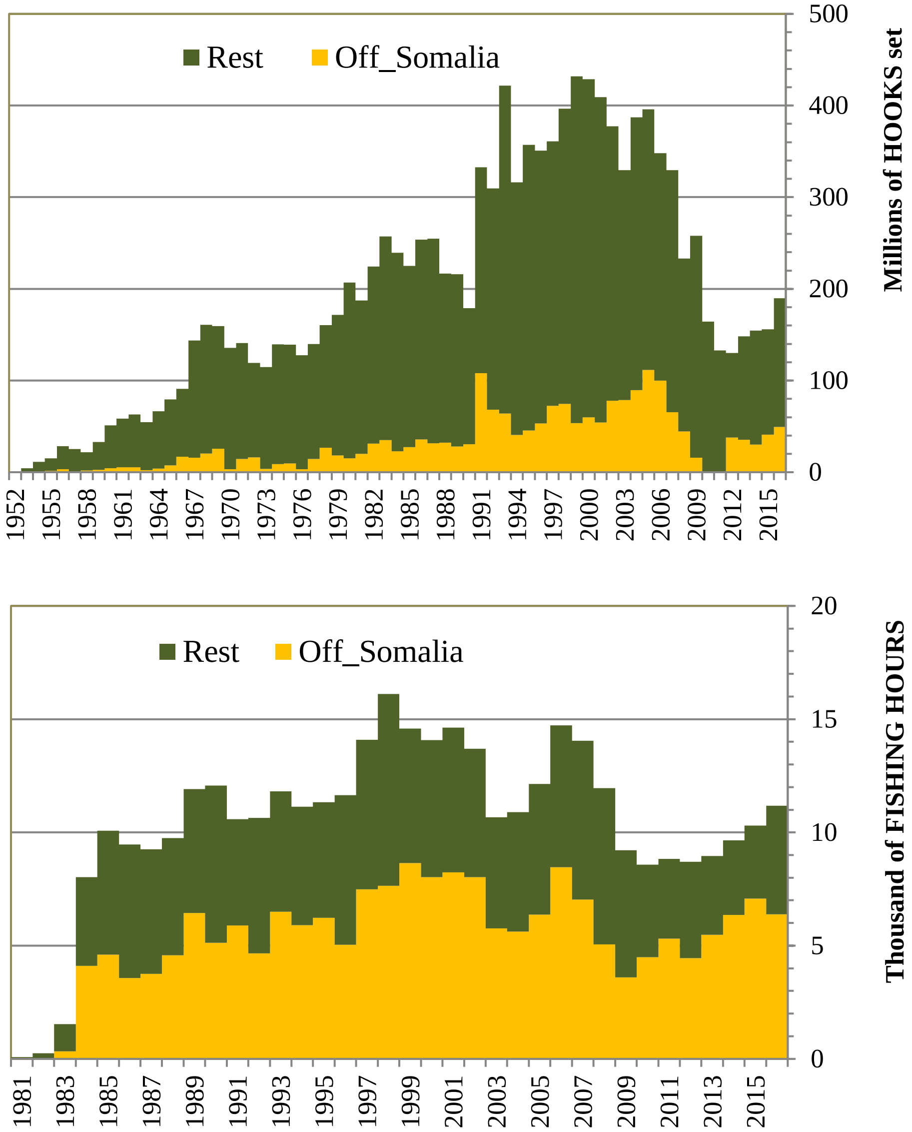

Fig. 3(a-b). Changes in total effort for a) longline vessels (number of hooks set in millions), and b) purse seine vessels (number of hours fished, in thousands) by year and geographical area: off the Somalia coastline (area shaded in green shown in Figs.1a and 1b) and for the rest of the Indian Ocean, based on catch and effort reported to the IOTC Secretariat.

11. STATUS OF TUNA AND TUNA-LIKE RESOURCES IN THE INDIAN OCEAN, AND ASSOCIATED SPECIES

IOTC Executive Summaries: target audience, content and resourcing

173. The SC recalled that the primary audience is currently considered to be the Commission, and that as such, only the first few pages of the current Executive Summaries (containing the stock status, outlook and management advice) should be included in the annual Scientific Committee report for the Commission's consideration. However, it was considered that the supporting information, currently provided as an Appendix to the Executive Summary while useful for secondary audiences such as scientisits and science advisors, should be made available via the IOTC website instead of the annual Scientific Committee Report.

174. The SC noted the Appendix VII of the WPDCS13 report which provides a summary of a consultation on proposed changes to the Executive Summaries supplementary information, and **AGREED** that future updates incorporate the list of agreed changes.

175. Noting the discussion and review of the Supporting Information for the tropical tuna species that took place at the WPM, WPTT and WPDCS in 2017, the SC **REQUESTED** the Secretariat update these with the revised figures as agreed by the WPDCS to be reviewed by WPs Chairs for publication on the IOTC website following the meeting.

11.1 Tuna – Highly migratory species

176. The SC **RECOMMENDED** that the Commission note the management advice developed for each tropical and temperate tuna species as provided in the Executive Summary for each species, and the combined Kobe plot for the four species assigned a stock status in 2017 (Fig. 4):
    - Albacore (*Thunnus alalunga*) – Appendix IX
    - Bigeye tuna (*Thunnus obesus*) – Appendix X
    - Skipjack tuna (*Katsuwonus pelamis*) – Appendix XI
    - Yellowfin tuna (*Thunnus albacares*) – Appendix XII

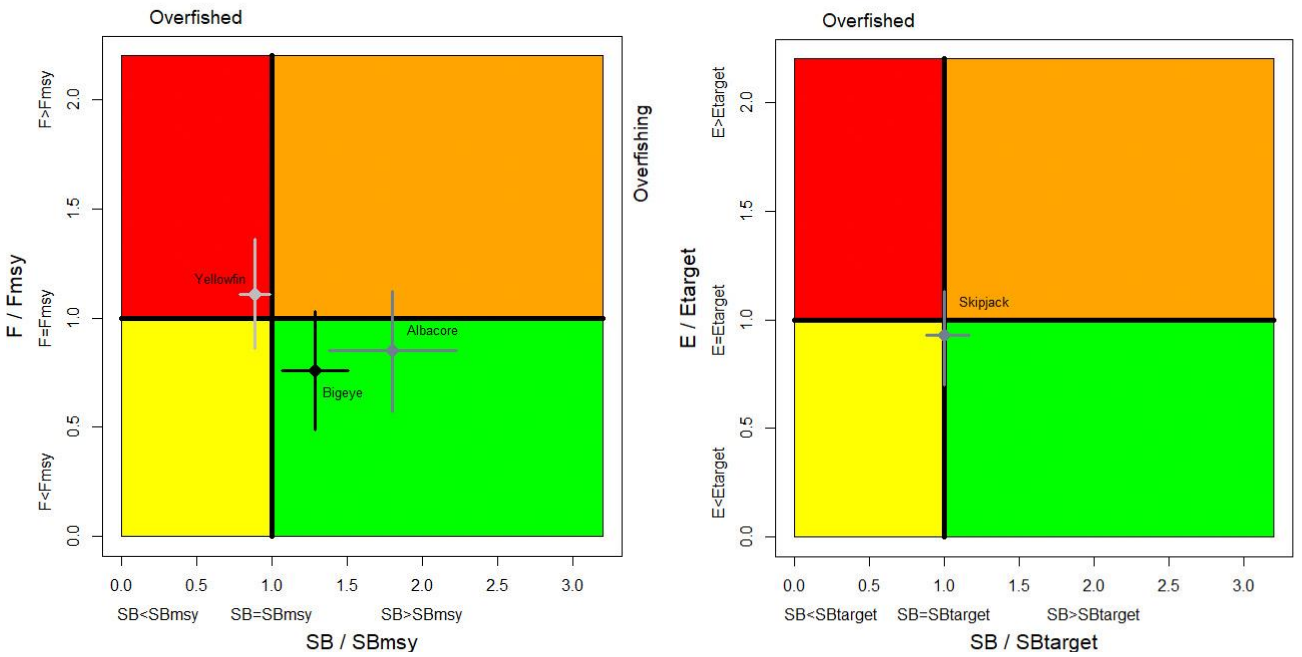

Fig. 4. (Left) Combined Kobe plot for bigeye tuna (black: 2015), yellowfin tuna (grey: 2015), and albacore tuna (dark grey: 2014) showing the estimates of current spawning stock size (SB) and current fishing mortality (F) in relation to SBtarget and Ftarget. (Right) Kobe plot for skipjack tuna (2016) showing the estimates of the current spawning stock status (SB) and exploitation rate in relation to SBtarget and Etarget. Numbers in brackets indicate the last year of data available at the time of the assessment. Cross bars illustrate the range of uncertainty from the model runs with 80% CI.

177. The SC noted paper IOTC–2017–SC20–ES05 which provided an overview of the biology, stock status and management of southern bluefin tuna (*Thunnus maccoyii*), and thanked CCSBT for providing it.

11.2 Tuna and seerfish – Neritic species

178. The SC **RECOMMENDED** that the Commission note the management advice developed for each neritic tuna (and mackerel) species under the IOTC mandate, as provided in the Executive Summary for each species, and the combined Kobe plot for the three species assigned a stock status in 2017 (Fig. 5):
    - Bullet tuna (*Auxis rochei*) – Appendix XVII

- Frigate tuna (*Auxis thazard*) – Appendix XVIII
- Kawakawa (*Euthynnus affinis*) – Appendix XIX
- Longtail tuna (*Thunnus tonggol*) – Appendix XX
- Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix XXI
- Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix XXII

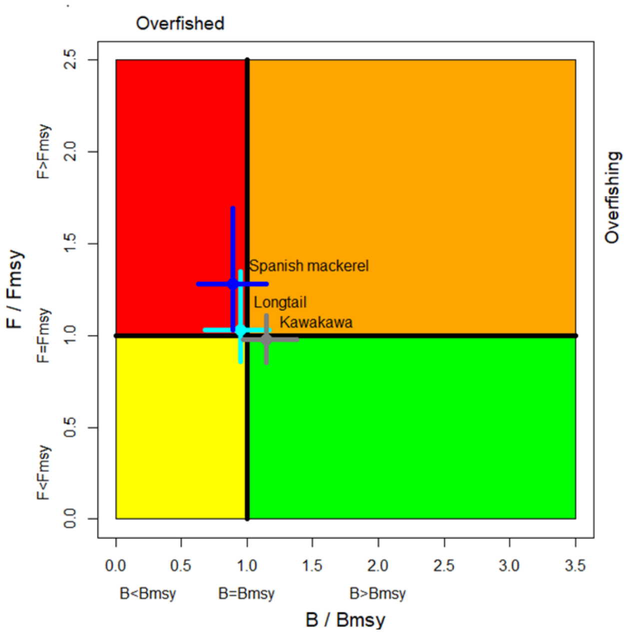

Fig. 5. Combined Kobe plot for longtail tuna (cyan: 2016), narrow-barred Spanish mackerel (dark blue: 2016), and kawakawa (white: 2015) showing the estimates of stock size (B) and current fishing mortality (F) in relation to MSY-based reference points. Numbers in brackets indicate the last year of data available at the time of the assessment. Cross bars illustrate the range of uncertainty from the model runs.

11.3 Billfish

179. The SC **RECOMMENDED** that the Commission note the management advice developed for each billfish species under the IOTC mandate, as provided in the Executive Summary for each species, and the combined Kobe plot for the five species assigned a stock status in 2017 (Fig. 6):
    - Swordfish (*Xiphias gladius*) – Appendix XII
    - Black marlin (*Makaira indica*) – Appendix XIII
    - Blue marlin (*Makaira nigricans*) – Appendix XIV
    - Striped marlin (*Tetrapturus audax*) – Appendix XV
    - Indo-Pacific sailfish (*Istiophorus platypterus*) – Appendix XVI

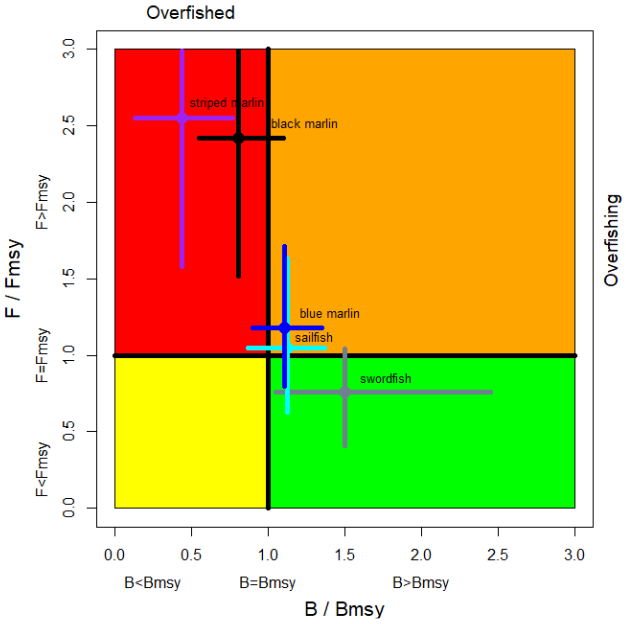

Fig. 6. Combined Kobe plot for swordfish (grey: 2015), indo-pacific sailfish (cyan: 2014), black marlin (black: 2015), blue marlin (blue: 2015) and striped marlin (purple: 2015) showing the estimates of stock size (SB or B, species assessment dependent) and fishing mortality (F) in relation to MSY-based reference points. Numbers in brackets indicate the last year of data available at the time of the assessment. Cross bars illustrate the range of uncertainty from the model runs.

12. Status of sharks, marine turtles and seabirds in the Indian Ocean

12.1 Sharks

180. The SC **RECOMMENDED** that the Commission note the management advice developed for a subset of shark species commonly caught in IOTC fisheries for tuna and tuna-like species:
    - Blue shark (*Prionace glauca*) – Appendix XXIII
    - Oceanic whitetip shark (*Carcharhinus longimanus*) – Appendix XXIV
    - Scalloped hammerhead shark (*Sphyrna lewini*) – Appendix XXV
    - Shortfin mako shark (*Isurus oxyrinchus*) – Appendix XXVI
    - Silky shark (*Carcharhinus falciformis*) – Appendix XXVII
    - Bigeye thresher shark (*Alopias superciliosus*) – Appendix XXVIII
    - Pelagic thresher shark (*Alopias pelagicus*) – Appendix XXIX

12.2 Marine turtles

181. The SC **RECOMMENDED** that the Commission note the management advice developed for marine turtles, as provided in the Executive Summary encompassing all six species found in the Indian Ocean:
    - Marine turtles – Appendix XXX

12.3 Seabirds

182. The SC **RECOMMENDED** that the Commission note the management advice developed for seabirds, as provided in the Executive Summary encompassing all species commonly interacting with IOTC fisheries for tuna and tuna-like species:
    - Seabirds – Appendix XXXI

12.4 Cetaceans

183. The SC **RECOMMENDED** that the Commission note the management advice developed for cetaceans, as provided in the newly developed Executive Summary encompassing all species commonly interacting with IOTC fisheries for tuna and tuna-like species:
    - Cetaceans – Appendix XXXII.

13. Implementation of the Regional Observer Scheme

184. The SC noted paper IOTC-2017-SC20-07 that provides an update on the status of implementation and reporting to the IOTC Secretariat set out by Resolution 11/04 *on a Regional Observer Scheme* (ROS), and Resolution 16/04

On the implementation of a pilot project in view of promoting the Regional Observer Scheme of IOTC (provided in Appendix XXXIII).

185. The SC noted that as of 3rd December 2017, fifteen CPCs (Australia, China (including Taiwan,China), Comoros, EU (France[3], Spain, Portugal and UK), 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 360 currently registered observers.

186. The SC noted that as of 3rd December 2017, 9975 observer trip reports has been submitted to the IOTC Secretariat by Australia, China (including Taiwan,China), EU (France, Italy, Portugal and Spain), France OT (until 2013), Indonesia, Japan, Kenya, Rep. of Korea, Madagascar, Mauritius, Mozambique, Seychelles, Sri Lanka, South Africa and Tanzania.

187. The levels of coverage estimated for all combined fleets and CPCs are still very low and, for longline fleets, are well below the minimum levels recommended by the Commission.

188. The SC noted that Seychelles Fishing Authority is currently recording observer data for Rep. of Korea flagged purse seiners landing in Seychelles, and that data analysis is currently ongoing and once completed the data will be submitted to the relevant authority of the Rep. of Korea. Once the Rep. of Korea has submitted this data to the IOTC, the revised observer coverage will be presented at the next update for the SC.

189. The SC noted that port sampling is currently a requirement in Resolution 11/04 for small vessels (<24m fishing within the EEZ) to collect basic catch and size data and that onboard coverage is not required for these fleets.

190. The SC also noted that as part of the Regional Observer Scheme Pilot Project, port sampling will be explored as a complementary method of data collection to the information collected through on-board electronic monitoring. Areas of data collection which are complementary to EMS include items such as vessel and gear specifications as well as verification of retained catches.

191. At the same time, the SC noted that port sampling activities are also a requirement for small-scale vessels that cannot accommodate onboard observers, or implement EMS, and as such, should be considered separately from EMS.

192. The SC noted South Africa's comment that the catch and observer data from the Japanese charter vessels are submitted by South Africa and, thus, should be computed as South Africa and that the matter has been on-going since 2014.

193. The SC **REQUESTED** that South Africa raises this issue at the next Session of the Commission so it can be resolved to avoid double accounting of catches and to avoid non-apportionment of catches from joint venture fishing activities.

194. The SC also noted that the issue in the attribution of captures and observer coverage to either Japan or South Africa, where a joint-venture agreement between private companies (the foreign vessel owner and the fishing rights holder), is mostly a compliance issue and that as such it should be addressed during the Compliance Committee.

195. The SC acknowledged the financial support of the EU for the implementation of Resolution 16/04 *On the implementation of a Pilot project in view of promoting the Regional observer scheme of IOTC*, which is expected to deliver long-lasting improvements in the data collection and reporting of scientific observer data to the IOTC Secretariat.

196. The SC noted that there are no specific data collection standards for electronic monitoring systems, in terms of minimum coverage levels and recalled that the Commission has specifically requested the development of minimum standards for EMS through Resolution 16/04 and the need for this to be part of the Pilot Project.

197. The SC therefore **RECOMMENDED** that the EMS standards presented for purse seine fisheries (IOTC-2016-SC19-15) are adopted and **REQUESTED** that draft standards are similarly proposed for the longline fleets by CPCs currently trialling and implementing EMS on these vessels and that draft standards are also developed for gillnet fleets through the ROS Pilot Project.

198. Noting the development of a Steering Committee for the ROS Pilot Project and the few nominations received to-date (one CPC and one NGO), the SC encouraged interested parties submit their nominations to the Secretariat as soon as possible.

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

14. Progress on the Implementation of the Recommendations of the Second Performance Review Panel

199. The SC noted paper IOTC–2017–SC20–08 which provided an update on progress regarding Resolution 16/03 *On the second performance review follow-up*.

200. The SC noted that the Technical Committee on the Performance Review is due to be held in February 2018.

201. The SC **RECOMMENDED** that the Commission note the updates on progress regarding Resolution 16/03, as provided at Appendix XXXIV.

15. Program of work and schedule of Working Party and Scientific Committee meetings

15.1 Progress on previous recommendations from WPs and the SC

202. The SC noted paper IOTC–2017–SC20–13 which provided the Scientific Committee (SC) with an update on the progress made on its previous recommendations made in 2016, also available in Appendix XXXV.

15.2 Program of Work (2018–2022) and assessment schedule

15.2.1 Program of Work

203. The SC noted paper IOTC–2017–SC20–09 which provided the Scientific Committee (SC) with a proposed Program of Work for each of its Working Parties (WP), including prioritisation of the elements requested by each WP.

204. The SC noted the proposed Program of Work and priorities for the Scientific Committee and each of the Working Parties and **AGREED** to a consolidated Program of Work as outlined in Appendix XXXVIa-g. The Chairpersons and Vice-Chairpersons of each working party shall ensure that the efforts of their working party are focused on the core areas contained within the appendix, taking into account any new research priorities identified by the Commission at its next Session.

205. The SC recalled the process for developing the consolidated SC PoW (IOTC–2014–SC17–R, para. 179):

• Step 1: Working Parties to identify research needs (based on the needs of the Commission), rank them by order of priority, provide cost estimates and list potential funding sources;

• Step 2: The SC and Working Party Chair and Vice-Chair, in liason with the IOTC Secretariat should develop a consolidated document taking into account the different Working Party research needs and priorities, with the objective of ranking the research needs among all Working Parties;

• Step 3: The Chair of the SC shall present these to the SC, to be discussed and endorsed as the consolidated research priorities for the IOTC Science process;

• Step 4: The IOTC Secretariat, in consultation with the Chair and Vice-Chair of the SC and Chair and Vice-Chair or relevant Working Parties, shall identify funding possibilities to undertake the consolidated research priorities;

• Step 5: Once the funding sources have been committed to a particular research priority, the panel mentioned above in Step 2 shall develop terms of reference of the 'Expression of Interest' (including tasks, timelines and deliverables) and the selection procedure/criteria;

• Step 6: IOTC Secretariat to advertise a call for 'Expression of Interest' among the IOTC Commissioner's and Science contact lists, and via the IOTC website;

• Step 7: The Chair of the SC, Chair(s) and Vice-Chair(s) of the WP(s) concerned, in liaison with the IOTC Secretariat shall determine the most appropriate project proposal, based on the criteria defined in Step 5 and in line with the financial rules of the Commission and FAO. Potential contracted candidate will be contacted by the IOTC Secretariat to confirm availability.

206. The SC **AGREED** on the consolidated table of priorities across all Working Parties, as developed by each WP Chair, and **REQUESTED** that the IOTC Secretariat, in consultation with the Chair and vice-Chair of the SC and relevant Working Parties, develop ToRs for the specific projects to be carried out (Table 4).

207. The SC noted that the consolidated table of priorities does not replace the full programme of work of each Working Party (Appendix XXXVIa-g) and that adequate attention and focus should still be allocated to those activities where possible. The SC further noted that Table 4 has been developed by the SC and WP Chairs to

provide more specific direction to the IOTC Secretariat and the SC Chair as to the priorities of the SC so that, if and when external funding becomes available intersessionally, it is possible to clearly prioritise across all WPs based on the objectives of the SC (as agreed in IOTC-2014-SC17-R, para. 179).

208. The SC noted that the WPM has selected five species for MSE (albacore, yellowfin, bigeye, skipjack and swordfish). While these species are equally prioritised in terms of science, swordfish has been labelled as the first priority in Table 4 given that it is the only species currently lacking funding.

209. The SC noted Table 4 outlining the highest priorities from each WP in terms of funding requirements. The complete set of research priorities identified (and ranked according their importance) by each WP are detailed more fully in Appendix XXXVIa-g.

Table 4. Priority topics for obtaining the information necessary to develop stock status indicators for all Working Parties. Numbering (in bold) represents numbers of each specific WP workplan, of which further details can be found in Appendix XXXVIa-g.

PR	**WPTT (2016) Budget (potential source)**		**WPEB Budget (potential source)**		**WPNT Budget (potential source)**		**WPTmT (2016) Budget (potential source)**		**WPB Budget (potential source)**		**WPDCS (2016) Budget (potential source)**		**WPM Budget (potential source)**	
1	**5.** Develop standardised CPUE series for each tropical tuna for the Indian Ocean (PS and Joint LL)	US$ 30K	**2.1** Historical data mining for the key species and IOTC fleets (e.g. as artisanal gillnet and longline coastal fisheries)		**1.** Collate and characterise operational level data for the main neritic tuna fisheries in the Indian Ocean to investigate their suitability to be used for developing standardised CPUE indices.	CPCs	**2.1.** Age and growth to construct catch at age and growth curves to use in the stock assessments.		**1.2** Tagging research to determine connectivity, movement rates and mortality estimates of billfish.	US$100K	**1.** Artisanal fisheries data collection	$?? (TBD)	**1.5.** SWO MSE	$?? (TBD)
2	**6.4.** Size frequency data of LL/PS and spatial assumptions including potential effects of limited tag mixing on stock assessment outcomes (analysis of tagging data)	US$ 30K	3.4 Ecological Risk Assessment (sharks & rays)	US$40K	**2.** Develop standardised CPUE series for the main fisheries for longtail, kawakawa, Indo-Pacific King mackerel and Spanish mackerel in the Indian Ocean, with the aim of developing CPUE series for stock assessment purposes.	CPCs directly	**4.1.** Develop standardized CPUE series for each albacore fishery for the Indian Ocean, with the aim of developing a single CPUE series.		**6.2** Stock assessment of billfish species in 2017 and 2018	US$ 16250	**6.1.1** Support the adoption of the ROS e-Reporting and ROS national database tools by countries not having any existing observer data collection and management system in place	$?? (TBD)	**1.2.** Review and progress of SKJ MSE	$?? (TBD)

3	**2.** Ageing of YFT and BET to calculate age/length keys and catch at age for using in the stock assessments.	US$ 150K	**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).	Partially funded (153,000 € IOTC + 100.000 € EU/DCF	**3.** Develop and compare multiple assessment approaches to determine stock status for longtail tuna, kawakawa and Spanish mackerel (SS3, ASPIC etc).	IOTC Regular budget	**2.2.1** Age-at-maturity Quantitative biological studies are necessary for albacore throughout its range to determine key biological parameters including age-at-maturity and fecundity-at-age/length relationships, age-length keys, age and growth, which will be fed into future stock assessments.		**6.3** Workshops on techniques for assessment including CPUE estimations for billfish species from gillnet fisheries in 2017 and 2018.	US$11,750	6.2.1 Incorporate all historical observer data	US$20K ~~US$35K~~ ~~US$20K~~	**1.4.** YFT MSE	Funded to Dec 2018 (ABNJ/ CSIRO)

15.2.2 Assessment schedule

210. The SC **ADOPTED** a revised assessment schedule, ecological risk assessment and other core projects for 2017–21, for the tuna and tuna-like species under the IOTC mandate, as well as the current list of key shark species of interest, as outlined in Appendix XXXVII.

15.2.3 Invited Experts

211. The SC **REQUESTED** that at least one 'Invited Expert' be brought to each of the science Working Parties in 2018 and in each subsequent year, so as to further increase the capacity of the Working Paties to undertake the work detailed in the Program of Work.

15.2.4 Consultants

212. Noting the highly beneficial and relevant work done by IOTC stock assessment consultants in 2016 and in previous years, the SC **RECOMMENDED** that the engagement of consultants be continued for each coming year based on the Program of Work. Consultants will be hired to supplement the skill set available within the IOTC Secretariat and CPCs.

15.3 Schedule of meetings for 2018 and 2019

213. The SC noted paper IOTC–2017–SC20–10 which outlined the proposed schedule for IOTC Working Parties and SC meetings for 2018 and 2019.

214. The SC noted that the TCMP will be held over two days and **REQUESTED** that the meeting schedule on the IOTC website is updated to reflect this.

15.3.1 Increasing workload of science meetings

215. The SC noted the issue with increasing workload of Working Party meetings. Many Working Parties have been receiving an increasing number of papers year-on-year e.g. in 2017 there were 57 accepted for WPEB13, 55 accepted for WPTT19, 40 for WPDCS13. In some cases, this is despite filtering of papers by the Chairs and IOTC Secretariat based on relevance to priority agenda items for the meeting and requests to some authors to withdraw papers, submit them as information documents (not for presentation) or pass them to a different meeting.

216. The SC therefore noted the need to develop guiding principles for the provision of papers to ensure they are directly related to the Program of Work of the respective Working Parties and SC, as endorsed by the Commission, and give greater discretion to Chairs on the matter, while still encouraging new and emerging issues to be presented.

15.3.2 Data preparatory meetings

217. Acknowledging that holding data preparatory meetings prior to stock assessments is considered to be best practice, the SC noted that these are not currently possible within the current resourcing, timing and staffing constraints of the IOTC Secretariat and participating CPCs. The SC **AGREED** to explore other methods to overcome this issue such as using the WP meetings for data preparation in the year prior to assessment and through electronic correspondence amongst WP participants ahead of assessments to agree on items such as data inclusion for base case model runs, review of provisional model assumptions and to elaborate sensitivity trials to alternative assumptions thereby further increasing the transparency of the process.

15.3.3 WPNT meeting schedule

218. The SC noted the serious issues with data limitations faced by the WPNT and the difficulty in progressing with the planned assessment schedule. Results produced based on the limited data are highly uncertain and, hence, progress in providing appropriate advice to the Commission has been relatively slow. Therefore, the SC **AGREED** to adjust the assessments to a triennial cycle with capacity building/data mining workshops to be held in the intermediate years, focussing on a particular priority topic. As CPUE analysis is the main priority in the current PoW, the SC further **AGREED** to focus solely on this issue in 2018 as per the new assessment schedule outlined in Appendix XXXVII.

15.3.4 WPEB meeting schedule

219. The SC noted that the WPEB has noted particular issues with increasing content as well as a diverse group of participants who may not be fully engaged in every aspect of the meeting given the very different

specialist groups in attendance. The recent report provides a summary (IOTC-2017-WPEB13-R, para. 214-215):

214. The WPEB recalled its previous recommendation to the Scientific Committee:
*"The WPEB **RECOMMENDED** that the SC note the following:*

> *The WPEB discussed the future format in order to focus the efforts of scientists working on different groups of bycatch species to address more efficiently, the mandate of the group.*
> *The WPEB considered a range of options which the SC is asked to consider:*
> *o **Option 1**: The current WPEB be split into two; A dedicated Working Party on Sharks (WPS) and a Working Party on Ecosystems and Bycatch (WPEB).*
> *o **Option 2**: Retaining the WPEB in its current form, with alternating focus of sharks in one year, followed by other ecosystem and bycatch issues in the next year.*
> *o **Option 3**: Maintaining the WPEB with clear guidelines to deal with sharks every year, as well as other issues and bycatch groups in alternate years or as required.*
> *The WPEB **AGREED** that shark issues were important to address on a yearly basis".*
> *(Para. 253, IOTC-2013-WPEB09-R)*

and the response of the Scientific Committee:

"The SC AGREED that the WPEB should be maintained as a single working party for the next few years, to deal with sharks every year, as well as other issues, especially ecosystem related matters, and bycatch groups in alternate years or as required by the Commission". (Para. 58, IOTC-2013-SC)

220. The SC noted that this approach has not proved successful, particularly in years when a stock assessment has been undertaken as the large number of papers submitted (~60) cannot be fully considered in the time available. The SC therefore **AGREED** that in future years when a stock assessment is planned, the meeting is extended in length by a number of days to more adequately accommodate the workplan, with some of the days dedicated exclusively to the stock assessment work.

15.3.5 WPTmT meeting schedule

221. The SC recalled the proposal by the WPTmT that future stock assessment cycle for albacore tuna should be conducted every three years (rather than two years), in line with the assessment of species covered by other IOTC Working Parties, and that the WPTmT should in addition be convened during the year preceding the next stock assessment to focus on priority areas for improvement in the albacore assessment, such as the standardization of CPUE, or estimation of biological parameters.

222. The SC noted that, exceptionally, that the WPTmT has proposed to meet twice in 2019 (postponing the data preparatory meeting initially planned for 2018), with an initial data preparatory meeting scheduled for January, followed by a full assessment of albacore tuna in July 2019 (Appendix XXXVIII).

223. The SC **REQUESTED** that the schedule of Working Party and Scientific Committee meetings for 2018 and 2019 provided at Appendix XXXVIII be communicated by the IOTC SC Chair to the Commission for its endorsement.

16.IOTC Scientific Strategic Plan

224. The SC noted the presentation providing an update on the proposal for the development of of a Strategic Research Plan for the IOTC Scientific Committee detailed in paper IOTC-2016-SC19-16.

225. The SC acknowledged the importance of developing a strategic plan to guide the future direction of the SC according to the requests of the Commission, and noted that funding for a consultancy has now been identified and the work is due to commence in 2018 in collaboration with the SC Chair and IOTC Secretariat.

17.Other Business

17.1 Election of a Chair and a Vice-Chair for the next biennium

226. The SC noted that the first term of the current Chairperson, Dr Hilario Murua, is due to expire at the end of the current SC meeting and as per the IOTC Rules of Procedure (2014), participants are required to elect a new Chairperson for the next biennium.

227. Noting the Rules of Procedure (2014), the SC called for nominations for the position of Chairperson of the IOTC SC. Dr Hilario Murua was nominated, seconded and re-elected as Chairperson of the SC for the next biennium.

228. The SC noted that the first term of the current Vice-Chairperson, Dr Shiham Adam is also due to expire at the closing of the current SC meeting and as per the IOTC Rules of Procedure (2014), participants are required to elect a new Vice-Chairperson/s for the next biennium.

229. Noting the Rules of Procedure (2014), the SC called for nominations for the position/s of the Vice Chairperson of the IOTC SC. Dr Shiham Adam was nominated, seconded and re-elected as Vice-Chairperson of the SC for the next biennium.

17.2 Estimation of catches in the IOTC database

230. The SC noted paper IOTC–2017–SC20–INF05 which summaried the issues associated with the attribution of catches within EEZ area or high seas, based on available information in the IOTC database.

231. The SC thanked the IOTC Secretariat for the exploratory analysis, and noted the high level of uncertainty between the lower and upper range of catch estimates for some EEZ areas, depending on the choice of method to attribute catches.

232. The SC supported the analysis conducted by the IOTC Secretariat that illustrates:
    - i.) the limitations of using the spatially aggregated catches data reported to IOTC (i.e., catch-and-effort reported at 1º and 5º grid areas) to attribute catches intersected by EEZ boundaries;
    - ii.) uncertainty in the catch estimates for artisanal fisheries, which are generally considered to be incomplete, and in some cases, low quality;
    - iii.) fundamental gaps in the mandatory data to be reported to the IOTC Secretariat (i.e., particularly time-area catches in the catch-and-effort dataset) which make it necessary to apply substitution schemes using proxy fleets or fisheries to assign catches by time-area;
    - iv.) the necessity to make strong assumptions when attributing catches (e.g., that all catches from artisanal or coastal fleets occur wholly within EEZ areas), due to the lack of alternative information.

233. However the SC acknowledged that the analysis serves as a stimulus to improve national fisheries monitoring and data collection in order to provide the IOTC Secretariat and Scientific Committee with more accurate data at finer spatial scales.

17.3 Template for Invited Experts

234. The SC noted paper IOTC-2017-SC20-INF06 on the development of ToRs for Invited Experts to the IOTC WP meetings.

235. The SC noted that one of the key differences between an Invited Expert and an external peer reviewer is that an Invited Expert attends Working Party meetings on a voluntary basis.

236. The SC **AGREED** that developing a reporting template for Invited Experts would be useful, however, this should be voluntary, flexible and focus on providing constructive criticism. The SC **REQUESTED** that the IOTC Secretariat draft some guidelines, with input from the SC Chair and Vice-Chair, and make these available to the SC for review next year. These should be more flexible and less prescriptive than those described in paper IOTC-2017-SC20-INF06.

237. Noting the recommendation of the IOTC Performance Review (PRIOTC02.02d), the SC **AGREED** that a comprehensive, formal external peer review is sometimes important for important or contentious assessments. Thus, the SC **RECOMMENDED** that a process is established and that the Commission allocates funding for external peer review of stock assessments to take place periodically, based on priorities identified by the SC, and **REQUESTED** that the Secretariat develop ToRs for these, with input from the SC Chair and Vice-Chair, and potentially based on a framework similar to that established for the Center for Independent Experts.

17.4 Common Oceans ABNJ Tuna Project

238. The SC noted progress of the Common Oceans ABNJ Tuna Project and support provided by the project to various IOTC initiatives relevant to the work of the SC and to joint RFMO initiatives aimed at sharing

experiences between t-RFMOs. The SC further noted that the Common Oceans ABNJ Tuna Project started to develop ideas for a potential second phase of the project and the invitation extended to IOTC CPCs and the Secretariat to discuss these and additional ideas (IOTC-2017-SC20-INF09).

18. Adoption of the Report of the 20th Session of the Scientific Committee

239. The SC **RECOMMENDED** that the Commission consider the consolidated set of recommendations arising from SC20, provided at Appendix XXXIX.

240. The SC **ADOPTED** the report of the 20th Session of the Scientific Committee (IOTC–2017–SC20–R) on 4 December 2017.

APPENDIX I
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APPENDIX II
AGENDA FOR THE 20TH SESSION OF THE SCIENTIFIC COMMITTEE

Date: 30 November – 4 December 2017

Location: Seychelles

Venue: Savoy Hotel conference room, Beau Vallon

Time: 09:00 – 17:00 daily

Chair: Dr Hilario Murua (EU,Spain); **Vice-Chair:** Dr M. Shiham Adam (Maldives)

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

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

3. **ADMISSION OF OBSERVERS** (Chairperson)

4. **DECISIONS OF THE COMMISSION RELATED TO THE WORK OF THE SCIENTIFIC COMMITTEE** (IOTC Secretariat)
   - 4.1 Outcomes of the 21st Session of the Commission.
   - 4.2 Previous decisions of the Commission

5. **SCIENCE RELATED ACTIVITES OF THE IOTC SECRETARIAT IN 2017** (IOTC Secretariat)
   - 5.1 Report of the Secretariat – Activities in support of the IOTC science process in 2017

6. **NATIONAL REPORTS FROM CPCs** (CPCs)

7. **REPORTS OF THE 2017 IOTC WORKING PARTY MEETINGS**
   - 7.1 IOTC–2017–WPNT07–R Report of the 7th Session of the Working Party on Neritic Tunas
   - 7.2 IOTC–2017–WPB15–R Report of the 15th Session of the Working Party on Billfish
     - 7.2.1 Revision of catch levels of Marlins under Resolution 15/05
   - 7.3 IOTC–2017–WPEB13–R Report of the 13th Session of the Working Party on Ecosystems and Bycatch
     - 7.3.1 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
     - 7.3.2 Revision of mitigation measures contained in Resolution 12/04 for marine turtles
     - 7.3.3 Ecosystem Based Fisheries Management (EBFM) joint-meeting of tRFMOs (Chairperson)
   - 7.4 IOTC–2017–WPTT19–R Report of the 19th Session of the Working Party on Tropical Tunas
     - 7.4.1 Estimation of catch limit from SKJ HCR on Resolution 16/02
   - 7.5 IOTC-2016-WPTmT06-R Report of the 6th Session of the Working Party on Temperate Tunas
   - 7.6 IOTC–2017–WPM08–R Report of the 8th Session of the Working Party on Methods
     - 7.6.1 Management Strategy Evaluation joint tuna RFMO meeting (Chairperson)
   - 7.7 IOTC–2017–WPDCS13–R Report of the 13th Session of the Working Party on Data Collection and Statistics
   - 7.8 Summary discussion of matters common to Working Parties (capacity building activities; connecting science and management, etc.)

8. **OUTCOMES OF THE FIRST TECHNICAL COMMITTEE ON MANAGEMENT PROCEDURES (TCMP)**

9. **OUTCOMES OF THE IOTC AND JOINT t-RFMO FAD WORKING GROUP**

10. **EXAMINATION OF THE EFFECTS OF PIRACY ON FLEET OPERATIONS AND SUBSEQUENT CATCH AND EFFORT TRENDS** (Chairperson)

11. **STATUS OF TUNA AND TUNA-LIKE RESOURCES IN THE INDIAN OCEAN** (Chairperson)
    - 11.1 Tuna – Highly migratory species
    - 11.2 Tuna and mackerel – Neritic species
    - 11.3 Billfish

12. **STATUS OF SHARKS, MARINE TURTLES, SEABIRDS AND MARINE MAMMALS IN THE INDIAN OCEAN** (Chairperson)
    - 11.1 Sharks
    - 11.2 Marine turtles
    - 11.3 Seabirds
    - 11.4 Marine Mammals

13. **IMPLEMENTATION OF THE REGIONAL OBSERVER SCHEME** (IOTC Secretariat)
    - 12.1 Consideration of Resolution 16/04 *On the implementation of a Pilot Project in view of promoting the Regional Observer Scheme of IOTC*
        - 12.1.1 Pilot Project approved by the Commission in 2017
        - 12.1.2 Minimum standards for the implementation of Electronic Monitoring Systems

14. **PROGRESS ON THE IMPLEMENTATION OF THE RECOMMENDATIONS OF THE PERFORMANCE REVIEW PANEL** (IOTC Secretariat)

15. **PROGRAM OF WORK AND SCHEDULE OF WORKING PARTY AND SCIENTIFIC COMMITTEE MEETINGS** (IOTC Secretariat and Chairperson)
    - 15.1 Progress on previous Recommendations from WPs and SC
    - 15.2 Program of Work (2018–2022) and assessment schedule
    - 15.3 Schedule of meetings for 2018 and 2019

16. **IOTC SCIENTIFIC STRATEGIC RESEARCH PLAN** (Chairperson)

17. **OTHER BUSINESS** (Chairperson)
    - 17.1 Election of a Chair and a Vice-Chair for the next biennium (Chair and Secretariat)

18. **REVIEW OF THE DRAFT, AND ADOPTION OF THE REPORT OF THE 20th SESSION OF THE SCIENTIFIC COMMITTEE** (Chairperson)

APPENDIX III
LIST OF DOCUMENTS

Document	Title	Availability
IOTC–2017–SC20–01a	Draft: Agenda of the 20th Session of the Scientific Committee	✓ 24 October
IOTC–2017–SC20–01b	Draft: Annotated agenda of the 20th Session of the Scientific Committee	✓ 15 November
IOTC–2017–SC20–02	Draft: List of documents of the 20th Session of the Scientific Committee	✓ 15 November
IOTC–2017–SC20–03	Outcomes of the 21st Session of the Commission (IOTC Secretariat)	✓ 13 November
IOTC–2017–SC20–04	Previous decisions of the Commission (IOTC Secretariat)	✓ 7 November
IOTC–2017–SC20–05 Rev_1	Report of the Secretariat – Activities in support of the IOTC science process in 2017 (IOTC Secretariat)	✓ 14 November ✓ 29 November
IOTC–2017–SC20–06 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)	✓ 9 November
IOTC–2017–SC20–07	Update on the implementation of the regional observer scheme (IOTC Secretariat)	✓ 15 November
IOTC–2017–SC20–08	Update on progress regarding Resolution 09/01 – on the performance review follow–up (IOTC Secretariat)	✓ 13 November
IOTC–2017–SC20–09 Rev_1	Revision of the program of work (2018–2022) for the IOTC science process (IOTC Secretariat)	✓ 15 November
IOTC–2017–SC20–10 Rev_1	Proposed schedule of Working Party and Scientific Committee meetings for 2018 and 2019 (IOTC Secretariat)	✓ 14 November
IOTC–2017–SC20–11	Update on the conditioning of an operating model for the Indian Ocean swordfish (I. Mosqueira, D. Rosa, D. Fu, R. Coelho)	✓ 16 November
IOTC–2017–SC20–12 Rev_1	Calculation of the skipjack catch limit for the period 2018-2020 using the HCR adopted in Resolution 16/02 (H Murua et al.)	✓ 20 November
IOTC–2017–SC20–13	Progress on SC19 recommendations (IOTC Secretariat)	✓ 21 November
IOTC–2017–SC20–14	Scientific advice to support the implementation of IOTC Resolution 16/06	✓ 28 November
Executive Summaries		
IOTC–2017–SC20–ES01	Status of the Indian Ocean Albacore (ALB: *Thunnus alalunga*) resource	✓ 15 November
IOTC–2017–SC20–ES02	Status of the Indian Ocean bigeye tuna (BET: *Thunnus obesus*) resource	✓ 15 November
IOTC–2017–SC20–ES03	Status of the Indian Ocean skipjack tuna (SKJ: *Katsuwonus pelamis*) resource	✓ 15 November
IOTC–2017–SC20–ES04	Status of the Indian Ocean yellowfin tuna (YFT: *Thunnus albacares*) resource	✓ 15 November
IOTC–2017–SC20–ES05	Report on biology, stock status and management of southern bluefin tuna: 2017 (from CCSBT)	✓ 15 November
IOTC–2017–SC20–ES06	Status of the Indian Ocean bullet tuna (BLT: *Auxis rochei*) resource	✓ 15 November
IOTC–2017–SC20–ES07	Status of the Indian Ocean frigate tuna (FRI: *Auxis thazard*) resource	✓ 15 November
IOTC–2017–SC20–ES08	Status of the Indian Ocean kawakawa (KAW: *Euthynnus affinis*) resource	✓ 15 November
IOTC–2017–SC20–ES09	Status of the Indian Ocean longtail tuna (LOT: *Thunnus tonggol*) resource	✓ 15 November
IOTC–2017–SC20–ES10	Status of the Indian Ocean Indo-Pacific king mackerel (GUT: *Scomberomorus guttatus*) resource	✓ 15 November

Document	Title	Availability
IOTC–2017–SC20–ES11	Status of the Indian Ocean narrow-barred Spanish mackerel (COM: *Scomberomorus commerson*) resource	✓ 15 November
IOTC–2017–SC20–ES12	Status of the Indian Ocean black marlin (BLM: *Makaira indica*) resource	✓ 15 November
IOTC–2017–SC20–ES13	Status of the Indian Ocean blue marlin (BUM: *Makaira nigricans*) resource	✓ 15 November
IOTC–2017–SC20–ES14	Status of the Indian Ocean striped marlin (MLS: *Tetrapturus audax*) resource	✓ 15 November
IOTC–2017–SC20–ES15	Status of the Indian Ocean Indo-Pacific sailfish (SFA: *Istiophorus platypterus*) resource	✓ 15 November
IOTC–2017–SC20–ES16	Status of the Indian Ocean swordfish (SWO: *Xiphias gladius*) resource	✓ 15 November
IOTC–2017–SC20–ES17	Status of the Indian Ocean blue shark (BSH: *Prionace glauca*)	✓ 15 November
IOTC–2017–SC20–ES18	Status of the Indian Ocean oceanic whitetip shark (OCS: *Carcharhinus longimanus*)	✓ 15 November
IOTC–2017–SC20–ES19	Status of the Indian Ocean scalloped hammerhead shark (SPL: *Sphyrna lewini*)	✓ 15 November
IOTC–2017–SC20–ES20	Status of the Indian Ocean shortfin mako shark (SMA: *Isurus oxyrinchus*)	✓ 15 November
IOTC–2017–SC20–ES21	Status of the Indian Ocean silky shark (FAL: *Carcharhinus falciformis*)	✓ 15 November
IOTC–2017–SC20–ES22	Status of the Indian Ocean bigeye thresher shark (BTH: *Alopias superciliosus*)	✓ 15 November
IOTC–2017–SC20–ES23	Status of the Indian Ocean pelagic thresher shark (PTH: *Alopias pelagicus*)	✓ 15 November
IOTC–2017–SC20–ES24	Status of marine turtles in the Indian Ocean	✓ 15 November
IOTC–2017–SC20–ES25	Status of seabirds in the Indian Ocean	✓ 15 November
Working Party Reports		
IOTC–2017–WPNT07–R	Report of the 6th Session of the Working Party on Neritic Tunas	✓ 27 October
IOTC–2017–WPB15–R	Report of the 15th Session of the Working Party on Billfish	✓ 27 October
IOTC–2017–WPEB13–R	Report of the 13th Session of the Working Party on Ecosystems and Bycatch	✓ 27 October
IOTC–2017–WPM08–R	Report of the 8th Session of the Working Party on Methods	✓ 27 October
IOTC–2017–WPDCS13–R	Report of the 13th Session of the Working Party on Data collection and Statistics	✓ 30 November
IOTC–2017–WPTT19–R	Report of the 19th Session of the Working Party on Tropical Tunas	✓ 24 November
National Reports		
IOTC–2017–SC20–NR01	Australia	✓ 7 November
IOTC–2017–SC20–NR02	China	✓ 13 November
IOTC–2017–SC20–NR03	Comoros	✓ 14 November
IOTC–2017–SC20–NR04	Eritrea	Not provided
IOTC–2017–SC20–NR05	European Union	✓ 21 November
IOTC–2017–SC20–NR06	France (OT)	✓ 24 November
IOTC–2017–SC20–NR07	Guinea	Not provided
IOTC–2017–SC20–NR08	India	Not provided
IOTC–2017–SC20–NR09	Indonesia	✓ 3 November
IOTC-2017-SC20-NR10	Iran, Islamic Republic of	✓ 16 November
IOTC–2017–SC20–NR11	Japan	✓ 15 November
IOTC–2017–SC20–NR12	Kenya	✓ 21 November

Document	Title	Availability
IOTC–2017–SC20–NR13	Korea, Republic of	✓ 15 November
IOTC–2017–SC20–NR14	Madagascar	Not provided
IOTC–2017–SC20–NR15	Malaysia	✓ 15 November
IOTC–2017–SC20–NR16	Maldives, Republic of	✓ 12 November
IOTC–2017–SC20–NR17	Mauritius	✓ 15 November
IOTC–2017–SC20–NR18	Mozambique	✓ 15 November
IOTC–2017–SC20–NR19	Oman, Sultanate of	Not provided
IOTC–2017–SC20–NR20	Pakistan	✓ 26 October
IOTC–2017–SC20–NR21	Philippines	Not provided
IOTC–2017–SC20–NR22	Seychelles, Republic of	✓ 29 November
IOTC–2017–SC20–NR23	Sierra Leone	Not provided
IOTC–2017–SC20–NR24	Somalia	✓ 14 November
IOTC–2017–SC20–NR25	Sri Lanka	✓ 8 November
IOTC–2017–SC20–NR26	South Africa, Republic of	✓ 30 October
IOTC–2017–SC20–NR27	Sudan	Not provided
IOTC–2017–SC20–NR28	Tanzania	Not provided
IOTC–2017–SC20–NR29	Thailand	✓ 15 November
IOTC–2017–SC20–NR30	United Kingdom (OT)	✓ 15 November
IOTC–2017–SC20–NR31	Yemen	Not provided
Cooperating Non-Contracting Parties		
IOTC–2017–SC20–NR32	Bangladesh	✓ 14 November
IOTC–2017–SC20–NR33	Liberia	Not provided
IOTC–2017–SC20–NR34	Senegal	Not provided
Information papers		
IOTC–2017–SC20–INF01	Chair report of the 1st joint tRFMO FAD working group meeting	✓ 7 November
IOTC–2017–SC20–INF02	Report of the joint tRFMO meeting on Ecosystem Based Fisheries Management	✓ 7 November
IOTC–2017–SC20–INF03	Proposal for a data call for information to review the effect of mitigation measures outlined in IOTC Resolution 12/04 on marine turtles	✓ 24 November
IOTC–2017–SC20–INF04	Acquisition of catch-and-effort and size data from sport fisheries in the Western Indian Ocean (Pepperel, J., Griffiths, S. and Kadagi, N.)	✓ 24 November
IOTC–2017–SC20–INF05	Estimation of EEZ catches in the IOTC database: report on the availability and quality of catch estimates	✓ 28 November
IOTC–2017–SC20–INF06	Suggested format for written reports of Invited Experts (IOTC secretariat)	✓ 28 November
IOTC–2017–SC20–INF07	BIOFAD project (H.Murua et al.)	✓ 29 November
IOTC–2017–SC20–INF08	Update on the IOTC Stock Structure Project (Davies, C. et al.)	✓ 12 December
IOTC–2017–SC20–INF09	Update on the progress of the Common Oceans ABNJ Tuna Project (K.Hett et al.)	✓ 3 December

APPENDIX IVA
NATIONAL STATEMENTS

Agenda Item 2: Adoption of the Agenda and Arrangements for the Session

The SC noted the following statement made by Mauritius (1st statement):

"The Government of the Republic of Mauritius reiterates that the Chagos Archipelago, including Diego Garcia, and the Island of Tromelin form an integral part of the territory of the Republic of Mauritius.

The Government of the Republic of Mauritius reaffirms that it does not recognize the so-called "British Indian Ocean Territory" which the United Kingdom purported to create by illegally excising the Chagos Archipelago from the territory of Mauritius prior to its accession to independence, in violation of international law and of United Nations General Assembly Resolutions 1514 (XV) of 14 December 1960, 2066 (XX) of 16 December 1965, 2232 (XXI) of 20 December 1966 and 2357 (XXII) of 19 December 1967.

The Government of the Republic of Mauritius further reiterates that the United Kingdom is not entitled to be a member of the Indian Ocean Tuna Commission (IOTC) as it is not a "coastal State situated wholly or partly within the Area [of competence of the Commission]". Nor can the so-called "BIOT" claim to be a member of the IOTC on the basis of Article IV of the IOTC Agreement.

Moreover, the Government of the Republic of Mauritius rejects the sovereignty claim of France over the Island of Tromelin as well as France's claim to any sovereign right or jurisdiction over the EEZ adjacent to the Island of Tromelin. Further, the Government of the Republic of Mauritius does not recognize the validity of the inclusion of the Island of Tromelin in the French Southern and Antarctic Lands (TAAF) or the Scattered Islands/Iles Eparses. The Government of the Republic of Mauritius reaffirms that the Republic of Mauritius has full and complete sovereignty over the Island of Tromelin, including its maritime zones.

The Government of the Republic of Mauritius strongly objects to the use of terms such as "United Kingdom (OT)", "UK (OT)", "United Kingdom (Overseas Territories)" and "UK (I.O. Territories)" in documents which have been circulated for this meeting, in so far as these terms purport to refer to the Chagos Archipelago as a British territory or to imply that the United Kingdom or the so-called "BIOT" is entitled to be a member of the IOTC.

The Government of the Republic of Mauritius also objects to the use of terms such as "France (OT)" and "France (territories)" in the documents which have been circulated for this meeting, in so far as these terms purport to refer to the Island of Tromelin as a French territory.

On 20 December 2010, the Republic of Mauritius initiated proceedings against the United Kingdom under Article 287 of, and Annex VII to, the United Nations Convention on the Law of the Sea (UNCLOS) to challenge the legality of the 'marine protected area' ('MPA') which the United Kingdom purported to establish on 1 April 2010 around the Chagos Archipelago. The Arbitral Tribunal constituted under Annex VII to UNCLOS to hear the dispute delivered its Award on 18 March 2015. The Tribunal ruled that in establishing the 'MPA' around the Chagos Archipelago, the United Kingdom breached its obligations under Articles 2(3), 56(2) and 194(4) of UNCLOS.

Since the 'MPA' purportedly established by the United Kingdom around the Chagos Archipelago has been held to be in breach of international law, it cannot be enforced. Any reference to or consideration given by the IOTC, including this Committee, to the purported 'MPA' in disregard of the Award will be in contradiction with the Tribunal's ruling and international law. The Government of the Republic of Mauritius urges the Committee to ensure compliance with the Award of the Arbitral Tribunal constituted under Annex VII to UNCLOS.

In the light of the foregoing, the delegation of the Republic of Mauritius has no objection to the adoption of the draft agenda, subject to:

(a) there being no discussions at this meeting on the 'MPA' purportedly established by the United Kingdom around the Chagos Archipelago which has been held to be illegal under international law; and

(b) the Republic of Mauritius reserving its right to object to the consideration of any documents purportedly submitted by the United Kingdom, including in respect of the so-called "BIOT" which is not recognized by the Government of the Republic of Mauritius, and any other documents submitted by the Secretariat or any other party in relation to the so-called "BIOT".

Should any document which purports to refer to the Chagos Archipelago as the so-called "BIOT" or as a British territory be considered, such consideration as well as any action or decision that may be taken on the basis of any such document cannot and should not be construed in any way whatsoever as implying that the United Kingdom has sovereignty or analogous rights over the Chagos Archipelago or that the United Kingdom or the so-called "BIOT" is entitled to be a member of the IOTC.

Further, any consideration of any document which purports to refer to the Island of Tromelin as a French territory or use terms such as "France (OT)" and "France (territories)" as well as any action or decision that may be taken on the basis of any such document, cannot and should not be construed in any way whatsoever as implying that the Island of Tromelin is part of the French Southern and Antarctic Lands (TAAF) or the Scattered Islands/Iles Eparses or is a French territory.

The Republic of Mauritius also reserves all its rights under international law, including under Article XXIII of the Agreement for the Establishment of the Indian Ocean Tuna Commission.

This statement is applicable to all agenda items under which the Chagos Archipelago and the Island of Tromelin are dealt with."

The SC noted the following statement made by France:

"France declares that it does not recognize the Mauritian declaration as having any legal value because it disregards the fact that the island of Tromelin is a French territory over which France exercises consistently full sovereignty. Thus, France enjoys sovereign rights or jurisdiction conferred to it by international law in the Exclusive Economic Zone adjacent to the island of Tromelin. The meetings of the Indian Ocean RFMOs are not the place to discuss issues of territorial sovereignty, but France stresses that it will continue to have a constructive dialogue with the Republic of Mauritius on this subject."

The SC noted the following statement made by the United Kindgom (Overseas Territories) (1st statement):

"UK Position on Sovereignty of the British Indian Ocean Territory

The Government of the United Kingdom is clear about its sovereignty of the Chagos Archipelago, which has been British since 1814, and which it administers as the British Indian Ocean Territory. No international tribunal, including the Arbitral Tribunal constituted under Annex VII to the UN Convention on the Law of the Sea (UNCLOS), has ever called the UK's sovereignty of the Territory into doubt.

Whilst the United Kingdom does not recognise the Republic of Mauritius' claim to sovereignty of the Chagos Archipelago, it has repeatedly undertaken to cede it to Mauritius, when no longer required for defence purposes. We maintain that commitment, though it is for the UK alone to determine when this condition is met. In the meantime, BIOT is still needed for defence purposes. It is used to combat some of the most difficult problems of the 21st Century including terrorism, international criminality, instability and piracy.

UK Position on the right to participate at IOTC

The Agreement for the Establishment of the Indian Ocean Tuna Commission provides that IOTC membership shall be open, inter alia, to FAO members that are situated wholly or partly within the IOTC's Area of Competence. As the British Indian Ocean Territory is situated wholly within the IOTC's Area of Competence, there can therefore be no doubt that the United Kingdom, as the State with sovereignty over BIOT as aforementioned, is entitled to be a member of IOTC. As such we are full members of the IOTC and have every right to be here.

Marine Protected Area

The British Indian Ocean Territory Marine Protected Area (MPA), which the UK declared in 2010, is highly valued by scientists from many countries. They consider it a global reference site for marine conservation in an ocean which is heavily overfished.

The UNCLOS Tribunal was clear that it took no view on the substantive quality or nature of the MPA. Its concern was confined to the manner in which it was established. The Tribunal found that the UK needed to have further *consultation with Mauritius about the establishment of the MPA in order to have due regard to its rights and interests. We began implementation of the Tribunal's Award with a series of bilateral talks but Mauritius have refused to engage on this following their insistence on being given a date for sovereignty transfer.*

Mauritius suggests that the Marine Protected Area ('MPA') established within the Territory in 2010 by the UK has been ruled to be "illegal" by that same Arbitral Tribunal. That is not the case. The Tribunal's Final Observation is:

"In concluding that the declaration of the MPA was not in accordance with the provisions of the Convention, the Tribunal has taken no view on the substantive quality or nature of the MPA or the importance of environmental protection. The Tribunal's concern has been with the manner in which the MPA was established, rather than its substance. It is now open to the Parties to enter into the negotiations that the Tribunal would have expected prior to the proclamation of the MPA, with a view to achieving a mutually satisfactory arrangement for protecting the marine environment, to the extent necessary under a "sovereignty umbrella".""

The SC noted the following statement made by the Republic of Mauritius in response to UK's and France's Exercise of Right of Reply (2nd statement):

"The Government of the Republic of Mauritius reiterates that it does not recognize the so-called "British Indian Ocean Territory" ("BIOT") and that the Chagos Archipelago, including Diego Garcia, forms an integral part of the territory of the Republic of Mauritius, a position on which no international judge or arbitrator has expressed a contrary view. In the arbitral proceedings initiated in December 2010 by the Republic of Mauritius against the United Kingdom under the United Nations Convention on the Law of the Sea, two of the arbitrators concluded that the United Kingdom does not have sovereignty over the Chagos Archipelago.

The Government of the Republic of Mauritius reaffirms that the United Kingdom is not entitled to be a member of the Indian Ocean Tuna Commission (IOTC). Nor can the so-called "BIOT" claim to be a member of the IOTC.

The Government of the Republic of Mauritius maintains in no uncertain terms that the 'marine protected area' ('MPA') purportedly established by the United Kingdom around the Chagos Archipelago is illegal and cannot be enforced. At paragraph 547(B) of its Award, the Arbitral Tribunal constituted in the case brought by the Republic of Mauritius against the United Kingdom under the United Nations Convention on the Law of the Sea (UNCLOS) to challenge the legality of the purported 'MPA' declared that in establishing the purported 'MPA' around the Chagos Archipelago, the United Kingdom breached its obligations under Articles 2(3), 56(2) and 194(4) of UNCLOS.

Moreover, the Government of the Republic of Mauritius reiterates that the Island of Tromelin forms an integral part of the territory of the Republic of Mauritius and that it does not recognize the validity of the inclusion of the Island of Tromelin in the French Southern and Antarctic Lands (TAAF) or the Scattered Islands/Iles Eparses. The Government of the Republic of Mauritius reaffirms that it has full and complete sovereignty over the Island of Tromelin, including its maritime zones.

Since the United Kingdom and France purport to assert under the Agreement for the Establishment of the Indian Ocean Tuna Commission and in this multilateral forum rights which they does not have over the Chagos Archipelago and the Island of Tromelin respectively, the Republic of Mauritius considers that it is entitled to raise issues relating to the Chagos Archipelago and the Island of Tromelin in this forum. These are no doubt multilateral and not bilateral matters.

This second statement also reiterates the commitment expressed in the last paragraph of the First statement. In short Mauritius reiterates that both France and UK have no sovereign rights on Tromelin and Chagos Archipelago. Therefore the first and second statements apply to all cross cutting issues on the Agenda items where mention is made of Tromelin and Chagos Archipelago."

The SC **NOTED** the following statement made by the United Kindgom (Overseas Territories) (2nd statement)*:*

"<u>IOTC incorrect forum to raise bilateral issues</u>

The United Kingdom regrets the continued use of this important multilateral forum by the Republic of Mauritius to address a bilateral matter. This only serves to distract from the important work of IOTC members to evaluate the conservation status of key IOTC species and other matters considered by this Committee.

The UK notes the statement from the FAO at the IOTC meeting in May 2016 recognising that this is a bilateral matter between Mauritius and the United Kingdom and that the FAO Secretariat would not express any views on the question. The FAO Secretariat went on to state that "The United Kingdom and Mauritius are both Parties to *the IOTC Agreement and Members of the IOTC and that the instruments of acceptance of the IOTC Agreement of 1994 and 1995 and none of the instruments contains any declaration, restriction or reservation on the matter. The IOTC is not a forum to discuss issues of sovereignty." The FAO Secretariat requested both Members not to raise the matter in this forum and to avoid disruption of technical proceedings.*

UK thanks the FAO for the recognition of these matters as a bilateral issue and would reassure the Committee that the UK does not intend to repeat its position each time Mauritius intervenes, but note that our position will remain as set out previously and that we would be grateful for this to be indicated in the record of the meeting.

<u>On legality of MPA</u>

The Award does not have the effect of rendering the MPA illegal. It explicitly states that the Tribunal takes no view on the substance of the MPA, a measure that preserves the Indian Ocean's fish stocks, and safeguards their importance for the economy and food security of the region.

The Tribunal's finding was far more narrow: that the United Kingdom should have consulted the Republic of Mauritius more fully about the establishment of the MPA, so as to give due regard to its rights. As the Tribunal notes in its Final Observation, it is open to both Parties to enter into such negotiations now, and to do so without reference to matters of sovereignty, as the term "sovereignty umbrella" denotes. The Government of the United Kingdom has made extensive efforts to engage the Republic of Mauritius about conservation matters and, following the Award, has begun bilateral consultations with the Republic of Mauritius. We remain committed to working with the Republic of Mauritius to explore all aspects of its interests in relation to the MPA."

APPENDIX IVB
NATIONAL REPORT ABSTRACTS (2017)

Australia (IOTC-2017-SC20-NR01)

Pelagic longline and purse seine are the two main fishing methods used by Australian vessels to target tuna and billfish in the Indian Ocean Tuna Commission (IOTC) Area of Competence. The number of active longliners and levels of fishing effort have declined substantially in recent years due to reduced profitability, primarily as a result of lower fish prices and higher operating costs. In 2016, two Australian longliners from the Western Tuna and Billfish Fishery and five longliners from the Eastern Tuna and Billfish Fishery operated in the IOTC Area of Competence. They caught 30.1 t of albacore (*Thunnus alalunga*), 69.4 t of bigeye tuna (*Thunnus obesus*), 65.8 t of yellowfin tuna (*Thunnus albacares*), 133.8 t of swordfish (*Xiphius gladius*) and 0.9 t of striped marlin (*Kajikia audax*). These catches represent approximately 12 per cent of the peak catches taken by Australian vessels fishing in the IOTC Area of Competence in 2001, for these five species combined. In 2016, 2.2 t of shark was landed by the Australian longline fleet operating in the IOTC Area of Competence and 6247 sharks were discarded/released. In addition, 10.2 per cent of hooks deployed in the WTBF were observed in the 2016 calendar year. The catch of southern bluefin tuna (*Thunnus maccoyii*) in the purse seine fishery was 5012 t in 2016. There was no skipjack tuna (*Katsuwonus pelamis*) caught by purse seine fishing.

China (IOTC-2017-SC20-NR02)

Deep-frozen longline and ice fresh-longline are the only two fishing gears used by Chinese fleets to catch tuna and tuna-like species in the IOTC waters. The total number of Chinese longline vessels operated in the IOTC waters in 2016 was 67. The number of active deep-frozen longline vessels increased from 46 in 2015 to 54 in 2016. The tropical tunas catch (bigeye and yellowfin tuna) of Chinese longline fleet in 2016 was estimated at 5,898 MT, 624 MT lower than that in 2015 (6,522 MT). The number of ice-fresh longline vessels increased from 7 in 2015 to 13 in 2016. The albacore longline catch for 2016 was estimated at 1,920 MT, about 4.2% higher than in 2015 (1,843 MT). Both the logbook and observer programs are being implemented for the Chinese longline fleets. In 2016, four scientific observers were deployed on board longline vessels, and collected the data for both targeted and bycatch species as required.

Comoros (IOTC-2017-SC20-NR03)

La pêche aux Comores est exclusivement artisanale, pratiquée sur des embarcations non ponté en bois ou en fibre de verre, motorisé ou non motorisé d'une longueur de 3 m à 9 m. Elle exploite essentiellement les espèces pélagiques (Thunnus albacares, Katsuwonus pelamis, Thunnus alalunga Istiophorus platypterus, Thunnus obesus, Euthynnus affinis) et aussi des espèces benthiques. Elle contribue pour sa totalité à l'alimentation de la population comorienne, tout en fournissant 55% de l'emploi total du secteur agricole soit environ 7000 pêcheurs. Les techniques de pêche utilisées sont essentiellement la ligne de traine, la palangrotte et peu de filet pour les petits pélagiques. La durée de la marée est d'une journée à 7 jours. Depuis février 2011 les Comores ont mis en place un système de collecte des données sur les lieux de débarquement en collaboration avec la CTOI. En 2016 nous avons effectué une phase pilote en introduisant partiellement l'utilisation de smartphone pour la collecte des données. Au titre de 2016, La production annuelle issue de cette enquête est estimé à 16 338 tonnes toutes espèces confondu soit environ 15337 tonnes de thonidés sur un ensemble de 5006 embarcations.

Pour le moment la pêche industrielle est inexistante au niveau national. Cette activité de pêche est pratiquée par une flottille Etrangère qui opère dans le cadre d'un Accord de pêche, toutefois cette flottille transmet une copie de leur carnet de bord au niveau des Comores. Les captures de cette flottille ne sont ni débarquées ni transbordées dans le pays.

Eritrea (IOTC-2017-SC20-NR04)

National report not submitted.

European Union (IOTC-2017-SC20-NR05)

La flotte de l'Union européenne fréquentant les eaux de l'Océan Indien est composée de deux segments principaux.

Le premier est un segment hauturier regroupant

- des métiers à la senne coulissante ciblant les trois espèces de thons tropicaux
    - Données 2016:
        - 27 navires actifs
        - 36, 610 m³.j de capacité de transport
        - 6 ,553 jours de recherche et 7, 327 jours pêche
        - 207,544 t de captures
            - YFT 41.8 %
            - SKJ 51.8 %
            - BET 6.2 %
- des métiers à la palangriers ciblant l'espadon et présentant de captures associées importantes de certaines espèces de requins pélagiques
    - Données 2016
        - 20 navires actifs
        - 6,398 $*10^6$ hameçons mis à l'eau
        - 12,265 t de captures
            - SWO 40.4 %
            - BSH 41.9 %

- des métiers à la palangriers ciblant l'espadon et présentant de captures associées importantes de thonidés.
    - Données 2016
        - 19 navires actifs (>12m)
        - 3,710 $*10^6$ hameçons mis à l'eau
        - 1,885 t de captures
            - SWO 40.9 %
            - YFT & BET 35.3%
            - ALB 12.3 %

Le second est un segment côtier, regroupant des navires de moins de 12 m pratiquant et capturant des grands pélagiques et les espèces associées, utilisant pour certains des Dispositifs à concentration de poissons ancrés comme auxiliaires de pêche autour des deux Régions Ultrapériphériques de l'Union européenne de l'océan Indien, Mayotte et l'île de la Réunion. Ce segment côtier correspond à des métiers

- à la palangre
    - Données 2016
        - 22 unités à la Réunion
            - 0,614 $*10^6$ hameçons
            - 443 t de captures
        - 3 unités à Mayotte
            - N/A sorties
            - 59 t de captures
- à la ligne de traîne ou à la ligne à main
    - Données 2016
        - 152 unités à la Réunion
            - 12,244 sorties environ
            - 746 t de captures
        - 145 yoles dans le secteur formel professionnel à Mayotte, 369 barques et 729 pirogues dans le secteur informel, production total estimée à 2 050 t (en 2006) et comprise entre 965 et 1320 t en 2013/2015. L'estimation provisoire de 2016, uniquement pour les barques professionnelles, s'élève qu'à 687t.

La capacité de pêche de la flotte de l'Union européenne autorisée à développer une activité dans les pêcheries aux grands pélagiques localisées dans a zone de la convention de la CTOI est encadrée par des dispositions portant sur les limites de capacités prévues par les Résolutions de la CTOI et par des textes législatifs de l'Union européenne.

Par ailleurs, les conditions d'accès à certaines zones de pêche dans des eaux sous juridiction d'États côtiers du sud-ouest de l'océan Indien font l'objet de dispositions spécifiques sont définies dans des accords publiques engageant l'Union européenne appelés Accords de Partenariat dans le secteur de la Pêche Durable (APPD).

Conformément à la Résolution 10/02 de la CTOI, Les États membres de pavillon (Espagne, France, Italie, Portugal et Royaume Uni) ont soumis les données scientifiques caractérisant l'activité de la flotte de l'Union européenne ayant développé en 2016 un effort de pêche dans la zone de compétence de la CTOI, permettant au Comité Scientifique de la CTOI de conduire ses travaux.

France-territories (IOTC-2017-SC20-NR06)
Depuis le passage de Mayotte comme territoire sous régime communautaire depuis le 1er Janvier 2014, l’outre-mer français tropical de l’océan Indien ne concerne plus que les îles Eparses qui sont rattachées à l’administration supérieure des Terres Australes et Antarctiques françaises (TAAF). Un parc naturel marin a été créé le 22 février 2012 (décret n°2012-245), il s’agit du PNM des Glorieuses, qui dépend des îles Eparses et s’étend sur l’ensemble de la ZEE des Glorieuses.

Les Iles Eparses (France Territoires) ne disposent pas de flottilles thonières immatriculées pour ce territoire. Néanmoins, l’administration des TAAF délivre des licences de pêche à des palangriers et senneurs français et étrangers souhaitant pêcher dans les eaux administrées par France Territoires, et un programme observateur embarqué accompagne l’octroi de ces licences. En 2016, l’administration des TAAFs a opéré des embarquements d’observateurs scientifiques sur 11 navires. Ces embarquements ont totalisé 562 jours d’observations parmi lesquels 16 jours concernent la ZEE des TAAFs. (soit 2,5% des jours observés). Un total de 414 coups de pêche a été observé durant ces campagnes. Parmi ces coups de pêche 19 ont réalisés dans les ZEE des Iles Eparses, à Juan et Nova (11 calées) et aux Glorieuses (7 calées). Au cours de ces calées 431 tonnes de thons ont été capturés et mises à bord.

Le dispositif de recherche sur les grands pélagiques actuel de la France (IRD & Ifremer essentiellement) couvre des activités de type observatoire, l’étude des comportements migratoires des grands pélagiques, des études génétiques pour la délimitation des stocks, des études sur la biologie de la reproduction, la mise au point de mesures d’atténuations des prises accessoires et l’étude de la dynamique de l’écosystème tropical. La plupart des projets sont financés sur appels d’offre internationaux, européens ou nationaux. On trouvera dans le rapport la liste des différents projets qui se sont poursuivis ou ont débuté en 2016. La France a participé activement à tous les groupes de travail organisés par la CTOI, et a présenté 24 contributions scientifiques en 2016 en incluant les rapports nationaux proposés pour l’élaboration du rapport Européen et le rapport France-Territoires à l’intention du Comité Scientifique de la Commission.

Guinea (IOTC-2017-SC20-NR07)

National report not submitted.

India (IOTC-2017-SC20-NR08)

National report not submitted.

Indonesia (IOTC-2017-SC20-NR09 Rev_1)
For fisheries management purpose, Indonesian waters is divided into eleven Fisheries Management Areas (FMA). Three of them located within the IOTC area of competence, namely Fisheries Management Areas (FMAs) 572 (Indian Ocean – West Sumatera), FMA 573 (South of Java – East Nusa Tenggara) and 571 (Malacca Strait and Andaman Sea). Indonesian fishers operate various fishing gears such as Long line, Purse seine, hand line to catch large pelagic fishes such as tuna, skipjack, marlins etc. Longline is the main fishing gear type targeting tunas which operated in those FMAs. The national catch of four main tuna species in 2016 was estimated 132,961 tons which composed of albacore (7,179 t); bigeye tuna (22,016 t); skipjack tuna (67,657 t) and yellowfin tuna (35,839 t). Port sampling and scientific observer programs are still continuing and conducting by Research Institute for Tuna fisheries (RITF), in the meantime national observer programs developed and conducted by Directorate General of Captured Fisheries . Following the issuance of ministerial regulation No. 1/2013 concerning observer onboard for fishing and carrier vessel, the national tuna management plan (NTMP) was officially lunched in Bali in 2014 and legalized recently in 2015. Furthermore, transshipment at sea also banned by ministry regulation no 57/PERMEN/2014 and implemented by 2015.

Iran (Islamic Republic of) (IOTC-2017-SC20-NR10)

Iran (Islamic Republic of) fishing grounds in northern and southern waters of the country are located in the Caspian Sea and Persian Gulf and Oman Sea Respectively.
Iran fishing grounds in southern waters of country are of the oldest and most important resources of large pelagic species. There are 4 coastal provinces in those areas with vast resources in terms of 5800 km coastline (including coastal areas of the Persian Gulf Islands), 2700 km Length of continental coastline and 196000 km^2 Shelf areas has the opportunity to access High Seas through Strait of Hurmoz. Along the southern coastline about193 port and landing places and around 143 thousand fishermen individuals which are directly engaged in fishing activities and more than 11 thousands fishing crafts consist of fishing boat, dhows and vessels which are engaged in fishing in the coastal and offshore waters. There are four fishing methods targeting tuna and tuna-like species in the IOTC area competency which include gillnet, purse seine, trolling and longline which the last one is one of the priorities of IFO for developing and improving the artisanal fisheries. Gillnet is the dominant fishing gear in the IOTC area competency, Majority of the production comes from the gillnet vessels operating within EEZ of Iran as well as offshore fishery.

The Catch quantity of large pelagic in Iran was 251215 Mt in 2016 reported to the IOTC Secretariat and around 234000Mt belongs to tuna and tuna-like fishes in the Indian Ocean areas. Total amount of catch mainly consist comprised of Tropical tuna with 34.8% (87337Mt), Neritic tuna52% (130639Mt) and billfish species with 5.9% (14841Mt), 1.9% (4797Mt) different species of shark and around 5.4% (13601Mt) other species.

Japan (IOTC-2017-SC20-NR11)

This Japanese national report describes following 8 issues in recent five years (2012-2016), i.e., (1) tuna fisheries (longline fishery and purse seine fishery) (2) fleet information, (3) catch and effort by species and gear, (4) ecosystem and bycatch, (5) national data collection and processing systems including “logbook data collection and verification”, “vessel monitoring system”, “scientific observer program”, “port sampling program” and “unloading and transshipment”, (6) national research programs and (7) Implementation of Scientific Committee recommendations & resolutions of the IOTC relevant to the Scientific Committee and (8) working documents.

Kenya (IOTC-2017-SC20-NR12)

The Kenyan tuna fishing fleet structure consists of an artisanal commercial segment and recreational fleets which all combined target and impact species under the IOTC mandate. The commercial artisanal fishing fleet is composed of a multi-gear and multi-species fleet operating in the territorial waters. The local boats are broadly categorized as outrigger boats or dhows which come with variants depending on the construction designs. It is estimated that 414 artisanal vessels are engaged in the fishing for tuna and tuna like species in 2016 within the coastal waters. The Main gears used are artisanal long line hooks, gillnets, monofilament nets and artisanal trolling lines. Catches of scombrids from artisanal fisheries were 3,431 tons, which is a decrease from 8,265 tons recorded in 2015. Other IOTC species landed during the year were sailfish (371 tons), Swordfish (200 tons), Sharks (412 tons), Rays and Skates (710 tons) and hammerhead sharks (31 tons). The main target species from the recreational fisheries are marlins and sailfish (*Istiophiridae*), swordfish (*Xiiphidae*) and tuna (*Scombridae*).Other species caught include small pelagic species such as barracuda, Spanish mackerel, Wahoo and sharks are landed. The artisanal fisheries and recreational fishing fleets have interactions with sharks where sharks are caught and the carcass is retained and fully utilised in artisanal fisheries and recreational trolling line fisheries have a voluntary shark release policy for sharks.

Republic of Korea (IOTC-2017-SC20-NR13)

The number of active vessels in 2016 was 13 for longline fishery and 5 for purse seine fishery. With this fishing capacity, Korean tuna longline fishery caught 2,670 mt in 2016, which was 21% lower than that of 2015. The fishing efforts in 2016 were 5,862 thousand hooks and mainly distributed in the western Indian Ocean, while the fishing efforts averaged for 5 recent years (2012-2016) were 5,789 thousand hooks and distributed in the western tropical areas around 0-20°S as well as in the western and eastern areas around 20°S-40°S. Since 2015, some vessels have moved to the western tropical area between 5°N-10°S to fish for bigeye tuna and yellowfin tuna. As results, the catch of bigeye tuna increased, while the catch of albacore tuna decreased. Korean tuna purse seine fishery in the Indian Ocean recorded about 24,635 mt in 2016. In 2016, 5 vessels of Korean tuna purse seine fishery operated mainly in the western and central tropical areas around 10°N-10°S to fish for skipjack tuna and yellowfin tuna. The fishing efforts in 2016 were 1,220 sets, which mainly distributed in the western and central tropical areas around 40°E-70°E. In 2016, 3 scientific observers for longline fishery and 3 scientific observers for purse seine fishery were dispatched onboard for implementing observer program and scientific data collection, which carried out 4.3% and 7.8% of observer coverage in terms of the number of hooks and sets, respectively.

Madagascar (IOTC-2017-SC20-NR14)

National report not submitted.

Malaysia (IOTC-2017-SC20-NR15)

Total catch of marine fish from Malaysian waters in 2016 were 1.57 million mt, a slide increased 6% compared to 1.48 million in 2015. The total landing in 2016 were attributed to the catch from 56,111 registered vessels with trawlers, purse seines, drift nets contributed large percentage of the catches. In 2016, marine fish production from the west coast of Peninsular Malaysia (Malacca Straits) contribute 813,758 mt (51.8%) out of the total catch. The remaining catches were from the South China Sea and Sulu Celebes Seas, east coast of Sabah. Coastal fisheries produced 76% (1,195,359 mt) and 24% (377,481 mt) from offshore fisheries.

Therefore, there is an emphasis by the government to develop tuna fisheries not only in coastal waters, but also in offshore waters within the Exclusive Economic Zone (EEZ). Tuna fisheries, which include both oceanic and neritic tuna, are targeted to be developed in the near future. The second strategic development plan for tuna fisheries was launched at the end of 2013.

During the early 1980s, small tuna (as neritic tuna were called then) were only caught as by-catch by gill nets and purse seines. When tuna purse seines were introduced in 1987, the neritic tuna fisheries started to develop. A tagging experiment on neritic tuna carried out in South China Sea showed that 50% of the recaptured tuna came from the purse seine operators. Initially purse seine operators visually searched for tuna schools. Gradually, some of these operators started to use lights to aggregate fish . Following complaints from other fishermen, the use of lights were regulated and limited to less than 30 kilowatts, although there have been incidences of non- compliance.

Neritic tuna contribute more 4.7% of Malaysia's marine fish landings in 2016. Purse sienes are the most important fishing gear in neritic tuna fisheries, especially the 40-69.9 GRT and >70 GRT vessel size. It contributed more than 82% of the annual catches of neritic tuna in Malaysia. In Kuala Perlis, neritic tuna species are the second most abundant (13%) landed by purse seines after scad (16%), with longtail tuna dominated the landings followed by kawakawa and frigate tuna. In the year 2016, neritic tuna landings in west coast Peninsular Malaysia amounted to 13,307 mt; decreasing by 3.45% compared to 13,783 mt in 2015. Meanwhile landings in Malaysia ranged from 40,000 mt to 65,000 mt. The highest catch was recorded in 2008 and 2002 with 65,000 mt and 62,000 mt respectively. There was a decreasing trend in landings from 2002 to 2005 before an increasing trend until 2008. Landings of neritic tune in Malaysia appear to have stabilised from 2010 to 2016.

The catch of oceanic tuna in 2016 increased significantly by 26.79% from 1270.78 tons in 2015 to 1,610.55 tons in 2016. Albacore showed most apparent increasing from 1,049.1 tons in 2015 to 1,330.61 tons in 2016. The fleet which consisted of 5 fishing vessels and one carrier, unloaded and exported the catches at the Port Louis, Mauritius. Albacore tuna formed nearly 70% of the catches in the form of frozen tuna. Another 5 vessel were unload at Penang Port. On observer program, it will only be implemented accordingly when the size of Malaysian fleet increase to 20 units.

However, for domestic vessels operating beyond 30 nm offshore, there are plan by the DoF to implement observer on board and logbook system. The revised NPOA- Sharks is already complete and gazetted and will be published by end of 2014. On sea turtle, 2 sanctuary and information centres have regularly implementing awareness program for student and fishermen communities. Hatching program at these centres managed to release over 65,000 baby turtles back to the sea. There are several research programs on sea turtle been carried out at different areas in Malaysian waters and the ongoing projects are c-hook and satellite tracking.

Maldives (IOTC-2017-SC20-NR16)

The Maldivian tuna fishery comprises of four main components; pole-and-line, handline, longline and troll line. The most important is still the traditional livebait pole-and-line tuna fishery. The main target species is skipjack tuna (*Katsuwonus pelamis*), but small amounts of juvenile yellowfin tuna (*Thunnus albacares*) are also caught in the fishery of which about 5-10% is bigeye tuna (*Thunnus obesus*). Handline fishery is still expanding which targets large yellowfin tuna (> 70 cm FL) from the surface (<10m). Following termination of joint venture licencing in 2010, a fully Maldivian-flagged longline fishery is now established. Troll fishery is minor and targets mainly neritic species of kawakawa (*Euthynnus affinis*) and frigate tuna (*Auxis thazard*), but occasionally also catches skipjack and yellowfin tuna.

Total tuna catches for the 5 species of tunas (skipjack tuna, yellowfin tuna, bigeye tuna, frigate tuna and kawakawa) caught in the Maldives was at about 126,000 t. These catches came from pole and line, handline, longline and trolling gear. Pole and line catch, dominated by skipjack tuna, was at 69,500 t while the handline catch, which targets surface dwelling schools of large yellowfin tuna, was at 53,000 t. Landings from the longline fleet observed an increase from the previous year to 1,300 t. The catch from trolling fleet continues to be on the decline with a mere 64 t being reported in 2015

Skipjack tuna registered a slight decrease in catch in 2016 relative to 2015 (~1%). Catches for the most recent five years ranged between 50 and 75,000 t, with an average of 67,000 t. catches have been of the order of 50,000 – 75,000 t. Caches of yellowfin are steadily increasing, due to the growing handline fishery. Most recent five years' catch averaged at 49,000 t with a range of 44 – 53,700 t. Bigeye tuna landings increased by ~42% to 2,400 t in 2016. The growth was driven by the increased contribution from longline and pole and line.

Maldives pole-and-line and handline tuna fishery have minimal impact on the ecosystem. Catch and interactions with Endangered, Threatened and Protected (ETP) species and other species of ecological importance is virtually non-existent. Sharks bycatch and turtles are reported from the longline fishery, which has strict measures to report and release those that are caught. In addition, measures to mitigate bird entanglement in the longline gear are mandated by law. Logbooks for all the tuna fisheries have provisions to report catch and interactions of ETP species. Marine Research Centre currently conducts scientific observations of fishing trips that allow verification of logbook reported data.

The national data collection was based on complete enumeration system, which is now replaced by a modern logbook data collection system. A web-enabled database is now online to allow compilation and processing of catch and effort data. The web-enabled database is also used to record tuna purchases by the exporters. The database will also help maintain records of active fishing vessel and fishing licenses. Vessel monitoring system covers 100% of the longline vessels and trips and a number of pole and line and handline vessels. In addition, the observer data collected from pole-and-line and handline fisheries enable verification of fishermen reported data. Beginning 2018, electronic observer systems will be installed on licensed fishing vessels on a rotational basis to cover 5% of the trips.

A number of research programs funded by the Government and NGOs are currently being implemented. The programs are geared towards improving national reporting and compliance to IOTC conservation and management measures and towards understanding and minimising impacts of fisheries on the ecosystem. Research activities relevant to fisheries managed by IOTC include work on understanding the behaviour of tunas around Anchored FADs, understanding the socio-economic dimensions in tuna fisheries of the coastal states in the context of IOTC rights-based management and allocation issues, bycatch sampling, and continued development of the Fishery Information System.

Mauritius (IOTC-2017-SC20-NR17)

In 2016, five semi-industrial boats were added to the Mauritius fleet and are authorised to fish both within and outside the national EEZ targeting tuna species, each having a GT of 90t. Two of those vessels operated only within the EEZ while the other three boats operated exclusively outside the EEZ. The semi-industrial fleet operating inside the EEZ increased from 5 boats in 2015 to 8 boats in 2016. The total catch from the EEZ amounted to 192 tonnes with an effort of 439046 hooks. 215 tonnes of tuna and tuna-like species was reported for the fleet operating outside the EEZ, with a deployment of 322532 hooks. Hence, a total catch of 407 tonnes was recorded for the semi-industrial fleet for 2016 and761578 hooks were deployed. Shortfin mako sharks (*Isurus oxyrhinchus*), hammerhead sharks (*Sphyrnidae*) and blue sharks *(Prionace glauca*) were caught and release of live sharks and live rays was reported by the longliners.

As for the purse seine fleet, two vessels were registered under the Mauritius flag and their catch amounted to 11777 tonnes with 463 sets deployed within latitudes 0°N-5°N; 0°S-14°S and longitudes 50°E -69°E; 40°E-80°E respectively. The catch consisted mainly of yellowfin tuna (63%) followed by skipjack tuna (32%) and bigeye tuna (5%). Three observers were deployed on both purse seiners in 2016.

Sampling exercises were undertaken on the catch unloaded by the local flagged purse seiners and the fork lengths of 801 yellowfin tuna 243 skipjack tuna and 14 bigeye tuna were measured. For the semi-industrial fleet, fork lengths of 211 albacore tuna, 176 bigeye tuna and 240 yellowfin tuna were taken while the operculum to keel length of 534 swordfish was recorded as well as the whole length of 8 mako sharks.

Mozambique (IOTC-2017-SC20-NR18 Rev_1)

This document represent an update of all related fishing activities in Mozambique for species under the IOTC mandate in order to comply with the IOTC rules of providing information whenever requested within the agreed procedures. The summary also, provides an update of ongoing actions across the country to ensure a long term sustainable exploitation and management of species under the IOTC mandate.

In 2016, similarly to previous years, the industrial tuna fishery was dominated by the distant water fishing nations - DWFN- accessing the resources through fishery Partnership Access Agreement. A total of 23 longliners and seven purse seiners were licensed in this year. The total catch reported by these fleets was 3,445 tons, 12% above the registered catch in 2015.

At domestic level, the national industrial tuna fleet operated with a total of five longline vessels, from which three only operated during the first quarter of the year. The total catch of this fleet was 117 tons, which represents a reduction of 57% comparatively to 2015.

The semi-industrial linefishing fleet of 26 vessels (14m-19m LOA) targeting primarily demersal rocky bottom species, landed in 2016 about 83 tons of Narrow-barred Spanish mackerel, which is the only IOTC species caught by this sector.

The artisanal sector is the major and most complex fishing segment in Mozambique. The main gear used are gillnet, beach seine and handline. The Capture of IOTC species by this sector is at some extends opportunistic with limited species targeting. The annual landing of IOTC species is relatively low (around 3% of total catch) when compared to small pelagic and demersal fish species. The estimated total catch of IOTC primary species in 2016 was 3,715 tons, 12% below the 2015 landings. The Narrow-barred Spanish mackerel was the main IOTC species caught with a total of 2513 tons, 68% of the total IOTC primary species landings. Sharks are also a significant component among the IOTC species caught by this fishing segment with emphasis on hammerhead sharks and Requiem sharks. Neritic tunas are caught by small purse seiners and handline operators in the northern coast. In this particular area, tropical tunas and billfishes are also caught although in small quantity. Despite having a monitoring scheme in place for artisanal fisheries, there is still a need of improvement in data collection and reporting for IOTC species.

The recreational sector issued a total of 3,400 licenses in 2016, which also may represent a potential source of impact on tuna and tuna like species. However, data collection and reporting of this fishing segment is still deficient with a very rough estimate of IOTC species catches and effort.

In terms of research, Mozambique continued with the implementation of the program initiated in 2015 aiming to establish a specific and improved sampling for artisanal fisheries in the northern coast. This will improve the level of compliance with the resolution 15/02, and fill the gaps of knowledge on tunas and tuna like species, which is an important step towards the promotion of a target oriented small scale tuna fishery in accordance with the national strategic plan for development of tuna fisheries (PEDPA).

Currently Mozambique is fully implementing the Vessel Monitoring Scheme – VMS to monitor all licensed tuna vessels (both national and foreign). On Part State Measures, Mozambique is making efforts to follow all the steps required and has updated its inspection report form and advance request to enter into port – AREP which are being used during the pre-inspection of foreign tuna vessels. The pre-fishing briefing for all licensed vessels is also one of the areas where Mozambique is keen to move to in order to help in combating IUU fishing in the region. Finally, Mozambique is internally improving the monitoring and control of the tuna fisheries through implementation of initiatives involving different stakeholders (managers, researchers, operators and civil society.

Oman (IOTC-2017-SC20-NR19)

National report not submitted.

Pakistan (IOTC-2017-SC20-NR20 Rev_1)

Tuna and tuna like fishes are one of the components of pelagic resources. In Pakistan, mainly neritic and oceanic species are encountered in the tuna fishery. Tuna fishing fleet comprises of about 709 gillnet boats. The total production of tunas and tuna-like fishes, including Neritic and Oceanic tunas, Billfishes and Seerfishes during the year 2016 was 101,225 m. tonnes.

There are no reported instances of sea bird interaction in any of the tuna fishing boat. Sea turtles, Marine mammals and Whale sharks are protected in Pakistan under various national and provincial fisheries and wildlife legislations. Data on tuna production is collected by provincial fisheries departments of maritime provinces of Sindh and Balochistan and compiled by Marine Fisheries Department, Government of Pakistan, Ministry of Ports & Shipping.

Tuna and allied resources called as large pelagic resources. The large pelagic resources contributed 101,225 ton, accounting for 26.9% of the marine capture fish production. Major share of the landing was by Tunas (70%) followed by Seerfishes (20.2%) and dolphinfish (5.4%) and billfish (4.4%). Among the tunas, yellowfin was dominating with 33.3%, followed by longtail (29.7), frigate (19.6%), tuna-nei (8.5%), kawakawa (7.6%) and skipjack (1.6%). There was some landings of bullet tuna and striped bonito as well. There is a change in the pattern over the years, the contribution of the skipjack was 21.5% in 1997 and decreased down to 1.6%. whereas the frigate tuna increased from 6.8% in 1997 to 19.6%. Main reason for decline in the catch of Skipjack is because of concentration of operation of Pakistani vessels along Pakistan coast. Prior to 1999 majority of Pakistani fleet was operating in the ABNJ of IOTC area.

Significant progress has been made during the year 2016, for the conservation of bycatch species which include promulgation of fisheries legislations by both provinces of Sindh and Balochistan. These legislations prohibited the catching of turtle, cetacean (whales & dolphins), whale shark, silky shark, oceanic whitetip shark, thresher shark, hammerhead sharks, all species of sawfishes of family Pristidae, all species of guitar fishes and wedge fishes of family Rhinidae, Rhinobatidae or Rhynchobatodae. To monitor the activities of local tuna boat, it is made mandatory to have VMS on all fishing vessel larger than 15 meters (in length overall). The contravention of these regulations is punishable with fine and imprisonment.

Philippines (IOTC-2017-SC20-NR21)

National report not submitted.

Seychelles (IOTC-2017-SC20-NR22)

The Seychelles National Report summarizes activities of the Seychelles' fishing fleet targeting tuna and tuna-like species in the WIO for the year 2016 in comparison with previous years. It also summarizes research, and data collection related activities as well as actions undertaken in 2016 to implement Scientific Committee recommendations and IOTC Conservation and Management Measures.

The Seychelles purse seine fleet increased from 8 vessels in 2012 to 13 vessels in 2016. The number of supply vessels also increased from 3 to 7 vessels during the same period. The annual trend in fishing effort in term of fishing days shows that following a drop of 15% in fishing effort in 2013 from the previous year, the purse seine fishing effort has since then been increasing gradually. In 2016 the nominal effort increased by 786 days (24%) when compared to the previous year to reach a total of 4,050 days fished.

In 2016, the catch increased by 22% from 88,740MT in 2015 to 108,613 MT in 2016. This was achieved from a fishing effort of 4,050 fishing days thus giving a mean catch rate of 26.82MT/Fishing day. Skipjack was the dominant caught, accounting for 56% of the total catch whilst yellowfin tuna made up 37% of the total catch of the Seychelles flagged purse seiners in WIO. Catches of yellowfin tuna increased by 3% from 39,072 MT in 2015 to 40,121 MT in 2016 and catches of skipjack tuna increased by 44% from 42,426MT in 2015 to 60,991 MT in 2016.

One more fishing vessels joined the Seychelles Industrial longline fleet in 2016 making a total of 46 vessels. The total catch reported by the industrial longline fleet for 2016 was estimated at 14,486 MT representing a 16% increase in catches with 45% increased in fishing effort when compared to 2015.
In term of species composition, bigeye tuna remained as the dominant species caught by this fleet for the past five years, accounting for 35% of the total catch. The estimated catch rate increase to 0.44 MT/1000 hooks in 2016.
In 2016, the Semi industrial fishery recorded the highest catch since the beginning of the fishery with a reported total catch of 969 Mt representing an increase of 397% over the 195 MT reported in 2015.The fishing effort also increase by 500% from 205,505 hooks set to 1,233,657 hooks. The catch rate decreased from 0.95MT/1000 hooks to 0.79MT/1000 hooks .
Similar to previous years, the SFA is implementing various actions to improve the quantity and quality of data collected from its fleet targeting tuna and tuna-like species in the Indian Ocean. Actions include improved logbook for data capture, review and upgrade of data collection and management system and implementation of National Scientific Observer Programme. The Observer programme is currently in its 3rd phase, focusing on data analysis and reporting. In 2016 Seychelles reviewed its NPOA shark and developed a new one for the 2016 – 2020 period. A NPOA for seabird is currently in the process of being developed.

Sierra Leone (IOTC-2017-SC20-NR23)

National report not submitted.

Somalia (IOTC-2017-SC20-NR24)

Somali has the longest coastline in Africa (3,330km) and an EEZ of 1,165,500 Km^2, there is potential to sustainably increase employment, food security, nutrition and revenues from its fisheries but there is currently no active fisheries management. The fishery resources in Somali waters are said to be one of the richest in the African continent.

The marine fisheries can be further divided into offshore (conducted by foreign vessels), coastal or artisanal (limited to waters of the relatively narrow continental shelf, operated by traditional vessels and vessels with outboard/inboard engines) and Houri by traditional boats. The fishing seasons of Somali waters is governed by the monsoon winds that occur in the calendar year between May and September. In this period, high waves and strong winds force small and medium size commercial boats not to call at Somali ports. The fishing days of the artisanal fishery varies between 220-240 days per year while the offshore fishing vessels were forced to change their fishing ground, gear or target species.

Large pelagic species including tuna and tuna-like species such as yellow-fin, big-eye, skipjack, and mackerel are the most highly priced species locally. Although they are highly migratory, the traditional fishing grounds for these species are found along the Indian Ocean from latitude 05 to 100 N due to upwelling that occurs twice annually in the period of southwest monsoons. It is also known that there are good fishing opportunities in the Gulf of Aden and Indian Ocean for tuna during the Southwest monsoon in the deeper waters.

Besides, there is no MCS of the marine resources and data collection system on marine products on both inshore and offshore fisheries. Strengthen its capacity in development and implementation of central database along its coast for artisanal fishery is the key priority areas in Somalia.

Sri Lanka (IOTC-2017-SC20-NR25)

The total production of tuna and tuna like species of Sri Lanka in year 2016 was 85,295t . The catch shows 5% decline than that of 2015. 84% of the catch was from the EEZ and 16% was from the high seas. Skipjack tuna dominated the catch amounting to 35,512t and was 11% decline than that of 2015. 22% of the catch is Yellow fin tuna (26,240t) and 5% was bigeye tuna. The bill fish were the second most group which contributed 13% to the catch and sword fish dominate in the catch. The shark catch was 1507t. The new regulations on catch prohibition of certain shark species was enforced. Over 4000 multi day boats engaged in large pelagic fishing and 1461 boats operated at high seas. All high seas boats are less than 24m in length and almost all are in length range of 10- 15m. Long line and gill net are the major fishing gears used. 25% of vessel operated for tuna are dedicated long liners and 40% are gillnetters. Rest of the boats use different gears in a seasonal pattern one at a time. New trend of operating ring nets targeting mackerel scads is observed with the reduction of the neritic tuna catches.1461 numbers of high seas operating vessels fitted with VMS and monitored by FMC. *The VMS data are being used to crosscheck the accuracy of position data provided in the logbooks.* Electronic data recording log book has been developed and the prototype tested, the results were successful. Trials are being conducted. It was impossible to *deploy observers on board in the small boats due to lack of space and safety.*

South Africa (IOTC-2017-SC20-NR26)

South Africa has two large pelagic commercial fishing sectors in the Indian Ocean – the Large Pelagic Longline and the Tuna Pole-Line (baitboat) sectors. In 2016, only two Tuna Pole-Line vessels fished in the Indian Ocean with a combined fishing effort of 25 days. Negligible catches of albacore (*Thunnus alalunga*) and snoek (*Thrysites atun*) were made by these two vessels. The South African-flagged large pelagic longline vessels have traditionally used swordfish (*Xiphias gladius*) targeting methods, whilst the Japanese-flagged vessels that operate under joint-ventures and fish under South African rights holders target tropical tunas with effort focused in the Indian Ocean. In 2016, 19 longline vessels were active in the IOTC area of competence, which is the equal to that in 2015. However, a single Japanese foreign-flagged vessel that was permitted to fish in South African waters opted not to do so. This significantly decreased the number of hooks set and proportion of effort observed in the IOTC area due to foreign-flagged vessels requiring 100% observer coverage. Given this effort decrease, annual catches decreased in the IOTC area of competence from 2015 to 2016 for some of the major species. Swordfish catches decreased by 24%, followed by yellowfin (21%) and bigeye (20%). Increases in catches for the same period were observed for the following species: albacore (8%), southern bluefin tuna (66%), shortfin mako (87%) and blue shark (33%). The observed increase in shark catches, particularly shortfin mako, can be attributed to the fishery straddling the IOTC/ICCAT boundary line. As such, a slight movement eastward by the fishery resulted in a higher proportion of fish being caught in the IOTC region. Research into the stock origin and intermixing of tuna, swordfish and large pelagic shark populations at the boundary between the Atlantic and Indian Oceans is a priority in South Africa.

Sudan (IOTC-2017-SC20-NR27)

National report not submitted.

Tanzania (IOTC-2017-SC20-NR28)

National report not submitted.

Thailand (IOTC-2017-SC20-NR29)

In 2016, neritic tuna were caught in the Andaman Sea, Thailand by purse seiners. These catch comprise 4 species of tuna; longtail tuna (*Thunnus tonggol),* kawakawa *(Euthynnus affinis)*, frigate tuna *(Auxis thazard)* and bullet tuna *(Auxis rochie*) which percentage of catch were 52.05%, 34.23%, 10.44% and 3.28%, respectively.

During 2011-2015, six Thai tuna longliners operated in the Western coast of the Indian Ocean, but in 2016, Thailand did not have commercial longliner vessels operated in Indian Ocean. There was one Thai purse seiner operated only one month in this area. They declared logbook to Department of Fisheries, Thailand. Data from logbook displayed important information of their fishing operation and effort. The fishing operations were recorded 6 times. The major neritic tuna species composed of kawakawa 9,176 kg and longtail tuna 1,910 kg. The quantity of pelagic fish including trevally, mackerel, narrow-barred Spanish mackerel, barracuda and other species were 9,350 kg, 4,185 kg, 221 kg, 144 kg and 146 kg, respectively. The average percentage composition by weight of trevally, kawakawa, mackerel, longtail tuna, narrow-barred Spanish mackerel and other species group were 37.20%, 36.51%, 16.65%, 7.60%, 0.88%, 0.57 and 0.58%, respectively.

Foreign tuna fleets landed at Phuket fishing port, in 2015 for 139 trips and increased into 203 trips in 2016. The estimate of total catch was 7,846.74 tonnes. The average percentage composition by weight of tuna group, billfish group and other species group were 85.48 %, 13.43 % and 1.09 %, respectively.

United Kingdom(OT) (IOTC-2017-SC20-NR30)

UK (BIOT) waters have been a Marine Protected Area (MPA) since April 2010. Diego Garcia and its territorial waters are excluded from the MPA and include a recreational fishery. UK (BIOT) does not operate a flag registry and has no commercial tuna fleet or fishing port. The United Kingdom (BIOT) National Report summarises fishing in its recreational fishery in 2016 and provides details of research activities undertaken to date within the MPA.

The recreational fishery landed 7.88 tonnes of tuna and tuna like species on Diego Garcia in 2016. Principle target tuna species of the industrial fisheries (yellowfin, bigeye and skipjack tunas) contributed 30% of the total catch of tuna and tuna like species of the recreational fishery. Recognising that yellowfin tuna are currently overfished and subject to overfishing in the Indian Ocean and that Resolution 17/01 seeks to address this, UK(BIOT) are taking action to reduce the number of yellowfin tuna caught in the BIOT recreational fishery and to encourage their live-release. Length frequency data were recorded for a sample of 133 yellowfin tuna from this fishery. The mean length was 73cm. Sharks caught in the recreational fishery are released alive.

IUU fishing remains one of the greatest threats to the BIOT ecosystem but a range of other threats exist including invasive and pest species, climate change, coastal change, disease, and pollution, included discarded fishing gear such as Fish Aggregating Devices. During 2016/7 the BIOT Environment Officer continued to take forward the BIOT Interim Conservation Management Framework. In 2016/7 Recommendations of the Scientific Committee and those translated into Resolutions of the Commission have been implemented as appropriate by the BIOT Authorities and are reported.

Yemen (IOTC-2016-SC19-NR31)

National report not submitted.

Bangladesh (IOTC-2017-SC20-NR32)

Bangladesh is blessed with her vast coastal and marine resources. Coastal area of the country is known as one of highly productive aquatic areas of the world. One of its unique features is the influence of mangrove forests, which supports abundance of high number of fishes and commercially important aquatic flora and fauna. Substantial biological and ecological values of the Bay of Bengal have been pointed out by many researchers. Coastal and marine fisheries have been playing a considerable role in socio-economic development of the country along with the regional ecological balance. Ample number of commercially important fishes are exporting to different countries and also consuming by local people as a nutritional balance. Tuna and tuna like other highly migratory species have become in a high priority list to the government for last couple of years especially after having the newly established sea boundary with neighbouring countries which offers Bangladeshi fishers to the Area Beyond National Jurisdiction (ABNJ) of high seas.

Although tuna and tuna like fishes are could be highly potential, Bangladesh is still lagged behind in exploring tuna fisheries. Proper attention and guidance are required exploring and building up a new era of deep sea fishing industry. Basically, there is no specific tuna fishery in Bangladesh. Tunas are by catch of industrial trawlers (about 2% of catch) and by artisanal gill netters (about 0.05%). Coastal and marine fisheries of Bangladesh are briefly reviewed in this report to provide a salient feature of available information for sustainable management and development of marine resources.

Djibouti (IOTC-2017-SC20-NR33)

National report not submitted.

Liberia (IOTC-2017-SC20-NR34)

National report not submitted.

Senegal (IOTC-2017-SC20-NR35)

National report not submitted.

APPENDIX V
STATUS OF DEVELOPMENT AND IMPLEMENTATION OF NATIONAL PLANS OF ACTION (NPOA) FOR SHARKS AND SEABIRDS AND IMPLEMENTATION OF THE FAO GUIDELINES TO REDUCE MARINE TURTLE MORTALITY IN FISHING OPERATIONS: 2017

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.
China		–		–			**Sharks:** China is currently considering developing an NPOA for sharks. **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:** Wildlife Protection Act introduced in 2013, Protected Wildlife shall not be disturbed, abused, hunted, killed, traded, exhibited, displayed, owned, imported, exported, raised or bred, unless under special circumstances recognized in this or related legislation. *Cheloniidae spp*., *Caretta Caretta*, *Chelonia mydas*, *Eretmochelys imbricate*, *Lepidochelys olivacea* and *Dermochelys coriacea* are listed into List of Protected Species. Domestic Fisheries Management Regulation on Far Sea Fisheries request all fishing vessels have to carry line cutters ,de-hookers and hauling net in order to facilitate the appropriate handling and prompt release of marine turtles caught or entangled.
Comoros		–		–			**Sharks:** Shark fishing is prohibited **Seabirds:** There is no fleet in operation south of 25 degrees south. **Marine turtles:** According to the Comoros Fisheries Code Article 78, fishing, capture, possession and marketing of turtle and marine mammals or of protected aquatic organisms is strictly forbidden in accordance with national legislation in force and International Conventions applicable to the Comoros.
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:** Indonesia has established an NPOA for sharks and rays in 2015-2019 **Seabirds:** An NPOA was finalized in 2016 **Marine turtles:** Indonesia has established an NPOA for Marine Turtles but this does not fully conform with FAO guidelines. Indonesia has also been implementing Ministerial Regulation 12/2012 regarding captured fishing business on high seas to reduce turtle bycatch.
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:** All Japanese fleets fully implement Resolution 12/04.

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		2014 – domestic fisheries		–	**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 2018. **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:** There is zero capture of marine turtle recorded in logbooks. All longliners use circle hooks. This has been confirmed by onboard observers and port samplers.
Malaysia		2008 2014		–		2008	**Sharks:** A revised NPOA-sharks was published in 2014. **Seabirds:** To be developed **Marine turtles:** A NPOA For Conservation and Management of Sea Turtles had been published in 2008. A revision will be published in 2017.
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		2016					**Sharks:** The NPOA-sharks has been finalised; it focuses on actions needed to exercise influence on foreign fishing through the IOTC process and licence conditions, as well as improving the national legislation and the skills and data handling systems available for managing sharks. **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:** 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 the NPOA-Shark started in 2016. At this stage, a baseline assessment was performed and the relevant information of coastal, pelagic and demersal shark species along the Mozambican coast was gathered. The ongoing process is expected to be completed by the end of 2018. **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 the Pakistani fishing fleet as the 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 10^{th} 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. **Marine turtles:** No information received by the Secretariat.
Seychelles, Republic of		Apr-2007		–			**Sharks:** Seychelles has developed and is implementing a new NPOA for Sharks for years 2016-2020 **Seabirds:** SFA is collaborating with Birdlife South Africa to develop an NPOA for sea bird. A consultant will be recruited to start development in December 2017 **Marine turtles:** An NPOA for turtles is planned to start in 2018.
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:** The Somali national fisheries law and legislation was reviewed and approved in 2014. This incudes Articles on the protection of marine turtles. Further review of the National Law is underway to harmonize this with IOTC Resolutions and is expected to be presented to the new parliament for endorsement in 2017.

South Africa, Republic of		–		2008			**Sharks**: The NPOA-sharks was approved and published in 2013. **Seabirds**: Published in August 2008 and fully implemented. The NPOA-seabirds has been earmarked for review. **Marine turtles**: The South African permit conditions for the large pelagic longline fishery prohibits landing of turtles. All interactions with turtles are recorded, by species, within logbooks and in observer reports, including data on release condition. Vessels are required to carry a de-hooker on board and instructions on turtle handling and release in line with the FAO guidelines are included in the South African Large Pelagic permit conditions. All turtle interactions in respective areas of competence are reported to the respective RFMOs. Recent South African led studies on impact of marine debris on turtles have been published in the scientific literature (Ryan et al. 2016). Marine turtle nesting sites in South Africa are protected by coastal MPAs since 1963.
Sri Lanka							**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 been provided to the WPEB and SC for approval. **Marine turtles:** Implementation of the FAO Guideline to Reduce Sea Turtle Mortality in Fishing Operation in 2015 was submitted to IOTC in January 2016. Marine turtles are legally protected in Sri Lanka. Longliner vessels are required to have dehookers for removal of hooks and a line cutter on board, to release the caught marine turtles. Gillnets longer than 2.5 km are now prohibited in domestic legislation. Reporting of bycatch has made legally mandatory and facilitated via logbooks.
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:** Sea turtles are protected by law. However as there is a national turtle and Dugong conservation committee that oversee all issues related to sea turtles and dugongs. There is no information so far with regards to interaction between sea turtles and long line fishery.
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).
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.
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	
Completed	
Drafting being finalised	
Drafting commenced	
Not begun	

APPENDIX VIA
REVISION OF CATCH LEVELS OF MARLINS UNDER RESOLUTION 15/01

Black Marlin

FLEET	2009-2014 Avg.	2015	2015 diff.	2016	2016 diff.
AUSTRALIA	0	0	(0)	0	(0)
BELIZE	4	0	(-4)	0	(-4)
CHINA	16	43	(+27)	13	(-3)
COMOROS	10	15	(+5)	334	(+325)
EUROPEAN UNION	53	20	(-33)	38	(-16)
EU.FRANCE.REUNION	28	39	(+11)	64	(+36)
GUINEA	0	0	(0)	0	(0)
INDIA	2319	3836	(+1517)	3836	(+1517)
INDONESIA	2338	2378	(+41)	2436	(+98)
IRAN ISLAMIC REP.	3119	5958	(+2839)	4148	(+1029)
JAPAN	63	50	(-13)	49	(-14)
KENYA	0	0	(0)	0	(0)
KOREA REP.	18	38	(+20)	18	(0)
MADAGASCAR	10	0	(-10)	0	(-10)
MALAYSIA	22	22	(+1)	23	(+1)
MALDIVES	46	38	(-8)	184	(+138)
MAURITIUS	2	1	(-1)	6	(+4)
MOZAMBIQUE	15	76	(+61)	10	(-5)
NEI.FRESH	159	16	(-143)	13	(-146)
NEI.FROZEN	35	10	(-25)	21	(-14)
OMAN	308	206	(-101)	264	(-44)
PAKISTAN	782	875	(+93)	875	(+93)
PHILIPPINES	1	0	(-1)	0	(-1)
SEYCHELLES	327	1136	(+809)	1040	(+713)
SOUTH AFRICA	7	6	(-1)	1	(-6)
SRI LANKA	3505	3695	(+190)	3911	(+407)
TAIWAN,CHINA	414	300	(-115)	521	(+107)
TANZANIA	8	19	(+11)	18	(+10)
THAILAND	18	24	(+6)	0	(-18)
UK.TERRITORIES	0	0	(0)	0	(0)
UN. ARAB EMIRATES	22	7	(-15)	7	(-15)
VANUATU	0	0	(0)	0	(0)
TOTAL	13543	18808	(+5265)	17829	(+4286)

Blue Marlin

FLEET	2009-2014 Avg.	2015	2015 diff.	2016	2016 diff.
AUSTRALIA	0	0	(0)	0	(0)
BELIZE	16	0	(-16)	0	(-16)
CHINA	108	298	(+190)	926	(+818)
COMOROS	1	0	(-1)	239	(+238)
EUROPEAN UNION	50	49	(-1)	69	(+19)
EU.FRANCE.REUNION	75	143	(+68)	189	(+115)
GUINEA	2	0	(-2)	0	(-2)
INDIA	255	1	(-254)	1	(-254)
INDONESIA	3487	4616	(+1129)	4516	(+1029)
IRAN ISLAMIC REP.	955	1816	(+861)	1363	(+408)
JAPAN	252	138	(-114)	122	(-130)
KENYA	13	0	(-13)	0	(-13)
KOREA REP.	29	108	(+79)	88	(+59)
MADAGASCAR	0	0	(0)	0	(0)
MALAYSIA	56	0	(-56)	9	(-47)
MALDIVES	91	17	(-74)	214	(+123)
MAURITIUS	1	4	(+2)	7	(+5)
MOZAMBIQUE	3	64	(+61)	68	(+66)
NEI.FRESH	188	441	(+253)	132	(-56)
NEI.FROZEN	359	244	(-116)	263	(-96)
OMAN	9	0	(-9)	0	(-9)
PAKISTAN	1431	1602	(+171)	1602	(+171)
PHILIPPINES	0	0	(0)	0	(0)
SEYCHELLES	34	21	(-13)	150	(+116)
SOUTH AFRICA	4	3	(-1)	1	(-4)
SRI LANKA	1016	764	(-252)	985	(-31)
TAIWAN,CHINA	4457	5222	(+765)	5389	(+932)
TANZANIA	47	7	(-40)	3	(-44)
THAILAND	1	0	(-1)	0	(-1)
UK.TERRITORIES	0	0	(0)	0	(0)
UN. ARAB EMIRATES	50	16	(-33)	16	(-33)
VANUATU	30	0	(-30)	0	(-30)
TOTAL	12842	15573	(+2731)	16353	(+3510)

Striped Marlin

FLEET	2009-2014 Avg.	2015	2015 diff.	2016	2016 diff.
AUSTRALIA	1	2	(+0)	1	(0)
BELIZE	3	0	(-3)	0	(-3)
CHINA	87	123	(+35)	424	(+337)
COMOROS	0	0	(0)	70	(+69)
EUROPEAN UNION	48	58	(+10)	70	(+22)
EU.FRANCE.REUNION	17	13	(-4)	14	(-3)
GUINEA	2	0	(-2)	0	(-2)
INDIA	102	414	(+312)	0	(-102)
INDONESIA	1257	1707	(+450)	1715	(+459)
IRAN ISLAMIC REP.	441	839	(+397)	634	(+192)
JAPAN	149	24	(-125)	97	(-52)
KENYA	1	0	(-1)	0	(-1)
KOREA REP.	11	15	(+4)	55	(+44)
MADAGASCAR	7	12	(+5)	14	(+7)
MALAYSIA	12	0	(-12)	2	(-10)
MALDIVES	20	3	(-17)	61	(+40)
MAURITIUS	0	0	(0)	2	(+1)
MOZAMBIQUE	1	0	(-1)	6	(+5)
NEI.FRESH	74	14	(-60)	11	(-62)
NEI.FROZEN	117	21	(-95)	89	(-27)
OMAN	1	0	(-1)	0	(-1)
PAKISTAN	301	350	(+49)	350	(+49)
PHILIPPINES	10	0	(-10)	0	(-10)
SEYCHELLES	157	71	(-86)	392	(+235)
SOUTH AFRICA	1	1	(-1)	1	(+0)
SRI LANKA	36	8	(-28)	13	(-23)
TAIWAN,CHINA	1103	512	(-591)	1248	(+145)
TANZANIA	15	8	(-7)	27	(+12)
THAILAND	11	2	(-9)	0	(-11)
UK.TERRITORIES	0	0	(0)	0	(0)
UN. ARAB EMIRATES	5	2	(-4)	2	(-4)
VANUATU	0	0	(0)	0	(0)
TOTAL	3901	4197	(+296)	5299	(+1398)

APPENDIX VIB
REVISIONS TO THE STANDARDISED METHODS FOR THE PRESENTATION OF MSE RESULTS

Introduction

The Indian Ocean Tuna Commission (IOTC) management strategy evaluation (MSE) work program was initiated following adoption of the proposal to implement the precautionary approach for managing IOTC species in 2012 (Resolution 12/01). From this Resolution, the IOTC Scientific Committee (SC) was instructed to assess the performance of candidate management procedures (MP) through MSE, and provide the Commission with advice on their performance against Commission objectives. The IOTC Working Party on Methods (WPM) leads the technical development of MSEs for key IOTC species.

Effective and consistent communication of MSE results is important to ensure that decision makers are clearly informed about the likely consequences of implementing different MPs or harvest control rules (HCR). The use of standardised terminology and presentation formats for MSE results would facilitate a better understanding and maximise the engagement of all partners in the MP dialogue. This proposal outlines some guidelines for standardising the communication of MSE results to the Technical Committee on Management Procedures (TCMP) and Commission.

Proposal for presenting MSE results

It is important that decision makers are presented with a selection of candidate MPs (or HCRs) from which to evaluate the relative performance against the Commission objectives. However, consideration needs to be given to limit the number of MPs (or HCRs) and performance measures that are presented to avoid saturation and confusion. As a guide, a maximum of 6 candidate MPs (or HCRs) and 6 performance measures would seem to allow sufficient coverage of the range of potential MPs of interest whilst limiting the amount of information to communicate.

The key elements of the presentation material are as follows:

1. **Illustrate the MPs** that have been evaluated in a figure and/or briefly define them in text.
2. Present the results for the performance of each MP in:
    a. **Boxplots** for a representative subset of performance measures
    b. **A summary table** that ranks the performance of each MP against a subset of performance measures
    c. **Trade-off plots** for a representative subset of performance measures
    d. **A Kobe plot** for the B/B_{MSY} and F/F_{MSY} performance measures
    e. **A stacked bar plot** indicating the proportion of runs in each of the Kobe quadrants in each year
    f. **Time series plots** for stock size, fishing intensity and catch performance measures.
3. Provide a clear and **succinct summary** of the performance of each MP.
4. Provide the numerical results for each MP across all 16 performance measures endorsed by the SC in a table in an appendix.

1. Illustrate the Management Procedures

It will be important that decision makers have a clear understanding of the MPs (or HCRs) that have been evaluated. To achieve this, a clear description of each MP (or HCR) should be presented prior to the MSE results, along with an explanation of the relevant decision steps involved. Example figures are illustrated in Figures 1 and 2.

2. Performance of Management Procedures

a. Boxplots

The key plots for communicating MSE results should clearly indicate the relative performance of each MP (or HCR) against a representative subset of performance measures from the categories of status, safety, yield, abundance and stability. These plots should clearly indicate the uncertainties in the MSE using error bars to represent percentiles. Example boxplots are illustrated in Figure 3. The summary period(s) which were used to generate the results should be clearly indicated.

b. Summary table

A summary table that ranks the performance of each MP against the key performance measures is shown in Table 1. The numbers in the table indicate the performance of each MP while the colours represent the relative ranking.

c. Trade-off plots

Trade-off plots provide useful information for evaluating the trade-off between different performance measures, particularly between yield (catch) and other performance measures. Example trade-off plots are illustrated in Figure 4. The summary period(s) which were used to generate the results should be clearly indicated.

d. Kobe plot

An example Kobe plot indicating the performance of MPs is illustrated in Figure 5. Consistent with the adopted guidelines for presenting stock assessment results, the Kobe plot indicates target and limit reference points. The summary period(s) which were used to generate the results should be clearly indicated.

e. Stacked bar plots

An example stacked bar plot in Figure 6 illustrates the proportion of individual projection runs for each of the MPs that were in each of the four Kobe quadrants in each year of the projections.

f. Time series plots

Example time series plots are illustrated for the stock size (Figure 7), fishing intensity (Figure 8), and catch (Figure 9) performance measures. Time series plots for additional performance measures may also be relevant. The key elements depicted in these figures are the median of all runs and the 25^{th}-75^{th} and 10^{th}-90^{th} percentiles and the target and limit reference points. A sample of individual realizations should be included in the projections to illustrate the typically erratic nature of individual trajectories.

3. Summary performance of Management Procedures and management advice

To assist with decisions on adopting candidate MPs, the Commission will require some guidance on the performance of each candidate MP, in addition to the figures and tables provided. A clear and succinct summary statement comparing the relative performance of each MP against the performance measures would allow the Commission to evaluate the trade-offs among alternative MPs when making such decisions.

The following statement provides an example summary of the performance for a hypothetical MP.

- MP1 achieved the second highest catches, and second lowest level of catch variability. There was a 5% chance that MP1 would be at or above the biomass target reference point and 2% chance it would be at or below the fishing mortality target reference point. There is a 25% risk that MP1 will cause the spawning biomass to fall below the limit reference point and a 50% risk that MP1 will cause the fishing mortality to exceed the limit reference point over the next 20 years.

4. Full set of results for each Management Procedure

While the main presentation of MSE results should focus on a selection of key performance measures summarised for a single time period, it is possible that the Commission will have interest in seeing the results for other performance measures or the same performance measures for a different summary time period. Therefore, the numerical results for each MP across all 16 performance measures and for the different time periods evaluated should be provided for reference in a table in an appendix, but not reported or presented in the main results. Table 2 provides an example table of MSE outputs comparing the performance of 6 MPs against all IOTC performance measures for 4 time periods (1, 5, 10, and 20 years). Additional information, such as percentiles ranges, could be added in parentheses for each value.

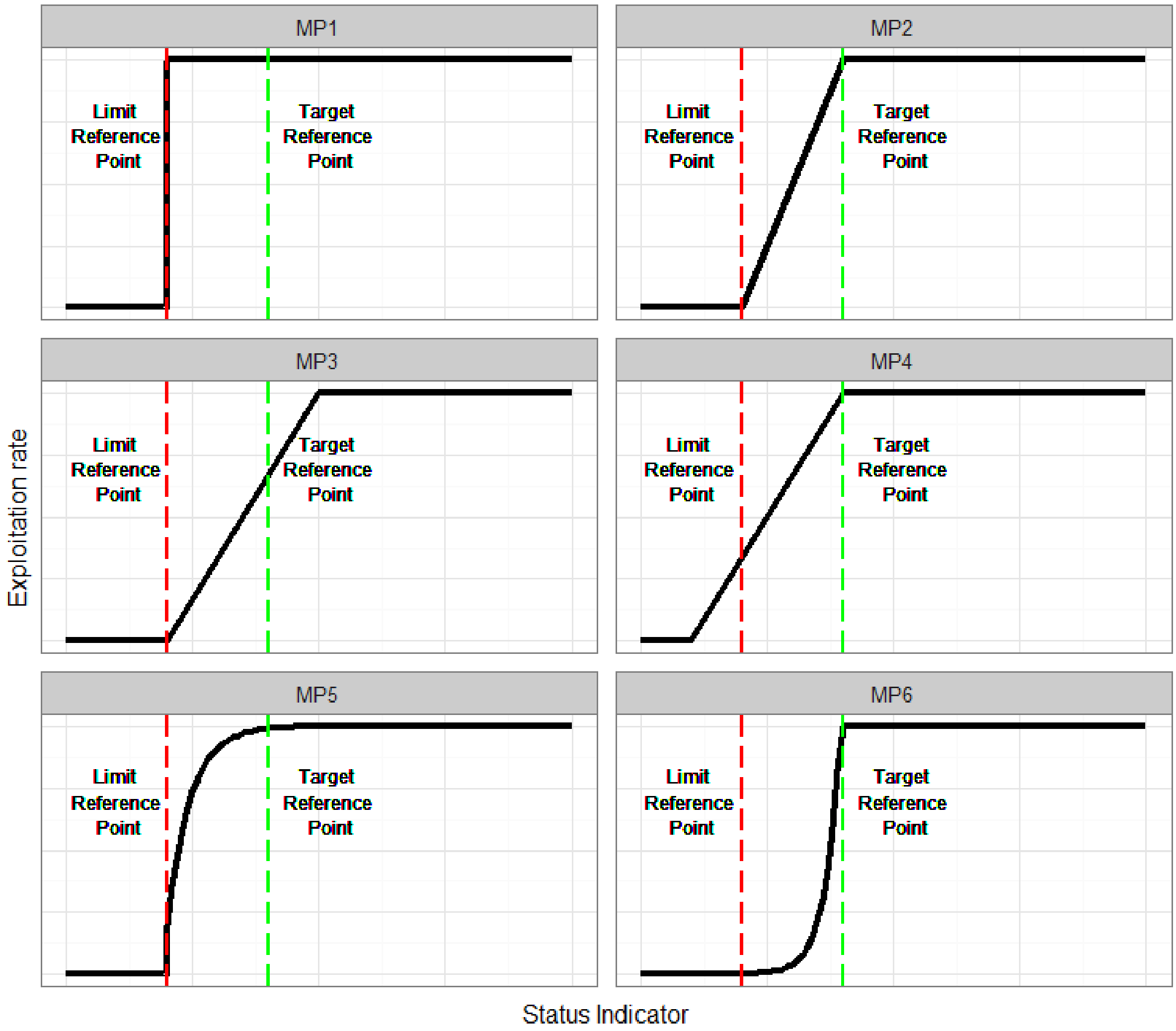


Figure 1. Illustration of six hypothetical example management procedures (MPs) relating the recommended exploitation rate to status indicator. The limit and target reference points are indicated by red and green dashed lines respectively.

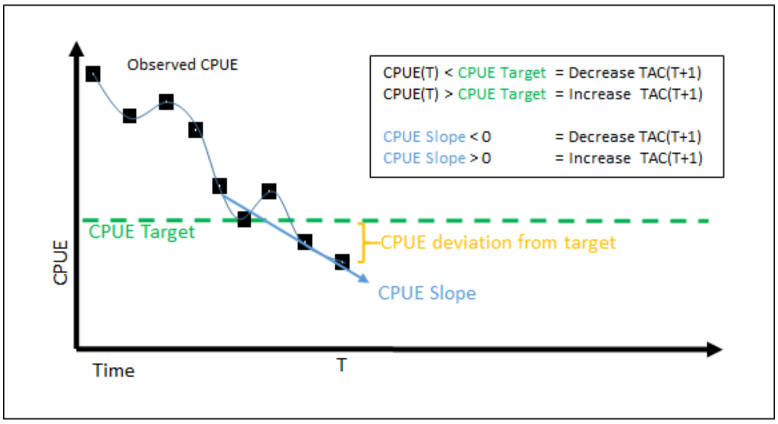


Figure 2. Illustration of an example catch per unit effort (CPUE) management procedure (MP) relating changes in the recommended TAC to changes in the CPUE over time. The target CPUE reference point is indicated by the green dashed line.

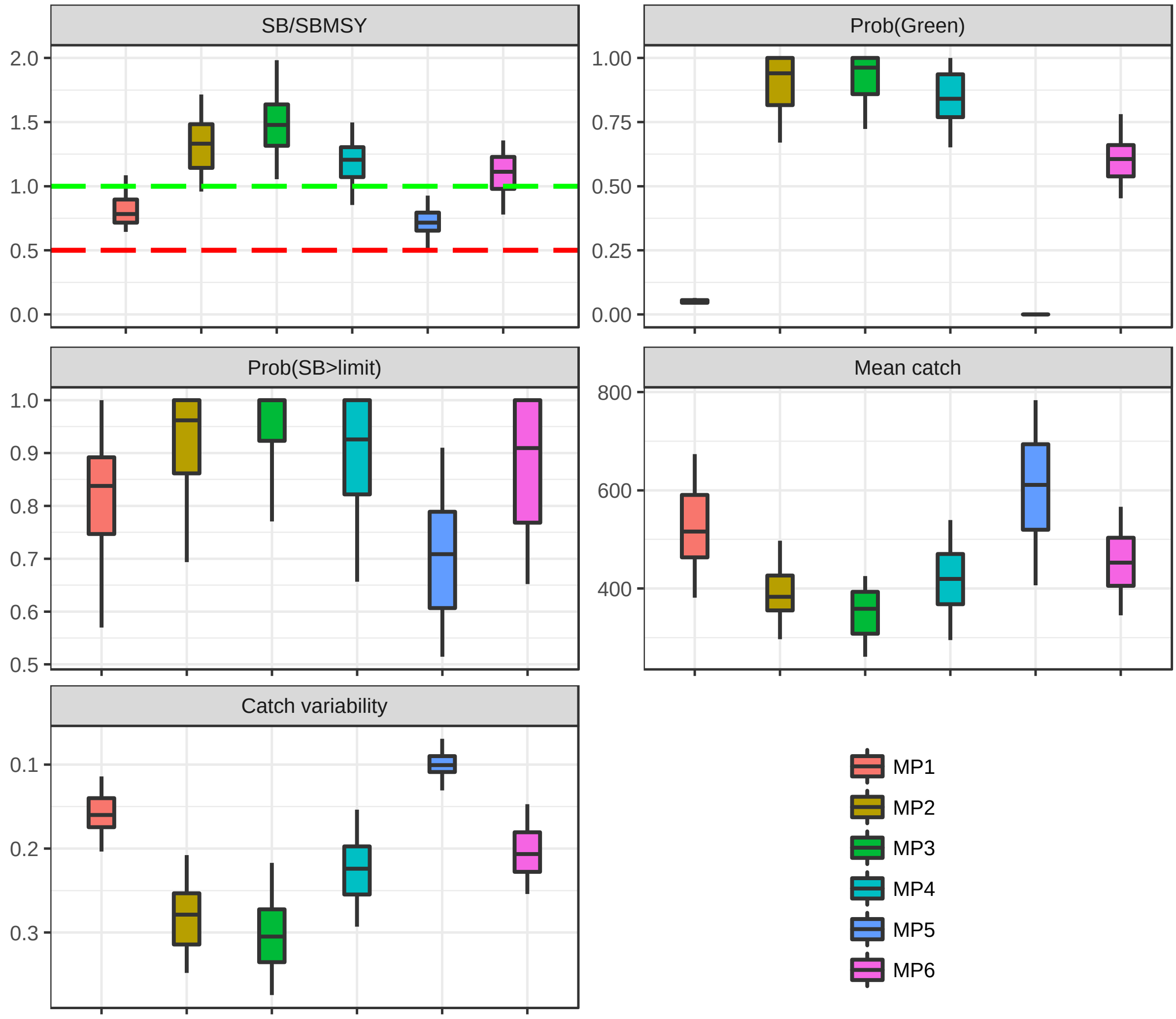


Figure 3. Example of MSE outputs comparing the performance of 6 management procedures (MPs) against 5 performance measures. Each data point represents the median over 20 years of simulation in the projection period as the horizontal line, 25th -75th percentiles as coloured bars, and 10th -90th percentiles as thin lines. Limit and target reference points for the biomass performance measure are indicated by red and green dashed lines respectively. Note the y-axis for catchability is reversed.

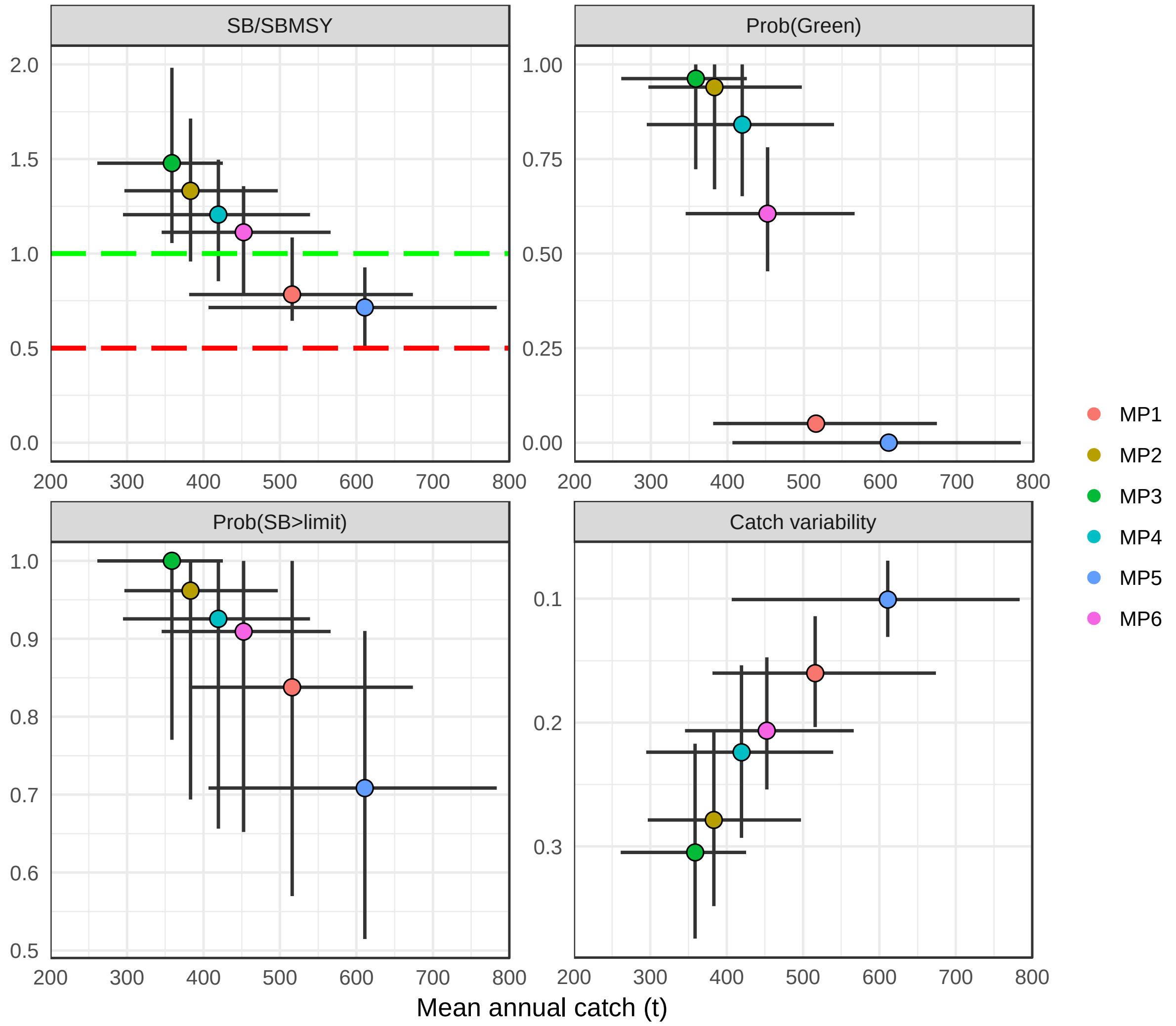


Figure 4. Example trade-off plots indicating the trade-offs in performance of 6 management procedures (MPs) between yield (catch) and 4 performance measures. Each data point represents the median over 20 years of simulation in the projection period and the errors bars represent the 25th -75th percentiles as thick lines, and 10th -90th percentiles as thin lines. Note the y-axis for catchability is reversed.

Table 1. Performance of six hypothetical example MPs against five key performance measures averaged over 20 years of simulation in the projection period. Shading indicates the relative performance for each MP (dark = better, light = worse). The 25th - 75th percentiles for SB/SB_{MSY} and catch are shown in parentheses. See Figures 2 and 3 for more detail on performance of each MP.

Management Procedure	**Performance Measure**				
	SB/SB_{MSY}	Prob(Green)	Prob(SB>limit)	Mean Catch	Catch variability
MP1	0.78 (0.64-1.09)	0.05	0.84	516 (463-590)	0.16
MP2	1.33 (0.96-1.71)	0.94	0.96	383 (355-426)	0.28
MP3	1.48 (1.06-1.98)	0.96	1	358 (308-393)	0.3
MP4	1.21 (0.85-1.50)	0.84	0.93	419 (368-470)	0.22
MP5	0.72 (0.51-0.93)	0	0.71	611 (520-694)	0.1
MP6	1.11 (0.78-1.36)	0.61	0.91	452 (405-503)	0.21

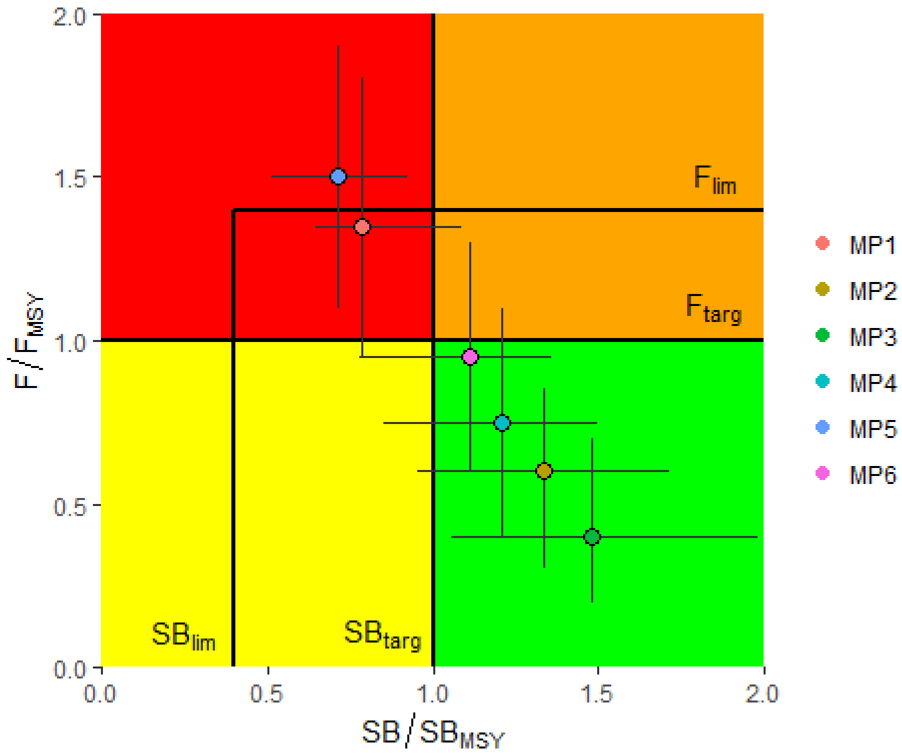


Figure 5. Kobe plot for hypothetical example of MSE outputs comparing 6 management procedures (MPs) against performance measures for SB/SB_{MSY} and F/F_{MSY}. Each data point represents the median in the final year of the projection period and the error bars represent the 90th percentiles. Target (SB_{targ} and F_{targ}) and limit (SB_{lim} and F_{lim}) reference points are indicated by black lines.

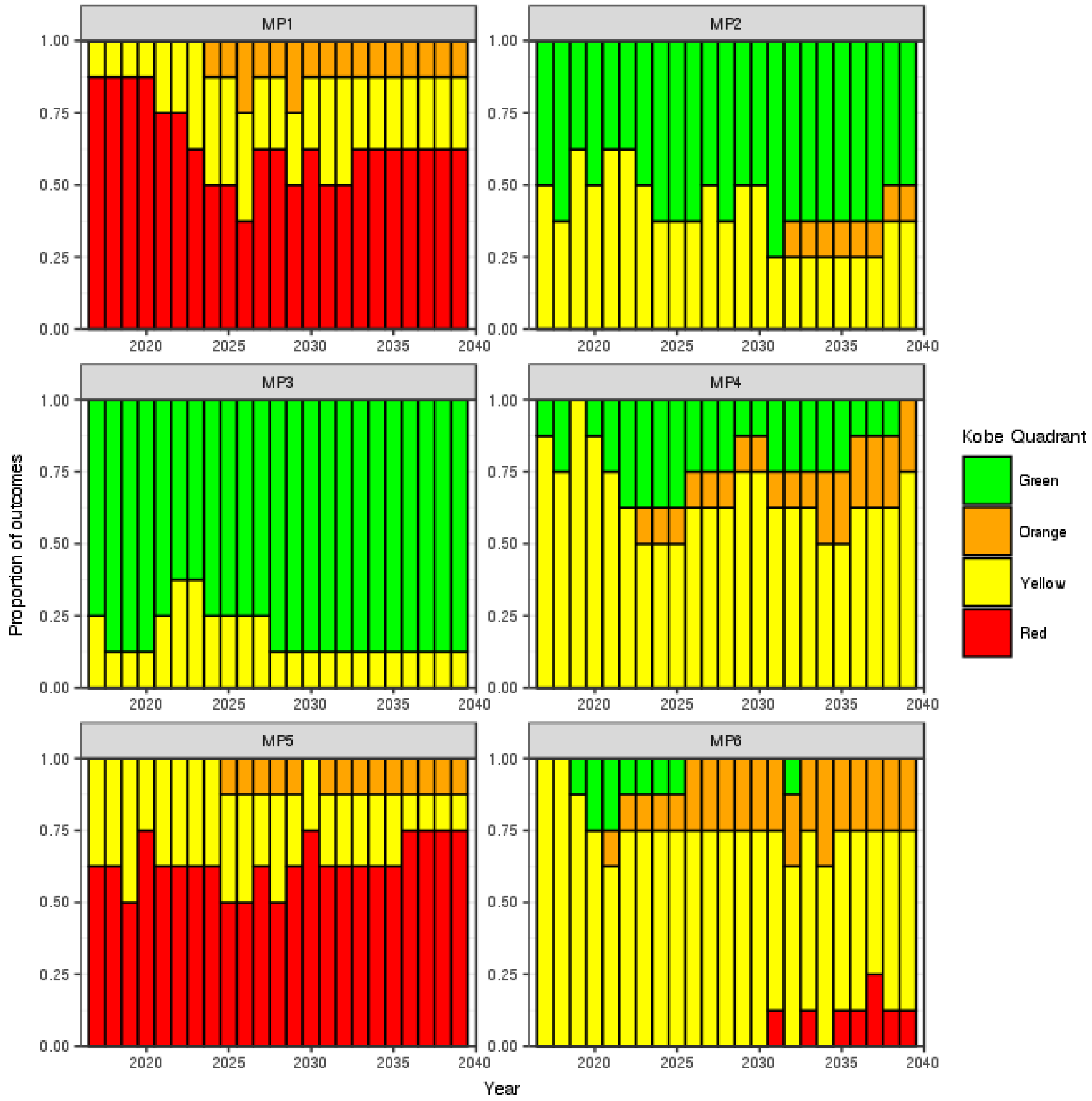


Figure 6. Proportion of runs in each of the Kobe quadrants (green, orange, yellow and red) in each projection year for a hypothetical example of MSE outputs comparing 6 management procedures (MPs).

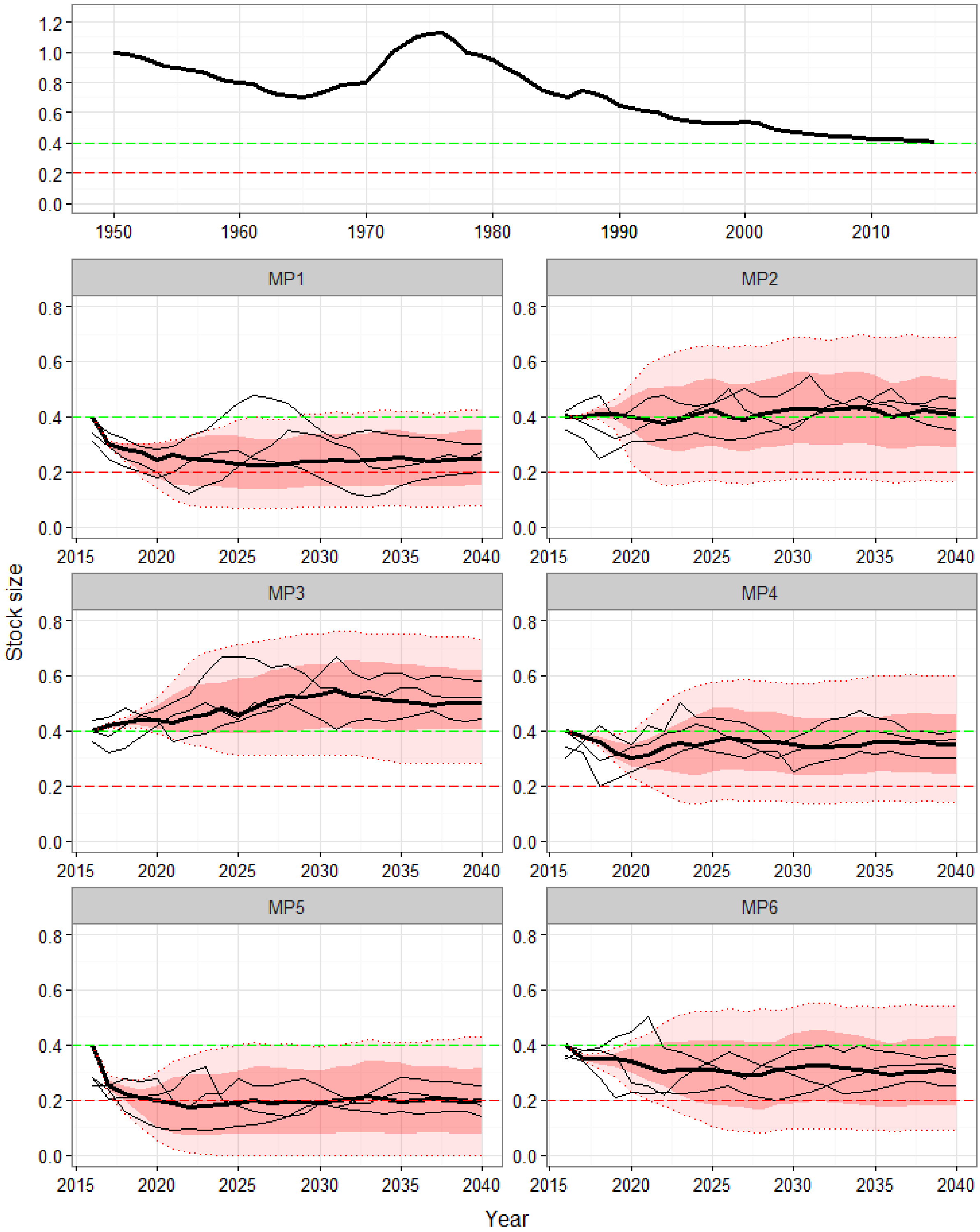


Figure 7. Time series plots for a hypothetical example of the performance of 6 MPs against the stock size performance measure. The top panel represents the historical period (1950-2015) and the bottom 6 panels represent the projection years (2016-2040). The median for each MP is represented by the bold black lines, a dark ribbon shades the 25th-75th percentile region and a light ribbon shades the 10th-90th percentile region. Three additional thin black lines show individual realizations. Horizontal lines indicate depletion-based target (green) and limit (red) reference points.

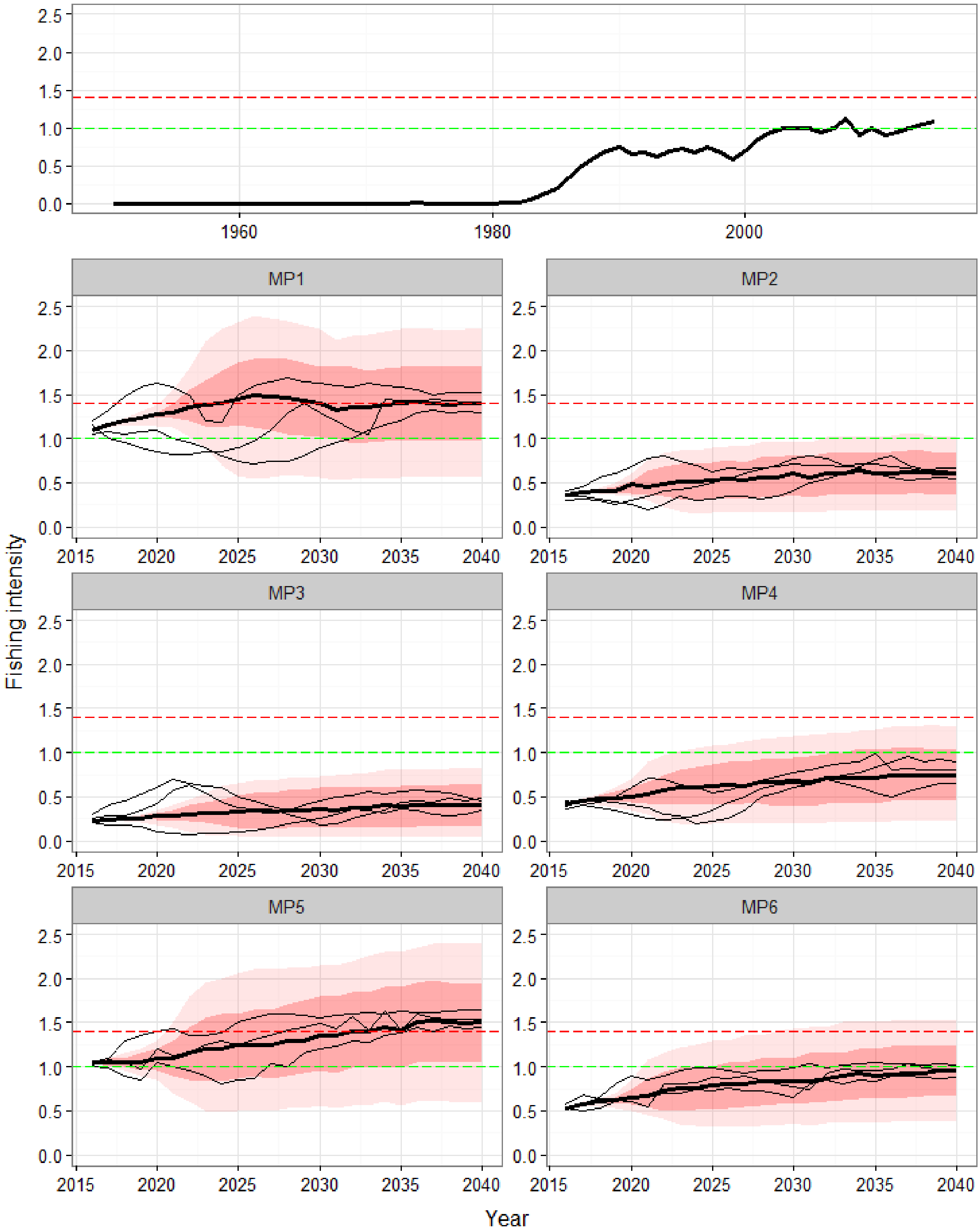


Figure 8. Time series plots for a hypothetical example of the performance of 6 MPs against the fishing intensity performance measure. The top panel represents the historical period (1950-2015) and the bottom 6 panels represent the projection years (2016-2040). The median for each MP is represented by the bold black lines, a dark ribbon shades the 25th-75th percentile region and a light ribbon shades the 10th-90th percentile region. Three additional thin black lines show individual realizations. Horizontal lines indicate depletion-based target (green) and limit (red) reference points.

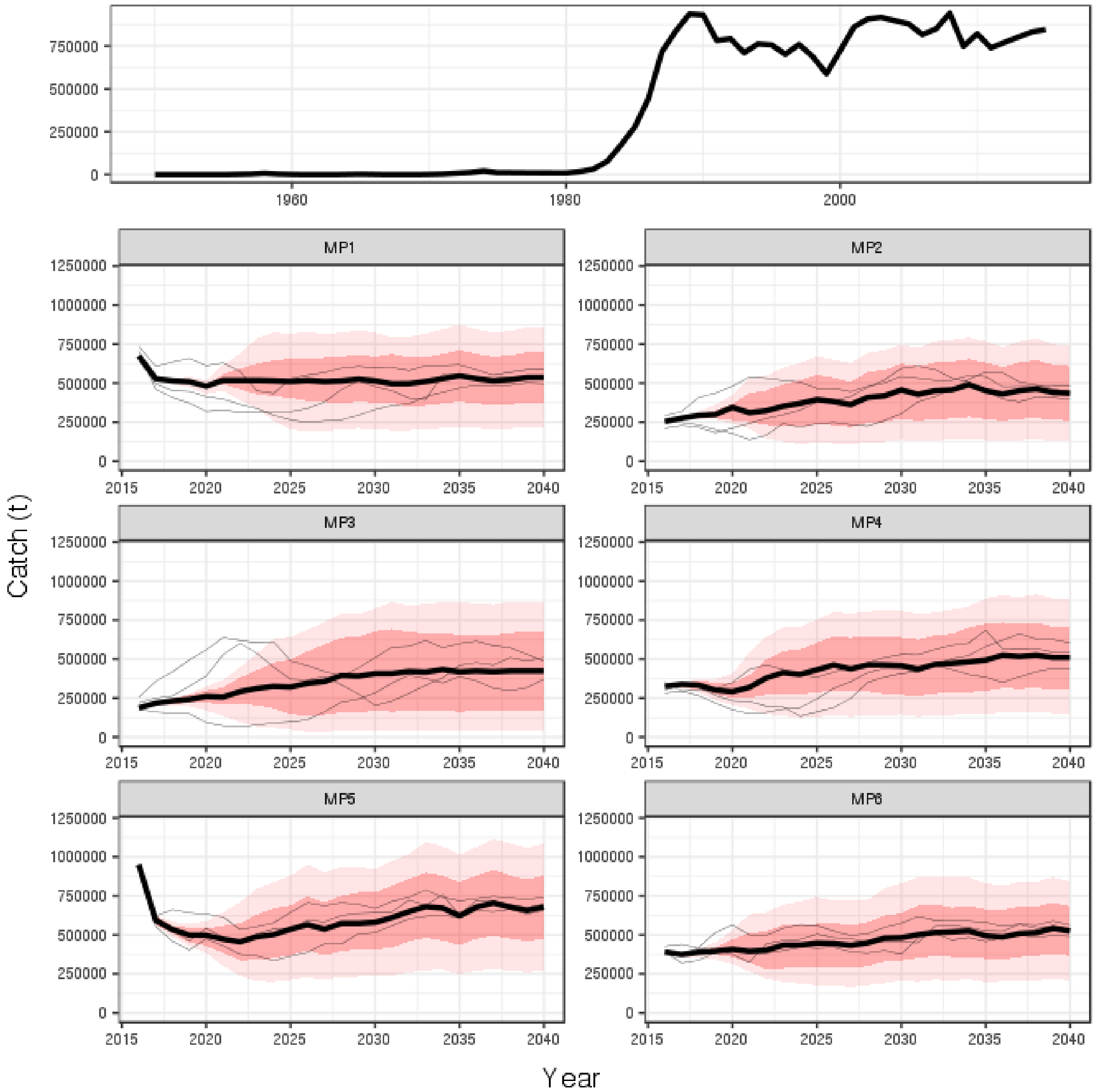


Figure 9. Time series plots for a hypothetical example of the performance of 6 MPs against the catch performance measure. The top panel represents the historical period (1950-2015) and the bottom 6 panels represent the projection years (2016-2040). The median for each MP is represented by the bold black lines, a dark ribbon shades the 25th-75th percentile region and a light ribbon shades the 10th-90th percentile region. Three additional thin black lines show individual realizations.

Table 2a. Hypothetical example of MSE outputs comparing the performance of 6 management procedures (MPs) against all IOTC performance measures for in the first projection year.

Status : maximize stock status		1 year					
		MP1	MP2	MP3	MP4	MP5	MP6
1. Mean spawner biomass relative to pristine	SB/SB_0	0.5	0.8	0.9	0.7	0.4	0.6
2. Minimum spawner biomass relative to pristine	SB/SB_0	0.3	0.6	0.6	0.5	0.2	0.4
3. Mean spawner biomass relative to SB_{MSY}	SB/SB_{MSY}	0.8	1.3	1.4	1.2	0.7	1.1
4. Mean fishing mortality relative to target	F/F_{tar}	1.4	0.6	0.4	0.8	1.5	0.9
5. Mean fishing mortality relative to F_{MSY}	F/F_{MSY}	1.4	0.6	0.4	0.8	1.5	0.9
6. Probability of being in Kobe green quadrant	SB,F	0.5	0.9	1	0.8	0.3	0.7
7. Probability of being in Kobe red quadrant	SB,F	0.3	0.1	0	0.1	0.5	0.2
Safety : maximize the probability of remaining above low stock status (i.e. minimize risk)							
8. Probability of spawner biomass being above 20% of SB_0	SB	0.8	0.9	0.9	0.8	0.7	0.8
9. Probability of spawner biomass being above B_{Lim}	SB	0.8	1.0	1.0	0.9	0.7	0.9
Yield : maximize catches across regions and gears							
10. Mean catch (1’000 t)	C	520	390	350	430	600	460
11. Mean catch by region and/or gear (1’000 t)	C	250	200	180	210	310	220
12. Mean catch relative to MSY	C/MSY	1.1	0.7	0.6	0.8	1.2	0.9
Abundance: maximize catch rates to enhance fishery profitability							
13. Mean catch rates (by region and gear) (for fisheries with meaningful catch-effort relationship)	I	3.2	3.8	3.9	2.7	2.5	2.6
Stability: maximize stability in catches to reduce commercial uncertainty							
14. Mean absolute proportional change in catch	C	0.2	0.3	0.3	0.2	0.1	0.2
15. % Catch co-efficient of variation	C	20	25	24	18	12	21
16. Probability of shutdown	C	0.01	0.01	0.01	0.01	0.01	0.01

Table 2b. Hypothetical example of MSE outputs comparing the performance of 6 management procedures (MPs) against all IOTC performance measures for a 5-year projection period.

Status : maximize stock status		5 years					
		MP1	MP2	MP3	MP4	MP5	MP6
1. Mean spawner biomass relative to pristine	SB/SB_0	0.5	0.8	1.0	0.7	0.4	0.6
2. Minimum spawner biomass relative to pristine	SB/SB_0	0.3	0.5	0.6	0.5	0.2	0.4
3. Mean spawner biomass relative to SB_{MSY}	SB/SB_{MSY}	0.9	1.2	1.3	1.1	0.7	1.2
4. Mean fishing mortality relative to target	F/F_{tar}	1.4	0.6	0.4	0.8	1.5	0.9
5. Mean fishing mortality relative to F_{MSY}	F/F_{MSY}	1.5	0.5	0.4	0.8	1.6	0.9
6. Probability of being in Kobe green quadrant	SB,F	0.5	0.9	0.9	0.8	0.3	0.7
7. Probability of being in Kobe red quadrant	SB,F	0.3	0.1	0.0	0.1	0.5	0.2
Safety : maximize the probability of remaining above low stock status (i.e. minimize risk)							
8. Probability of spawner biomass being above 20% of SB_0	SB	0.8	0.8	0.9	0.8	0.7	0.8
9. Probability of spawner biomass being above B_{Lim}	SB	0.8	1.0	1.0	0.9	0.7	0.8
Yield : maximize catches across regions and gears							
10. Mean catch (1’000 t)	C	551	417	378	434	600	460
11. Mean catch by region and/or gear (1’000 t)	C	248	194	176	229	335	218
12. Mean catch relative to MSY	C/MSY	1.2	0.6	0.6	0.8	1.3	1.0
Abundance: maximize catch rates to enhance fishery profitability							
13. Mean catch rates (by region and gear) (for fisheries with meaningful catch-effort relationship)	I	3.0	3.8	4.0	2.6	2.3	2.8
Stability: maximize stability in catches to reduce commercial uncertainty							
14. Mean absolute proportional change in catch	C	0.2	0.3	0.3	0.2	0.1	0.2
15. % Catch co-efficient of variation	C	19.4	27.3	26.2	17.6	11.5	21.0
16. Probability of shutdown	C	0.01	0.01	0.01	0.01	0.01	0.01

Table 2c. Hypothetical example of MSE outputs comparing the performance of 6 management procedures (MPs) against all IOTC performance measures for a 10-year projection period.

Status : maximize stock status		10 years					
		MP1	MP2	MP3	MP4	MP5	MP6
1. Mean spawner biomass relative to pristine	SB/SB_0	0.5	0.8	0.9	0.7	0.4	0.6
2. Minimum spawner biomass relative to pristine	SB/SB_0	0.3	0.6	0.6	0.5	0.2	0.4
3. Mean spawner biomass relative to SB_{MSY}	SB/SB_{MSY}	0.8	1.3	1.4	1.2	0.7	1.1
4. Mean fishing mortality relative to target	F/F_{tar}	1.4	0.6	0.4	0.8	1.5	0.9
5. Mean fishing mortality relative to F_{MSY}	F/F_{MSY}	1.4	0.6	0.4	0.8	1.5	0.9
6. Probability of being in Kobe green quadrant	SB,F	0.5	0.9	1	0.8	0.3	0.7
7. Probability of being in Kobe red quadrant	SB,F	0.3	0.1	0	0.1	0.5	0.2
Safety : maximize the probability of remaining above low stock status (i.e. minimize risk)							
8. Probability of spawner biomass being above 20% of SB_0	SB	0.8	0.9	0.9	0.8	0.7	0.8
9. Probability of spawner biomass being above B_{Lim}	SB	0.8	1.0	1.0	0.9	0.7	0.9
Yield : maximize catches across regions and gears							
10. Mean catch (1'000 t)	C	520	390	350	430	600	460
11. Mean catch by region and/or gear (1'000 t)	C	250	200	180	210	310	220
12. Mean catch relative to MSY	C/MSY	1.1	0.7	0.6	0.8	1.2	0.9
Abundance: maximize catch rates to enhance fishery profitability							
13. Mean catch rates (by region and gear) (for fisheries with meaningful catch-effort relationship)	I	3.2	3.8	3.9	2.7	2.5	2.6
Stability: maximize stability in catches to reduce commercial uncertainty							
14. Mean absolute proportional change in catch	C	0.2	0.3	0.3	0.2	0.1	0.2
15. % Catch co-efficient of variation	C	20	25	24	18	12	21
16. Probability of shutdown	C	0.01	0.01	0.01	0.01	0.01	0.01

Table 2d. Hypothetical example of MSE outputs comparing the performance of 6 management procedures (MPs) against all IOTC performance measures for a 20-year projection period.

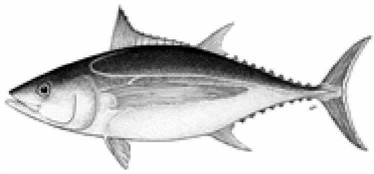
Status : maximize stock status		20 years					
		MP1	MP2	MP3	MP4	MP5	MP6
1. Mean spawner biomass relative to pristine	SB/SB_0	0.5	0.8	1.0	0.7	0.4	0.6
2. Minimum spawner biomass relative to pristine	SB/SB_0	0.3	0.5	0.6	0.5	0.2	0.4
3. Mean spawner biomass relative to SB_{MSY}	SB/SB_{MSY}	0.9	1.2	1.3	1.1	0.7	1.2
4. Mean fishing mortality relative to target	F/F_{tar}	1.4	0.6	0.4	0.8	1.5	0.9
5. Mean fishing mortality relative to F_{MSY}	F/F_{MSY}	1.5	0.5	0.4	0.8	1.6	0.9
6. Probability of being in Kobe green quadrant	*SB,F*	0.5	0.9	0.9	0.8	0.3	0.7
7. Probability of being in Kobe red quadrant	*SB,F*	0.3	0.1	0.0	0.1	0.5	0.2
Safety : maximize the probability of remaining above low stock status (i.e. minimize risk)							
8. Probability of spawner biomass being above 20% of SB_0	*SB*	0.8	0.8	0.9	0.8	0.7	0.8
9. Probability of spawner biomass being above B_{Lim}	*SB*	0.8	1.0	1.0	0.9	0.7	0.8
Yield : maximize catches across regions and gears							
10. Mean catch (1’000 t)	*C*	551	417	378	434	600	460
11. Mean catch by region and/or gear (1’000 t)	*C*	248	194	176	229	335	218
12. Mean catch relative to MSY	*C/MSY*	1.2	0.6	0.6	0.8	1.3	1.0
Abundance: maximize catch rates to enhance fishery profitability							
13. Mean catch rates (by region and gear) (for fisheries with meaningful catch-effort relationship)	*I*	3.0	3.8	4.0	2.6	2.3	2.8
Stability: maximize stability in catches to reduce commercial uncertainty							
14. Mean absolute proportional change in catch	*C*	0.2	0.3	0.3	0.2	0.1	0.2
15. % Catch co-efficient of variation	*C*	19.4	27.3	26.2	17.6	11.5	21.0
16. Probability of shutdown	*C*	0.01	0.01	0.01	0.01	0.01	0.01

APPENDIX VII
LIST OF CHAIRS, VICE-CHAIRS AND THEIR RESPECTIVE TERMS FOR ALL IOTC SCIENCE BODIES

Group	Chair/Vice-Chair	Chair	CPC/Affiliation	1st Term commencement date	Term expiration date (End date is until replacement is elected)	Comments
SC	Chair	Dr Hilario Murua	EU,Spain	28–Nov–15	End of SC in 2019	2nd term
	Vice-Chair	Dr Shiham Adam	Maldives, Rep. of	28–Nov–15	End of SC in 2019	2nd term
WPB	Chair	Dr Rui Coelho	EU,Portugal	14–Sept–17	End of WPB in 2019	1st term
	Vice-Chair	Dr Evgeny Romanov	EU,France	05–Sep–15	End of WPB in 2019	2nd term
WPTmT	Chair	Dr Jiangfeng Zhu	China	21–July–16	End of WPTmT in 2018	1st term
	Vice-Chair	Dr Toshihide Kitakado	Japan	21–July–16	End of WPTmT in 2018	1st term
WPTT	Chair	Dr Shiham Adam	Maldives, Rep. of	19–Nov–14	End of WPTT in 2018	2nd term
	Vice-Chair	Dr Gorka Merino	EU,Spain	19–Nov–14	End of WPTT in 2018	2nd term
WPEB	Chair	Dr Sylvain Bonhommeau	EU,France	08–Sept–17	End of WPEB in 2019	1st term
	Vice-Chair	Dr Reza Shahifar; Dr Ross Wanless	I.R. Iran / South Africa	11–Sept–15	End of WPEB in 2019	2nd term
WPNT	Chair	Dr Farhad Kaymaram	I.R. Iran	29–May–15	End of WPNT in 2019	2nd term
	Vice-Chair	Dr Mathias Igulu	Tanzania	29–May–15	End of WPNT in 2019	2nd term
WPDCS	Chair	Mr Stephen Ndegwa	Kenya	28–Nov–17	End of WPDCS in 2019	1st term
	Vice-Chair	Dr Julien Barde	EU,France	28–Nov–17	End of WPDCS in 2019	1st term
WPM	Chair	Dr Toshihide Kitakado	Japan	21–Oct–15	End of WPM in 2019	2nd term
	Vice-Chair	Dr Iago Mosqueira	EU,Spain	21–Oct–15	End of WPM in 2019	2nd term

APPENDIX VIII
EXECUTIVE SUMMARY: ALBACORE

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



Status of the Indian Ocean albacore (ALB: *Thunnus alalunga*) resource

TABLE 1. Albacore: Status of albacore (*Thunnus alalunga*) in the Indian Ocean.

Area[1]	Indicators – 2016 assessment		2017 stock status[3] determination
		SS3	
Indian Ocean	Catch 2016[2]:	35,996 t	(green)
	Average catch 2012–2016:	35,150 t	
	MSY (1000 t) (80% CI):	38.8 (33.9–43.6)	
	F_{MSY} (80% CI):	-	
	SB_{MSY} (1000 t) (80% CI):	30.0 (26.1–34.0)	
	F_{2014}/F_{MSY} (80% CI):	0.85 (0.57–1.12)	
	SB_{2014}/SB_{MSY} (80% CI):	1.80 (1.38–2.23)	
	SB_{2014}/SB_{1950} (80% CI):	0.37 (0.28–0.46)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 23%
[3] The stock status refers to the most recent years' data used in the last assessment conducted in 2016.

Colour key	Stock overfished(SB_{year}/SB_{MSY}< 1)	Stock not overfished (SB_{year}/SB_{MSY}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)	(red)	(orange)
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	(yellow)	(green)

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was carried out for albacore in 2017, thus, the stock status is determined on the basis of the 2016 assessment and other indicators presented in 2017.

Trends in the CPUE series suggest that the longline vulnerable biomass has declined to around 65% of the levels observed in 1980–82. Prior to 1980 there was 20 years of moderate fishing, after which total catches of albacore tuna in the Indian Ocean have more than doubled in subsequent years (**Fig. 1**). Catches have also increased substantially since 2007 for some fleets (i.e., Indonesian and Taiwan,China longline fisheries), although there is substantial uncertainty regarding the reliability of the catch estimates. Catches in 2014 were marginally above the MSY level of the SS3 model. Fishing mortality represented as F_{2014}/F_{MSY} is 0.85 (0.57–1.12). Biomass is considered to be above the SB_{MSY} level (SB_{2014}/SB_{MSY} = 1.80 (1.38–2.23)) from the SS3 model (**Table 1**, **Fig. 2**). The results from the other model options were also generally consistent with these estimates of stock status. Thus, the stock status in relation to the Commission's B_{MSY} and F_{MSY} target reference points indicates that the stock is **not overfished** and **not subject to overfishing** (**Table 1**).

Outlook. Maintaining or increasing effort in the core albacore fishing grounds is likely to result in further decline in the albacore tuna biomass, productivity and CPUE. However the impacts of piracy in the western Indian Ocean have resulted in the displacement of a substantial portion of longline fishing effort into the traditional albacore fishing areas in the southern and eastern Indian Ocean. With the reduction of the effects of piracy in recent years, due to increased security on-board vessels of some longline fleets (e.g., Taiwan,China, and China), it is unlikely that catch and effort on albacore will increase in the near future. There is a moderate probability of exceeding MSY-based reference points by 2017 if catches are maintained at 2014 levels (14% probability that $SB_{2017}<SB_{MSY}$, and 33% probability that $F_{2017}>F_{MSY}$) (**Table 2**).

Management advice. Although considerable uncertainty remains in the SS3 assessment, particularly due to the lack of biological information on Indian Ocean albacore tuna stocks, a precautionary approach to the management of albacore tuna should be applied by capping total catch levels to MSY levels (38,800 t; **Table 2**).

The following should be noted:

- The two primary sources of data that drive the assessment, total catches and CPUE, are highly uncertain and should be developed further as a priority.
- Catches in 2014 (39,507 t) marginally exceeded MSY levels (**Table 1**).
- The preliminary catch estimates for 2016 (~36,000 t) are below the current estimated MSY levels.
- A Kobe 2 Strategy matrix was calculated to quantify the risk of different future catch scenarios, using the projections from the SS3 model (**Table 2**).
- Provisional reference points: Noting that the Commission in 2015 adopted Resolution 15/10 *On interim target and limit reference points and a decision framework*, the following should be noted:
  - **Fishing mortality**: Current fishing mortality is considered to be below the provisional target reference point of F_{MSY}, and the provisional limit reference point of $1.4*F_{MSY}$ (**Fig. 2**).
  - **Biomass**: Current spawning biomass is considered to be above the target reference point of SB_{MSY}, and therefore above the limit reference point of $0.4*SB_{MSY}$ (**Fig. 2**).
- **Main fishing gear (average catches 2012–16)**: Albacore tuna are currently caught almost exclusively using drifting longliners, with the remaining catches recorded using purse seines and other gears. Catches from the longline fisheries are split between deep-freezing longliners, and fresh-tuna longliners (Fig. 1).
- **Main fleets (average catches 2012–16)**: The majority of albacore catches are attributed to vessels flagged to distant water fishing nations (i.e., Taiwan,China and Japan), followed by coastal countries such as Indonesia and Malaysia.

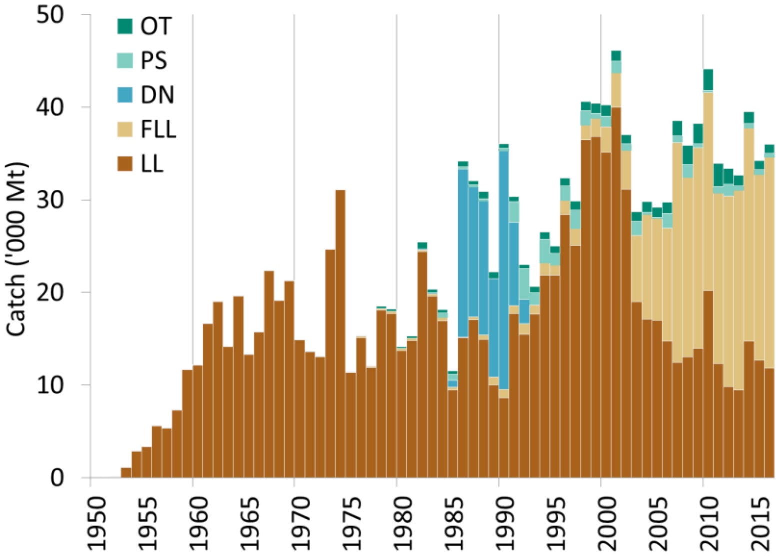


Fig. 1. Albacore: Catches of albacore by gear (1950-2016)[4].

[4] **Definition of fisheries**: Driftnet (**DN; Taiwan,China**); Freezing-longline (**LL**); Fresh-tuna longline (**FLL**); Purse seine (**PS**); Other gears nei (**OT**).

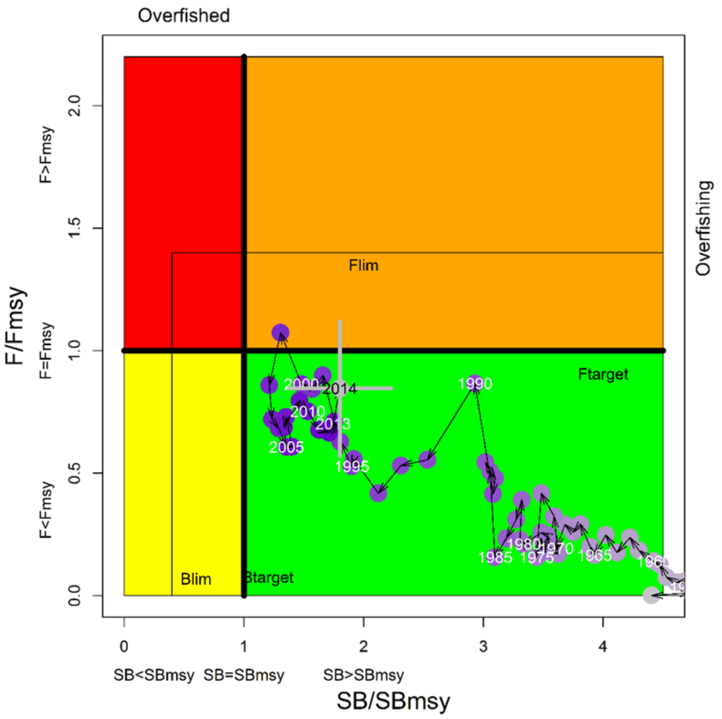


Fig. 2. Albacore: SS3 Aggregated Indian Ocean assessment Kobe plot. Blue circles indicate the trajectory of the point estimates for the SB ratio and F ratio for each year 1950–2014 (the grey lines represent the 80 percentiles of the 2014 estimate). Target (F_{targ} and SB_{targ}) and limit (F_{lim} and SB_{lim}) reference points are shown.

TABLE 2. Albacore: SS3 aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based target (top) and limit (bottom) reference points for constant catch projections (2014 catch levels*, ± 10%, ± 20%, ± 30%, and ± 40%) projected for 3 and 10 years.

Reference point and projection timeframe	**Alternative catch projections (relative to the catch level for 2014*) and probability (%) of violating MSY-based target reference points ($SB_{targ} = SB_{MSY}$; $F_{targ} = F_{MSY}$)**								
	60% (23,821)	**70% (27,791)**	**80% (31,761)**	**90% (35,731)**	**100% (39,701)**	**110% (43,671)**	**120% (47,641)**	**130% (51,611)**	**140% (55,581)**
$SB_{2017} < SB_{MSY}$	1	2	4	7	14	19	24	33	44
$F_{2017} > F_{MSY}$	0	1	5	18	33	47	59	71	77
$SB_{2024} < SB_{MSY}$	4	8	9	31	42	50	62	NA	92
$F_{2024} > F_{MSY}$	0	0	3	NA	39	56	66	70	100
Reference point and projection timeframe	**Alternative catch projections (relative to the catch level for 2014*) and probability (%) of violating MSY-based limit reference points ($SB_{lim} = 0.4\ SB_{MSY}$; $F_{Lim} = 1.4\ F_{MSY}$)**								
	60% (23,821)	**70% (27,791)**	**80% (31,761)**	**90% (35,731)**	**100% (39,701)**	**110% (43,671)**	**120% (47,641)**	**130% (51,611)**	**140% (55,581)**
$SB_{2017} < SB_{Lim}$	0	0	0	0	0	0	1	1	4
$F_{2017} > F_{Lim}$	0	0	0	0	2	10	20	34	46
$SB_{2024} < SB_{Lim}$	0	0	1	13	20	24	30	NA	65
$F_{2024} > F_{Lim}$	0	0	0	NA	10	27	48	60	100

** Catches for 2014, at the time of the last albacore assessment conducted in 2016.*

APPENDIX IX
EXECUTIVE SUMMARY: BIGEYE TUNA

Indian Ocean Tuna Commission
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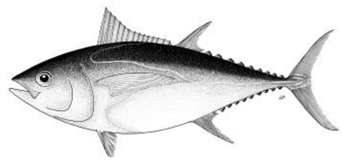

Status of the Indian Ocean bigeye tuna (BET: *Thunnus obesus*) resource

TABLE 1. Bigeye tuna: Status of bigeye tuna (*Thunnus obesus*) in the Indian Ocean.

Area[1]	**Indicators**		**2017 stock status**[3] **determination**
Indian Ocean	Catch in 2016[2]: Average catch 2012–2016:	86,586 t 100,455 t	**83.7%***
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2015}/F_{MSY} (80% CI): SB_{2015}/SB_{MSY} (80% CI): SB_{2015}/SB_0 (80% CI):	104 (87-121) 0.17 (0.14-0.20) 525 (364-718) 0.76 (0.49-1.03) 1.29 (1.07-1.51) 0.38 (n.a. – n.a.)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 27%
[3] The stock status refers to the most recent years' data used in the last assessment conducted in 2016.
* Estimated probability that the stock is in the respective quadrant of the Kobe plot (shown below), derived from the confidence intervals associated with the current stock status. The confidence intervals for SB_{2015}/SB_0 were not estimated for the models used.

Colour key	Stock overfished ($SB_{year}/SB_{MSY} < 1$)	Stock not overfished ($SB_{year}/SB_{MSY} \geq 1$)
Stock subject to overfishing($F_{year}/F_{MSY} > 1$)	**2.1%**	13.8%
Stock not subject to overfishing ($F_{year}/F_{MSY} \leq 1$)	0.4%	83.7%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was carried out for bigeye tuna in 2017, thus, stock status is determined on the basis of the 2016 assessment and other indicators presented in 2017. In 2016, six models were applied to the bigeye tuna stock in the IOTC area of competence (ASAP, BDM, ASPIC, SCAA, BSPM and SS3). The reported stock status is based on the SS3 model formulation using a grid designed to capture the uncertainty on stock recruitment relationship and the influence of tagging information. Spawning stock biomass in 2015 was estimated to be 38% of the unfished levels (Table 1) and 129% (107–151%) of the level that can support MSY. The assessment is qualitatively similar to the stock assessment conducted in 2013 but with a lower relative biomass (from 144 to 129% SB/SB_{MSY}) and higher relative fishing mortality (from 42 to 76% F/F_{MSY}). Considering the quantified uncertainty, which is conservative, the assessment indicates that, with high likelihood, SB_{2015} is above SB_{MSY} and F_{2015} is below F_{MSY}. The median value of MSY from the model runs presented with SS3 was 104,000 t with a range between 87,000 and 121,000 t (a median level 22% lower than the estimate in 2013). Catches in 2016 (≈86,586 t) remain lower than the estimated MSY values from the stock assessment conducted in 2016 (Table 1). The average catch over the previous five years (2012–16; ≈100,455 t) also remains below the estimated MSY. Thus, on the weight-of-evidence available in 2017, the bigeye tuna stock is determined to be **not overfished** and is **not subject to overfishing** (Table 1).

Outlook. Declines in longline effort since 2007, particularly from the Japanese, Taiwan, China and Rep. of Korea longline fleets have lowered the pressure on the Indian Ocean bigeye tuna stock, indicating that current fishing mortality would not reduce the population to an overfished state in the near future. The Kobe strategy matrix based on the plausible model runs from SS3 in 2016 illustrates the levels of quantified risk associated with varying catch levels over time and could be used to inform future management actions (Table 2). The SS3 projections from the 2016 assessment show that there is a low risk of exceeding MSY-based reference points by 2018, and 2025 if catches are maintained at current catch levels of 86,586 t (Table 2).

Management advice. The stock status determination did not qualitatively change in 2017. If catches remain below the estimated MSY levels estimated for the current mix of fisheries, then immediate management measures are not required. However, increased catch or increases in the mortality on immature fish will likely increase the probabilities of breaching reference levels in the future. Continued monitoring and improvement in data collection, reporting and analysis is required to reduce the uncertainty in assessments (Table 2).

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY):** estimate for the Indian Ocean stock is 104,101 t with a range between 87,000–121,000 t for SS3 (Table 1). The average 2012-2016 catches of ≈100,455 t, and catches for each year since 2009 were below the MSY level.
- **Interim reference points**: Noting that the Commission in 2015 agreed to Resolution 15/10 *on target and limit reference points and a decision framework*, the following should be noted:
  - **Fishing mortality**: Current fishing mortality is considered to be at 76% of the interim target reference point of F_{MSY}, and 54% of the interim limit reference point of 1.3*F_{MSY} (**Fig. 2**).
  - **Biomass**: Current spawning biomass is considered to at 129% of the interim target reference point of SB_{MSY} and well above the interim limit reference point of 0.5*SB_{MSY} (**Fig. 2**).
- **Main fishing gear** (Average catch 2012–16): Longline ≈54.0%; Purse seine ≈22% (FAD associated school (LS) ≈17%; free swimming school (PS) ≈6%); All other (artisanal) gears ≈23% (**Fig 1**).
- **Main fleets** (Average catch 2012–16): Indonesia ≈26%; Taiwan,China ≈21%; European Union ≈14% (EU-Spain: ≈10%; EU-France: ≈4%); Seychelles ≈12%; Japan ≈5%; All other fleets ≈22%.

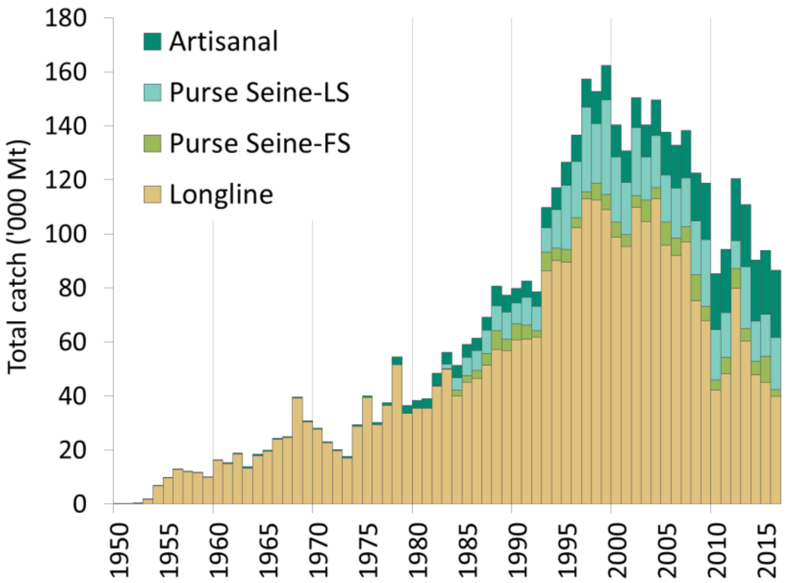

Fig. 1. Annual catches of bigeye tuna by gear (1950–2016)[5].

[5] **Definition of fisheries: Longline** (including Taiwan,China, Japan and other associated fleets); Purse seine free-school (**FS**); Purse seine associated school (**LS**); **Artisanal** (all other gears; e.g., pole-and-Line, handline, small longlines, gillnet, trolling).

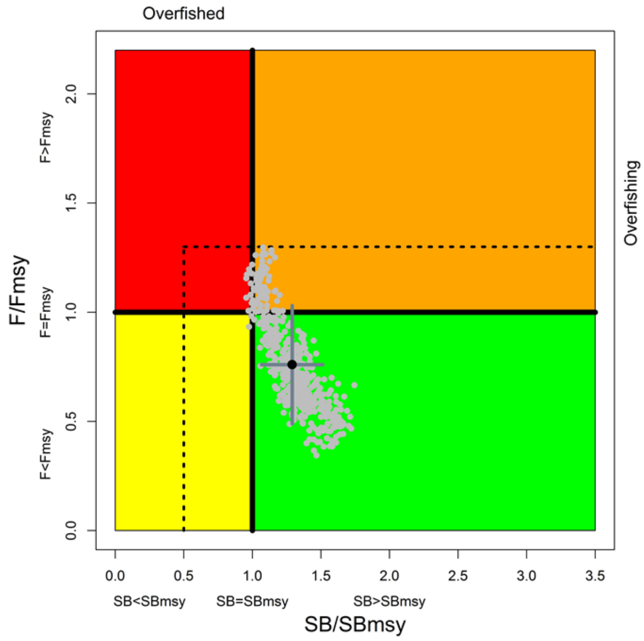

Fig. 2. Bigeye tuna: SS3 Aggregated Indian Ocean assessment Kobe plot. Dotted black lines are the interim limit reference points adopted by the Commission via Resolution 15/10. The grey points represent 500 estimates of 2015 stock status from the six SS3 scenarios. The black point represents the average of the six SS3 scenarios with associated 80% confidence interval.

TABLE 2. Bigeye tuna: Stock Synthesis base case Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based target (top) and limit (bottom) reference points for constant catch projections (relative to catches from 2015* (93,040t), ± 20%, + 40%) projected for 3 and 10 years.

Reference point and projection timeframe	**Alternative catch projections (relative to the catch level from 2015*) and weighted probability (%) scenarios that violate MSY-based target reference point**			
	80% (74,432t)	**100%** (93,040t)	**120%** (111,648t)	**140%** (130,256t)
$B_{2018} < B_{MSY}$	11	20	30	40
$F_{2018} > F_{MSY}$	2	19	40	61
$B_{2025} < B_{MSY}$	6	25	49	60
$F_{2025} > F_{MSY}$	1	19	42	53
Reference point and projection timeframe	**Alternative catch projections (relative to the catch level from 2015*) and probability (%) of violating MSY-based limit reference points ($B_{lim} = 0.5\ B_{MSY}$; $F_{Lim} = 1.3\ F_{MSY}$)**			
	80% (74,432t)	**100%** (93,040t)	**120%** (111,648t)	**140%** (130,256t)
$B_{2018} < B_{LIM}$	0	0	0	0
$F_{2018} > F_{LIM}$	0	4	18	37
$B_{2025} < B_{LIM}$	0	1	12	33
$F_{2025} > F_{LIM}$	0	9	30	48

** Catches for 2015, at the time of the last bigeye tuna assessment conducted in 2016.*

APPENDIX X
EXECUTIVE SUMMARY: SKIPJACK TUNA

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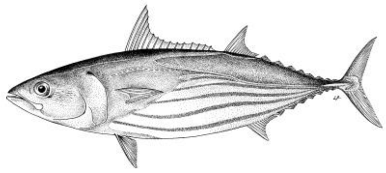

Status of the Indian Ocean skipjack tuna (SKJ: *Katsuwonus pelamis*) resource

TABLE 1. Skipjack tuna: Status of skipjack tuna (*Katsuwonus pelamis*) in the Indian Ocean.

Area[1]	Indicators		2017 stock status determination
Indian Ocean	Catch 2016[2]:	446,723 t	47%
	Average catch 2012–2016:	407,456 t	
	$Yield_{40\%SSB}$ (1000 t) (80% CI):	510.1 (455.9–618.8)	
	$C_{2016}/C_{40\%SSB}$ (80% CI):	0.88 (0.72-0.98)	
	SB_{2016} (1000 t) (80% CI):	796.66 (582.65-1,059.29)	
	Total biomass B_{2016} (1000 t) (80% CI):	910.4 (873.6-1195)	
	$SB_{2016}/SB_{40\%SSB}$ (80% CI):	1.00 (0.88–1.17)	
	SB_{2016}/SB_0 (80% CI):	0.40 (0.35–0.47)	
	$E^3_{40\%SSB}$ (80% CI):	0.59 (0.53-0.65)	
	SB_0 (80% CI):	2,015,220 (1,651,230–2,296,135)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 22%
[3] E is the annual harvest rate

Colour key	Stock overfished ($SB_{year}/SB_{40\%} < 1$)	Stock not overfished ($SB_{year}/SB_{40\%} \geq 1$)
Stock subject to overfishing($F_{year}/F_{40\%} > 1$)	**38%**	2%
Stock not subject to overfishing ($F_{year}/F_{40\%} \leq 1$)	13%	47%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new assessment was carried out for skipjack tuna in 2017. The 2017 stock assessment model results differ substantively from the previous (2014 and 2011) assessments. The main reasons for this are: (i) the correction of an error in specifying selectivity for small fish in the previous assessments, (ii) the addition of tag-release mortality in the model and (iii) assuming effort creep of 1% per year since 1995 for the standardized European purse seine CPUE. The final overall estimate of stock status indicates that the stock is at the target biomass reference point and that the current and historical fishing mortality rates are estimated to be below the target. Over the history of the fishery, biomass has been well above and the fishing mortality has been well below the established limit reference points. The median value of Catch at the target fishing mortality ($C_{SB40\%}$) from the model runs investigated is 510,090 t with a range between 455,920 and 618,760t. Current spawning stock biomass relative to unexploited levels is estimated at 40% (Table 1). Catch in 2016 (≈446,723 t) remain lower than the estimated range of $C_{SB40\%}$ (Table 1). The average catch over the previous five years (2012–16; ≈ 407,450 t) also remains below the estimated range of $C_{SB40\%}$. Thus, on the weight-of-evidence available in 2017, the skipjack tuna stock is determined to be **not overfished** and is **not subject to overfishing** (Table 1).

Outlook. Given the current status of the fishery and assuming that catch does not exceed prescription from Resolution 16-02, it would be expected that the stock would fluctuate around the target level. CPUE fluctuations, mainly for the purse seine, coincide with environmental signals at inter-annual timescale (e.g. Indian Ocean Dipole). Due to its specific life traits, skipjack can respond quickly to ambient foraging conditions driven by ocean productivity. Environmental indicators should be closely monitored to inform on the potential increase/decrease of stock productivity. There remains considerable uncertainty in the assessment, and the range of runs analysed illustrate a range of stock status to be between 0.35 and 0.47 of SB_{2016}/SB_0 based on all runs examined.

Management advice. The catch limit will be calculated applying the Harvest Control Rule specified in Resolution 16-02.

The following key points should also be noted:

- There is no evidence of any exceptional circumstance that may impede the application of the *harvest control rule* specified in Resolution 16-02. The spawning biomass is above the limit reference point.
- As agreed by the Commission, the application of the HCR provides a total annual catch limit for 2018-2020 using the following values estimated from the 2017 skipjack stock assessment. For each value, the reported median from the reference grid adopted by the Scientific Committee for advising the Commission is used:
  - The median of $SB_{2016}/SB_0 = 0.40$;
  - The estimate median of current spawning stock biomass (SB_{curr}) is 796,660 t;
  - The estimate of the equilibrium exploitation rate associated with sustaining the stock at SBtarg is Etarg = 0,59;
  - As current spawning biomass (SB_{curr}) is estimated to be at or above the threshold spawning biomass i.e., $SB_{curr} >= 0.4B_0$, then the fishing intensity parameter (I) corresponds to Imax (1);

Following Resolution 16/02, the catch limit is calculated as [I_{max} x E_{targ} x B_{curr}] = 1 * 0.59 * 796,660 t. which results in an annual overall catch limit of 470,029 t. for the period 2018-2020.

The SC has included in its programme of work further development of Management Strategy Evaluation (MSE) for the IOTC Skipjack tuna fishery including, but not limited to refinement of operating model(s)/ used, specifications for the assessment and data to be used, and alternative management procedures.

- **Reference points:** Commission in 2016 agreed to Resolution 16/02 on *harvest control rules for skipjack tuna in the IOTC area of competence*
- **Fishing mortality**: Current fishing mortality is considered to be below the target reference point, and also below the limit reference point (**Fig. 2**) as per Resolution 15/10,.
- **Biomass**: Current spawning biomass is considered to be at the target reference point of 40% of SB_0, and above the limit reference point of $0.2*SB_0$ (**Fig. 2**) as per Resolution 15/10,
- **Main fishing gear** (average catches 2012–16): Purse seine ≈33% (FAD associated school ≈31% and free swimming school ≈2%); Gillnet ≈24%; Pole-and-line ≈20%; Other ≈24% (**Fig 1**).
- **Main fleets** (average catches 2012–16): Indonesia ≈20%; European Union ≈20% (EU-Spain: ≈15%; EU-France: ≈5%); ≈Maldives 16%; Sri Lanka ≈14%; ≈I.R. Iran 9%; Seychelles ≈9%; India ≈6%; All other fleets ≈6%).

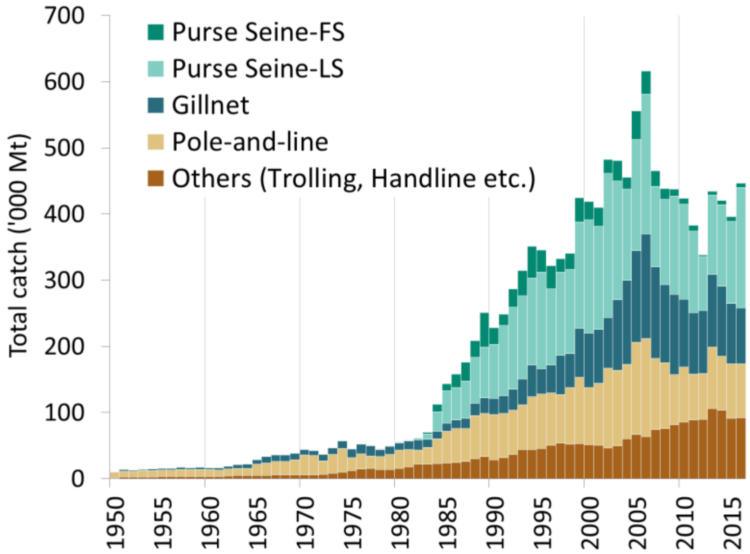

Fig. 1. Annual catches of skipjack tuna by gear (1950–2016)[6].

[6] **Definition of fisheries: Gillnet**, including offshore gillnet**; Pole-and-Line**; Purse seine free-school (**FS**); Purse seine associated school (**LS**); **Other gears** (e.g., troll line, handline, beach seine, Danish seine, liftnet).

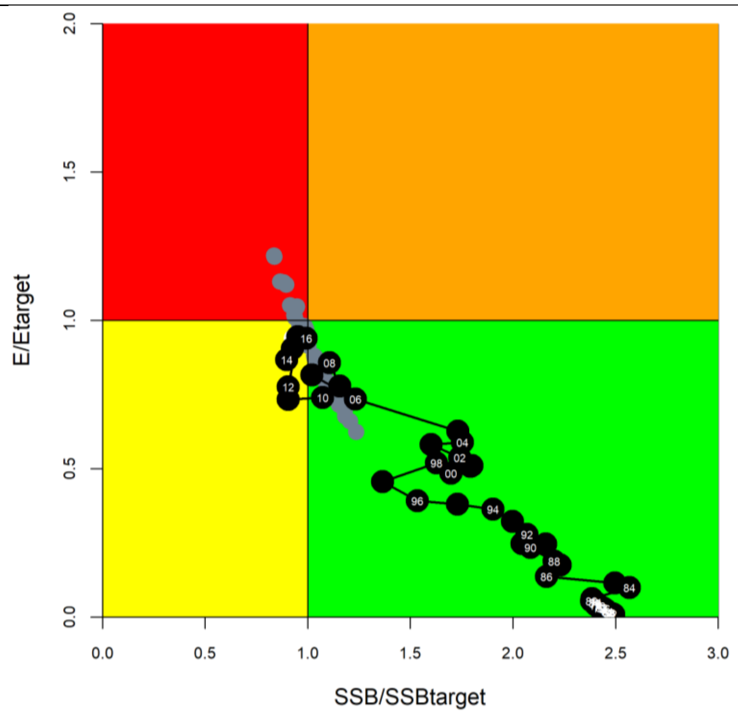

Fig. 2. Skipjack tuna: SS3 Aggregated Indian Ocean assessment Kobe plot of the 2017 uncertainty grid. Black circles indicate the trajectory of the median estimates for the SB/SB$_{target}$ ratio and E/E$_{target}$ ratio across all models of the 2017 uncertainty grid for each year 1950–2016; grey dots are the estimates for year 2016 from individual models.

APPENDIX XI
EXECUTIVE SUMMARY: YELLOWFIN TUNA

Indian Ocean Tuna Commission
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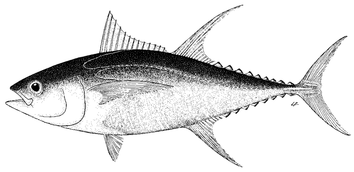


Status of the Indian Ocean yellowfin tuna (YFT: *Thunnus albacares*) resource

TABLE 1. Yellowfin tuna: Status of yellowfin tuna (*Thunnus albacares*) in the Indian Ocean.

Area[1]	Indicators		2017 stock status[3] determination
Indian Ocean	Catch 2016[2]: Average catch 2012–2016:	412,679 t 407,985 t	**67.6%***
	MSY (1000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2015}/F_{MSY} (80% CI): SB_{2015}/SB_{MSY} (80% CI): SB_{2015}/SB_0 (80% CI):	422 (406-444) 0.151 (0.148-0.154) 947 (900-983) 1.11 (0.86-1.36) 0.89 (0.79-0.99) 0.29 (n.a.-n.a.)	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 22%
[3] The stock status refers to the most recent years' data used in the last assessment conducted in 2016.
* Estimated probability that the stock is in the respective quadrant of the Kobe plot (shown below), derived from the confidence intervals associated with the current stock status. The confidence intervals for SB_{2015}/SB_0 were not estimated for the models used.

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)	**67.6%**	3.7%
Stock not subject to overfishing ($F_{year}/F_{MSY} \leq$ 1)	27.3%	1.4%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was carried out for yellowfin tuna in 2017, thus, stock status is determined on the basis of the 2016 assessment and other indicators presented in 2017. In 2016, two models were applied to the yellowfin tuna stock in the IOTC area of competence to update the stock status undertaken in 2015: a Biomass Dynamic Model (BDM) and Stock Synthesis III (SS3) model, which gave qualitatively similar results. Stock status and management advice was based on the SS3 model formulation. Spawning stock biomass in 2015 was estimated to be 28.9% of the unfished levels (Table 1) and 89% (79–99%) of the level which can support MSY. The assessment is somewhat more optimistic than the stock assessment undertaken in 2015 mainly due to the use of a new composite LL CPUE series, which results in a lower estimate of fishing mortality in the NE Indian Ocean. In addition, the catch series revised in 2016 reduced the catch data for 2014 by 5.1% (from 430,327 to 408,497), although the impact of this revision on status determination was minor. According to the information available for the stock assessment, the total catch has remained relatively stable at levels somewhat lower than the estimated MSY since 2012 (412,659 t in 2016, 402,384 t in 2015, 408,097 in 2014, 405,048 in 2013 and 400,502 in 2012). The inclusion of revised and new data into the updated assessment using the model structure applied in the 2015 assessment resulted in a higher estimated biomass in 2014 and lower estimated F/F_{MSY} than the corresponding estimates from the 2015 stock assessment. Nonetheless, the updated assessment estimates SB_{2015}/SB_{MSY} at 0.89 (0.79-0.99) and F_{2015}/F_{MSY} at 1.11 (0.86-1.36). The quantified uncertainty in these estimates is an underestimate of the underlying uncertainty of the assessment. On the weight-of-evidence available in 2017, the yellowfin tuna stock is determined to remain **overfished** and subject to **overfishing** (Table 1 and Fig. 1).

Outlook. The increase in longline, gillnet, handline and purse seine effort and associated catches in recent years has substantially increased the pressure on the Indian Ocean stock, with recent fishing mortality exceeding the MSY-related levels. There is a risk of continuing to exceed the MSY-based biomass reference point if catches increase or remain at around current levels (2016) until 2018 (88% risk that SB < SB_{MSY}) (Table 2). The modelled probabilities of the stock attaining levels consistent with the Commission's current management objective (e.g. SB > SB_{MSY}) are shown in the K2MSM, which provides a range of options for reducing catches and the probabilities of the yellowfin tuna stock recovering to the MSY target levels (Table 2).

Management advice. As no stock assessment was conducted in 2017, the stock status determination has not changed since 2016, and gives a somewhat more optimistic estimate of stock status than the 2015 assessment as a result of the use of more reliable information on catch rates of longline fisheries and catches updated to 2016. The stock status is driven by unsustainable catches of yellowfin tuna taken over the last five (5) years, and the relatively low recruitment levels estimated by the model in recent years. The Commission has an interim plan for the rebuilding of this stock (Resolution 17/01, which is yet to be evaluated and superseded Resolution 16/01) to achieve the recovery of yellowfin stock, with catch limitations based on 2014/2015 levels. The projections produced to advise on future catches are, in the short term, driven by the below average recruitment estimated for in recent years since these year classes have yet to reach maturity and contribute to the spawning biomass (see Table 2).

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY):** estimate for the Indian Ocean stock is estimated at 422,000 t with a range between 406,000-444,000 t (Table 1). The 2012-2016 average catches (407,985 t) were below the estimated MSY level.
- **Interim reference points**: Noting that the Commission in 2015 agreed to Resolution 15/10 *on target and limit reference points and a decision framework*, the following should be noted:
  - **Fishing mortality**: Current fishing mortality is considered to be 11% above the interim target reference point of F_{MSY}, and below the interim limit reference point of 1.4*F_{MSY} (**Fig. 2**).
  - **Biomass**: Current spawning biomass is considered to be 11% below the interim target reference point of SB_{MSY}, however above the interim limit reference point of 0.4*SB_{MSY} (**Fig. 2**).
- **Main fishing gear** (average catches 2012–16): Purse seine ≈34% (FAD associated school ≈21%; free swimming school ≈13%); Longline ≈19%; Gillnet ≈16%; All other gears ≈31% (**Fig. 1**).
- **Main fleets** (average catches 2012–16): European Union ≈21% (EU-Spain ≈15%; EU-France ≈7%); Maldives ≈12%; Indonesia ≈10%; I.R. Iran ≈10%; Sri Lanka ≈9%; Yemen ≈7%; India ≈7%; All other fleets ≈23%.

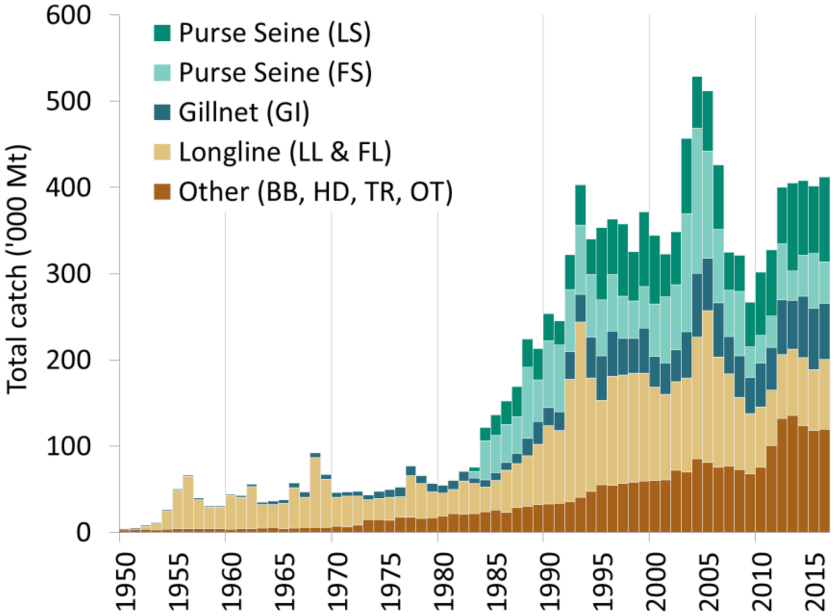


Fig. 1. Annual catches of yellowfin tuna by gear (1950–2016)[7].

[7] **Definition of fisheries**: **Gillnet**, including offshore gillnet (**GI**); Purse seine free-school (**FS**); Purse seine associated school (**LS**); Deep-freezing longline (**LL**); Fresh-tuna longline (**FL**); Other gears (including, Pole-and-Line (**BB**); Hand line (**HD**); Trolling (**TR**); Other gears nei (**OT**)).

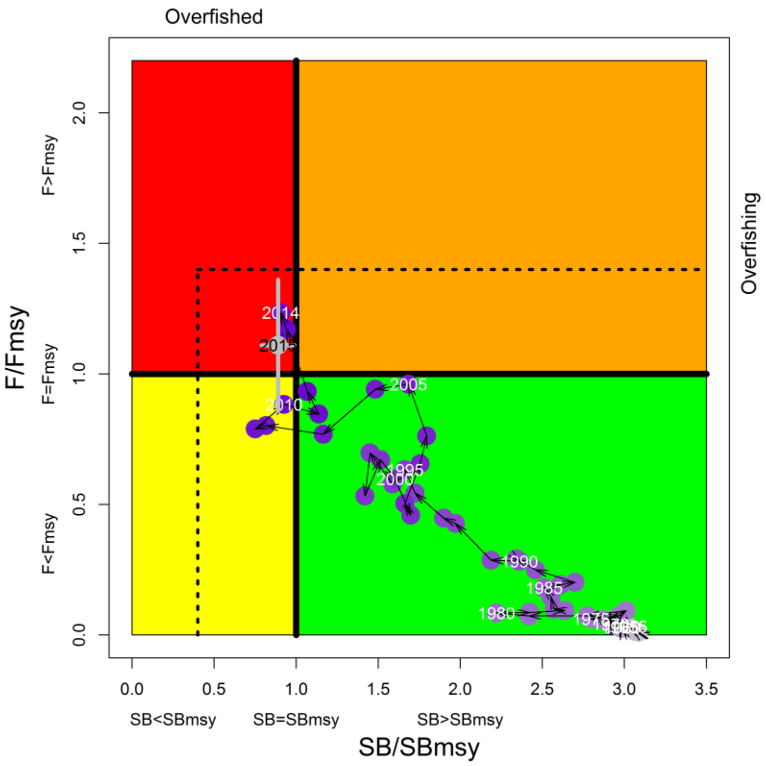


Fig. 2. Yellowfin tuna: Stock synthesis Kobe plot. Blue dots indicate the trajectory of the point estimates for the SB/SB_{MSY} ratio and F/F_{MSY} ratio for each year 1950–2015. The grey line represents the 80% confidence interval associated with the 2015 stock status. Dotted black lines are the interim limit reference points adopted by the Commission via Resolution 15/10.

TABLE 2. Yellowfin tuna: Stock synthesis assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based target (top) and limit (bottom) reference points for constant catch projections (relative to the catch level from 2015* levels (407,575t), -30%, - 25%, ± 20%, -15%, ± 10%, -5%), projected for 3 and 10 years), projected for 3 and 10 years.

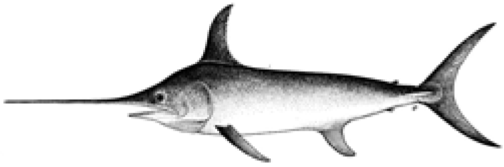
Reference point and projection timeframe	**Alternative catch projections (relative to the catch level from 2015*) and probability (%) of violating MSY-based target reference points ($B_{targ} = B_{MSY}$; $F_{targ} = F_{MSY}$)**								
	70% (285,302t)	75% (305,680t)	80% (326,059t)	85% (346,438t)	90% (366,816t)	95% (387,195t)	100% (407,574t)	110% (448,331t)	120% (489,089t)
$B_{2018} < B_{MSY}$	53	61	67	77	80	88	88	97	99
$F_{2018} > F_{MSY}$	2	7	23	47	65	73	100	100	100
$B_{2025} < B_{MSY}$	6	n.a.	20	37	60	100	100	100	100
$F_{2025} > F_{MSY}$	0	n.a.	10	40	57	100	100	100	100
Reference point and projection timeframe	**Alternative catch projections (relative to the catch level from 2015*) and probability (%) of violating MSY-based limit reference points ($B_{lim} = 0.4\ B_{MSY}$; $F_{Lim} = 1.4\ F_{MSY}$)**								
	70% (285,302t)	75% (305,680t)	80% (326,059t)	85% (346,438t)	90% (366,816t)	95% (387,195t)	100% (407,574t)	110% (448,331t)	120% (489,089t)
$B_{2018} < B_{Lim}$	2	1	2	4	6	6	12	21	38
$F_{2018} > F_{Lim}$	0	0	1	10	32	52	100	100	100
$B_{2025} < B_{Lim}$	0	n.a.	1	7	30	>30**	>30**	>30**	>30**
$F_{2025} > F_{Lim}$	0	n.a.	0	11	53	>30**	>30**	>30**	>30**

** Catches for 2015, at the time of the last yellowfin tuna assessment conducted in 2016.*

*** At least one fishery not able to take the catch due to absence of vulnerable fish in the projection period. The probability levels are not well determined, but likely progressively exceed 30% as the catch level increases beyond 90%.*

APPENDIX XII
EXECUTIVE SUMMARY: SWORDFISH

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



Status of the Indian Ocean swordfish (SWO: *Xiphias gladius*) resource

TABLE 1. Swordfish: Status of swordfish (*Xiphias gladius*) in the Indian Ocean.

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2016[2]: Average catch 2012-2016:	31,407 [3] (39,777[4]) t 31,463 [3] (35,142[4]) t	(green)
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2015}/F_{MSY} (80% CI): SB_{2015}/SB_{MSY} (80% CI): SB_{2015}/SB_{1950} (80% CI):	31.59 (26.30–45.50) 0.17 (0.12–0.23) 43.69 (25.27–67.92) 0.76 (0.41–1.04) 1.50 (1.05–2.45) 0.31 (0.26–0.43)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 38 %
[3] Indonesian fresh tuna longline catch assumed to be the same as in 2011–2013
[4] Indonesian fresh tuna longline catch estimated using species composition from the Taiwanese fresh tuna longline in the same years.

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new assessment was undertaken in 2017 using stock synthesis with fisheries data up to 2015. The assessment uses a spatially disaggregated, sex explicit and age structured model. The SS3 model, used for stock status advice, indicated that MSY-based reference points were not exceeded for the Indian Ocean population ($F_{2015}/F_{MSY} < 1$; $SB_{2015}/SB_{MSY} > 1$). Most other models applied to swordfish also indicated that the stock was above a biomass level that would produce MSY. Spawning stock biomass in 2015 was estimated to be 26–43% of the unfished levels. There are some uncertainties in the catch estimates from the Indonesian fresh tuna longline (Fig. 1b); an alternative catch history was used in the base case stock assessment (Fig. 1a). Most recent catches are at the MSY level (31,590 t). On the weight-of-evidence available in 2017, the stock is determined to be ***not overfished*** and ***not subject to overfishing***.

Outlook. The decrease in longline catch and effort from 2005 to 2011 lowered the pressure on the Indian Ocean stock, and despite the recent increase in total recorded catches, current fishing mortality is not expected to reduce the population to an overfished state over the next decade. There is a very low risk of exceeding MSY-based reference points by 2026 if catches are maintained at 2015 levels (<1% risk that $SB_{2026} < SB_{MSY}$, and <1% risk that $F_{2026} > F_{MSY}$) (Table 2).

Management advice. The most recent catches (31,407 t in 2016) are at the MSY level (31,590 t). However, given the uncertainty of most recent catches from Indonesian fresh tuna longline fisheries there is a possibility that total catches could already be 39,777 t. The catches should not be increased beyond the MSY level (31,590 t).

The following key points should also be noted:

- A revised advice should be developed after the next updated stock assessment scheduled in 2020 once Indonesian catches are corrected.
- **Maximum Sustainable Yield (MSY)**: estimate for the Indian Ocean is 31,590 t.
- **Provisional reference points**: Noting that the Commission in 2015 agreed to Resolution 15/10 *on target and limit reference points and a decision framework*, the following should be noted:
  a. **Fishing mortality**: Current fishing mortality is considered to be below the provisional target reference point of F_{MSY} and below the provisional limit reference point of $1.4*F_{MSY}$ (Fig. 2).

b. **Biomass**: Current spawning biomass is considered to be above the target reference point of SB_{MSY}, and therefore above the limit reference point of $0.4*SB_{MSY}$ (Fig. 2).

- **Main fishing gear (average catches 2012–16)**: Longline catches are currently estimated to comprise approximately 79% of total swordfish catches in the Indian Ocean.
- **Main fleets (average catches 2012-16):** Indonesia: 25%; Taiwan,China: 18%; Sri Lanka: 13%; EU,Spain: 11%.

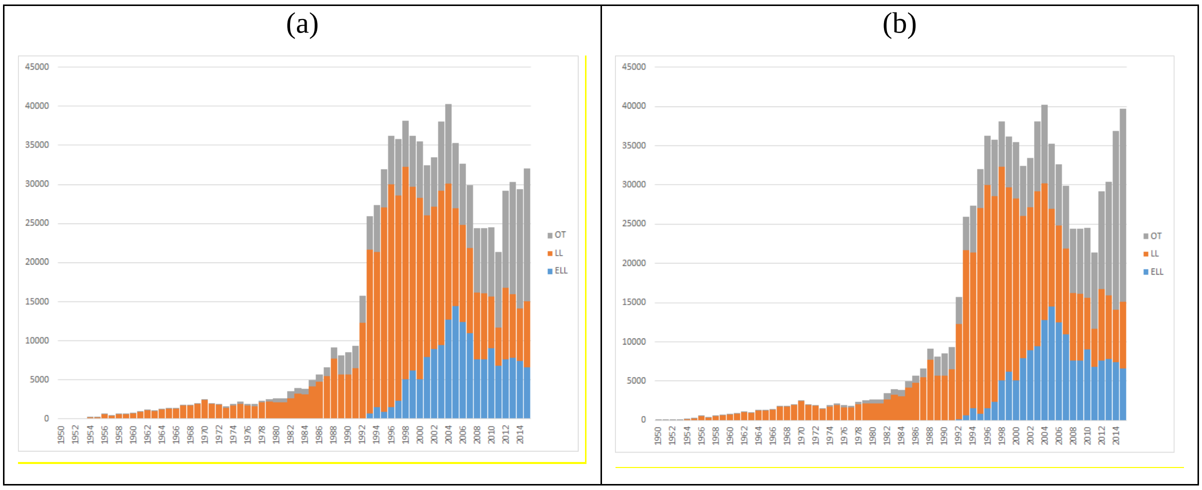


Fig. 1. Swordfish: catches by gear and year recorded in the IOTC Database (1950–2015): (a) the catch for Indonesian fresh tuna longline in 2014 and 2015 is assumed to be the average of 2011–2013; (b) the catch for Indonesian fresh tuna longline is estimated using species composition from the Taiwanese fresh tuna longline in the same years. Other gears (OT) includes: longline-gillnet, handline, gillnet, coastal longline, troll line, sport fishing, and all other gears.

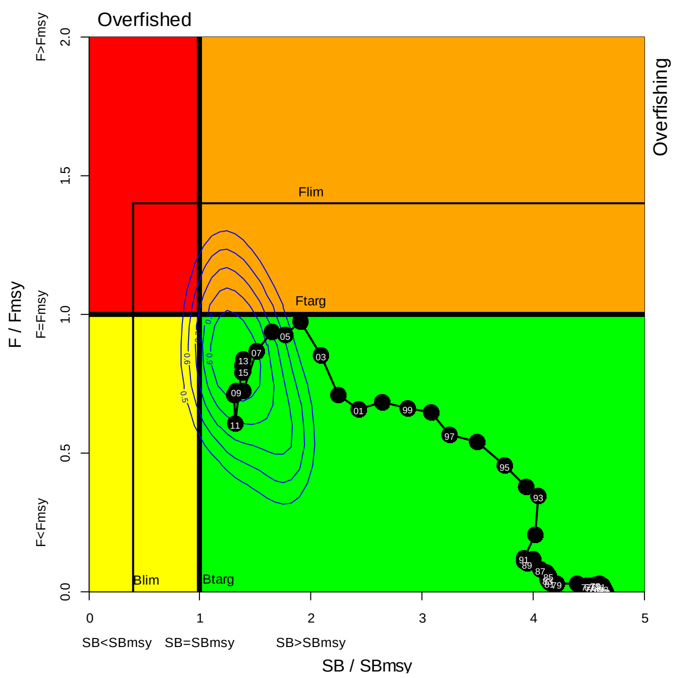


Fig. 2. Swordfish: SS3 Aggregated Indian Ocean assessment Kobe plot (contours are the 50, 60, 70, 80 and 90 percentiles of the 2015 estimate). Blue circles indicate the trajectory of the point estimates for the SB ratio and F ratio for each year 1950–2015. Interim target (F_{targ} and SB_{targ}) and limit (F_{lim} and SB_{lim}) reference points, as set by the Commission, are shown.

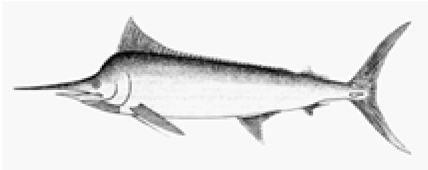
TABLE 2. Swordfish: SS3 aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based target (top) and limit (bottom) reference points for nine constant catch projections relative to 2015 catch level (32,129 t), ± 10%, ± 20%, ± 30% ± 40%) projected for 3 and 10 years.

Reference point and projection timeframe	**Alternative catch projections (relative to the average catch level from 2015: 32,129 t) and probability (%) of violating MSY-based target reference points ($SBtarg = SB_{MSY}$; $Ftarg = F_{MSY}$)**								
	60% (19,278 t)	**70%** (22,491 t)	**80%** (22,704 t)	**90%** (28,917 t)	**100%** (32,129 t)	**110%** (35,343 t)	**120%** (38,556 t)	**130%** (41,769 t)	**140%** (44,982 t)
$SB_{2018} < SB_{MSY}$	0	0	0	0	0	0	0	8	13
$F_{2018} > F_{MSY}$	0	0	0	0	13	33	42	58	71
$SB_{2025} < SB_{MSY}$	0	0	0	0	8	33	46	63	75
$F_{2025} > F_{MSY}$	0	0	0	4	38	54	71	83	88

Reference point and projection timeframe	**Alternative catch projections (relative to the average catch level from 2015: 32,129 t) and probability (%) of violating MSY-based limit reference points ($SB_{lim} = 0.4\ SB_{MSY}$; $F_{Lim} = 1.4\ F_{MSY}$)**								
	60% (19,278 t)	**70%** (22,491 t)	**80%** (22,704 t)	**90%** (28,917 t)	**100%** (32,129 t)	**110%** (35,343 t)	**120%** (38,556 t)	**130%** (41,769 t)	**140%** (44,982 t)
$SB_{2018} < SB_{Lim}$	0	0	0	0	0	0	0	0	0
$F_{2018} > F_{Lim}$	0	0	0	0	0	0	0	13	33
$SB_{2025} < SB_{Lim}$	0	0	0	0	0	0	0	0	21
$F_{2025} > F_{Lim}$	0	0	0	0	0	21	42	63	75

APPENDIX XIII
EXECUTIVE SUMMARY: BLACK MARLIN

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



Status of the Indian Ocean black marlin (BLM: *Makaira indica*) resource

TABLE 1. Black marlin: Status of black marlin (*Makaira indica*) in the Indian Ocean.

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2016[2]: Average catch 2012–2016:	17,829 t 16,638 t	**80%***
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): F_{2015}/F_{MSY} (80% CI): B_{2015}/B_{MSY} (80% CI): B_{2015}/B_0 (80% CI):	9.932 (6.963-12.153) 0.211 (0.089-0.430) 47.430 (27.435-100.109) 2.42 (1.52-4.06) 0.81 (0.55-1.10) 0.30 (0.20-0.41)	

[1]Boundaries for the Indian Ocean = IOTC area of competence;
[2]Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 42%
* Estimated probability that the stock is in the respective quadrant of the Kobe plot (shown below), derived from the confidence intervals associated with the current stock status.

Colour key	Stock overfished(B_{year}/B_{MSY}< 1)	Stock not overfished (B_{year}/B_{MSY}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)	80%	19%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	0%	1%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. Stock status based on BSP-SS stock assessment suggests that the stock in 2015 is in the red zone in the Kobe plot with F/F_{MSY}=2.42 and B/B_{MSY}=0.81. Another approach by ASPIC examined in 2016 came to similar conclusions. The Kobe plot (Fig. 2) from the BSP-SS model indicated that the stock has been **subject to overfishing** and **overfished** in recent years (Table 1; Fig. 2).

Outlook. The uncertainty in the data available for assessment purposes and the CPUE series suggests that the advice should be interpreted with caution. The recent sharp increase of catch changed the status of stock to the red zone of the Kobe plot. Even if the catch levels are reduced by 40% of the average 2013-2015 levels, it is unlikely that biomass would be above the B_{MSY} and F would be below the F_{MSY} in the next 10 years (Table 2).

Management advice. The current catches of BLM (Fig. 1) are considerably higher than MSY (9,932 t) and the stock is overfished (B_{2015}< B_{MSY}) and currently subject to overfishing (F_{2015}> F_{MSY}). Even with a 40% reduction in current catches, it is very unlikely (less than 5%) to achieve the Commission objectives of being in the green zone of the Kobe Plot by 2025. Current catch levels are not sustainable and there is a need for urgent actions to decrease these catch levels. In order to enable the stock to start rebuilding, the Commission should consider a reduction of substantially greater than 40% from the current catches.

The following key points should be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the whole Indian Ocean is 9,932 t.

- **Provisional reference points**: Although the Commission adopted reference points for swordfish in Resolution 15/10 *on target and limit reference points and a decision framework*, no such interim reference points nor harvest control rules have been established for black marlin.
- **Main fishing gear (average catches 2012–16)**: Black marlin are largely considered to be a non-target species of industrial and artisanal fisheries. Gillnets account for around 53% of total catches in the Indian Ocean, followed by longlines (17%), with remaining catches recorded under troll and handlines. (Fig. 1).
- **Main fleets (average catches 2012-16):** Iran (≈28%), India (≈20%), Sri Lanka (≈20%), and Indonesia (≈15%).

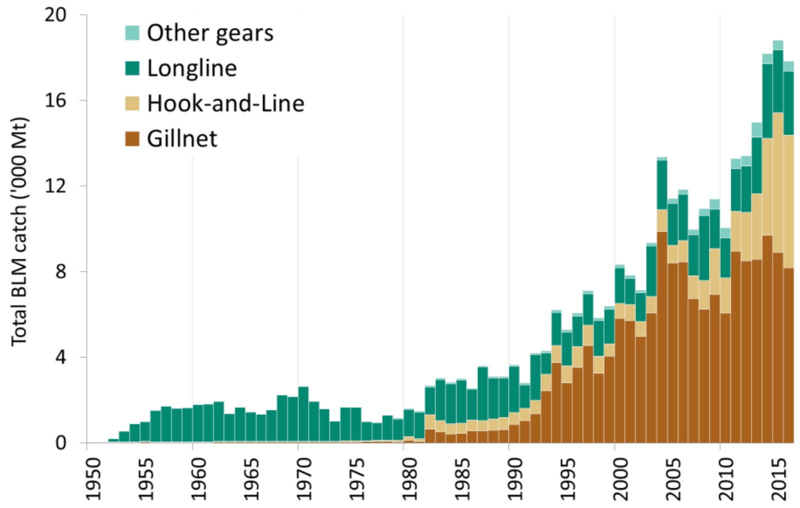


Fig. 1. Black marlin: catches by gear and year recorded in the IOTC Database (1950–2016)[8].

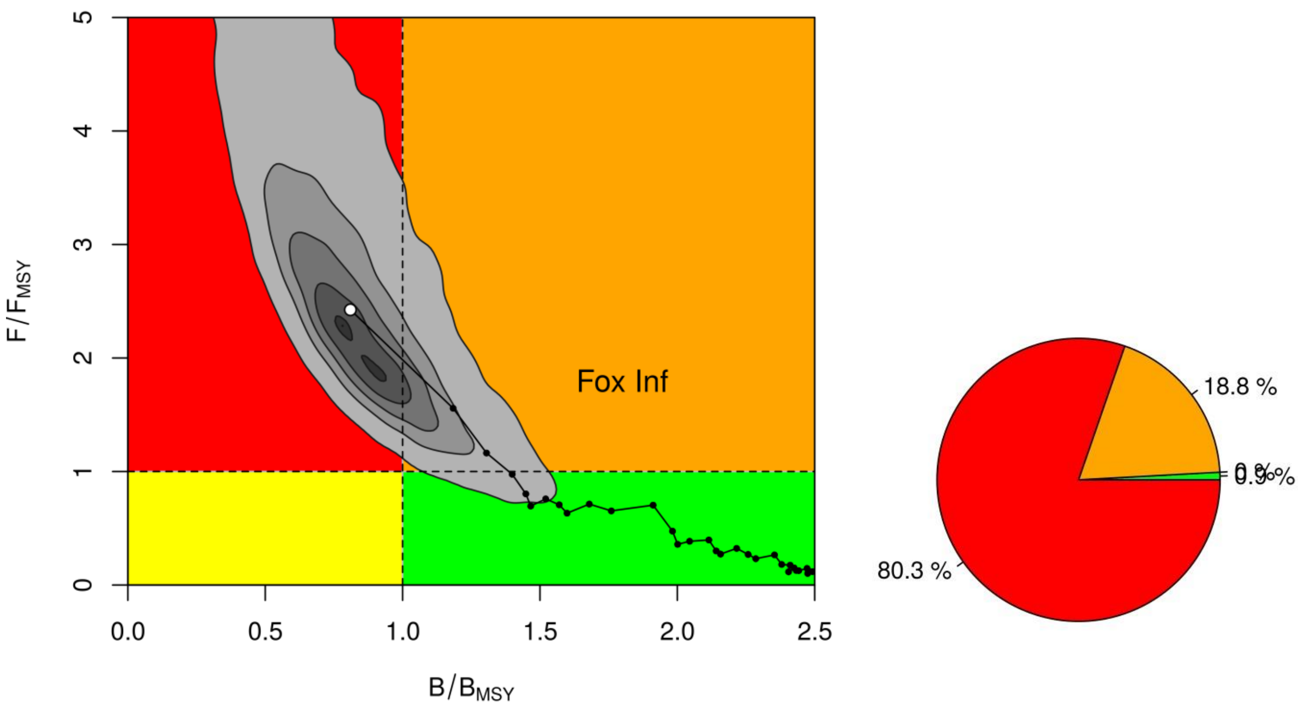


Fig. 2. Black marlin: BSP-SS aggregated Indian Ocean assessment Kobe plots for black marlin (contours are the 25, 50, 75 and 90 percentiles of the 2015 estimate). Black line indicates the trajectory of the point estimates for the total biomass (B) ratio and F ratio for each year 1950–2015.

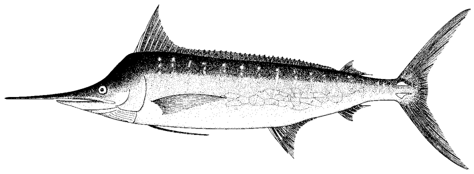
[8] **Definition of fisheries:** Longline; Gillnet; Hook-and-Line (includes handline, trolling, baitboat, and sport fisheries); Other gears (includes coastal purse seine, Danish purse seine, beach seine, and purse seine).

Table 2. Black Marlin: Indian Ocean BSP-SS Kobe II Strategy Matrix.Probability (percentage) of violating the MSY-based reference points for nine constant catch projections (average catch level from 2013 to 2015 17,171 t, ± 10%, ± 20%, ± 30% ± 40%) projected for 3 and 10 years.

Reference point and projection timeframe	**Alternative catch projections (relative to the average catch level from 2013 to 2015, 17,171 t, and probability (%) of violating MSY-based reference points**								
	60%	**70%**	**80%**	**90%**	**100%**	**110%**	**120%**	**130%**	**140%**
	10,303 t	12,020 t	13,737 t	15,454 t	17,171 t	18,888 t	20,605 t	22,322 t	24,039 t
$B_{2018} < B_{MSY}$	91	94	96	97	98	98	99	99	99
$F_{2018} > F_{MSY}$	89	96	98	99	100	100	100	100	100
$B_{2025} < B_{MSY}$	98	100	100	100	100	100	100	100	100
$F_{2025} > F_{MSY}$	97	99	100	100	100	100	100	100	100

APPENDIX XIV
EXECUTIVE SUMMARY: BLUE MARLIN

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



Status of the Indian Ocean blue marlin (BUM: *Makaira nigricans*) resource

TABLE 1. Blue marlin: Status of blue marlin (*Makaira nigricans*) in the Indian Ocean.

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2016[2]:	16,353 t	**46.8%***
	Average catch 2012–2016:	15,859 t	
	MSY (1,000 t) (80% CI):	11.93 (9.23–16.15)	
	F_{MSY} (80% CI):	0.11 (0.08 –0.16)	
	B_{MSY} (1,000 t) (80% CI):	113 (71.7 – 162.0)	
	H_{2015}/H_{MSY} (80% CI):	1.18 (0.80–1.71)	
	B_{2015}/B_{MSY} (80% CI):	1.11 (0.90–1.35)	
	B_{2015}/B_0 (80% CI):	0.56 (0.44 – 0.71)	

[1] Boundaries for the Indian Ocean = IOTC area of competence
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 41%
* Estimated probability that the stock is in the respective quadrant of the Kobe plot (shown below), derived from the confidence intervals associated with the current stock status.

Colour key	Stock overfished(B_{year}/B_{MSY}< 1)	Stock not overfished (B_{year}/B_{MSY}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)	24.6%	46.8%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	1.0%	27.6%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No stock assessment was carried out in 2017**.** Stock status based on BSP-SS stock assessment carried out in 2016 suggests that the stock in 2015 is in the orange zone in the Kobe plot and both F and B are close to their MSYs, i.e., F/F_{MSY}=1.18 and B/B_{MSY}=1.11. Two other approaches examined in 2016 came to similar conclusions, namely ASPIC and SS3. The results from the BSP-SS model indicated that the stock has been **subject to overfishing** but **not overfished** in recent years (Table 1; Fig. 2).

Outlook. The uncertainty in the data available for assessment purposes and the CPUE series suggests that the advice should be interpreted with caution. The recent rapid increase of catch may bring the status of stock to the red zone (Kobe plot) in the near future if such high levels of catch continue. There is a high probability (70-80%) to exceed MSY-based reference points in next 10 years if the catch level at the time of the assessment is maintained.

Management advice. The current catches of BUM (average of 15,859 t in the last 5 years, 2012-2016) (Fig.1) are higher than MSY (11,926 t) estimated for 2015 and the stock is currently subject to overfishing ($F_{2015} > F_{MSY}$). If catches of blue marlin are reduced to a maximum value of 11,704 t. (24 % reduction from average catch 2013-2015 at the time of the assessment), then the stock is expected to recover to the green zone of the Kobe Plot by 2025 ($F_{2025} < F_{MSY}$ and $B_{2025} > B_{MSY}$) with at least a 50% probability.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the Indian Ocean blue marlin stock is 11,926 t (estimated range 9,232–16,149 t).
- **Provisional reference points**: Although the Commission adopted reference points for swordfish in Resolution 15/10 *on target and limit reference points and a decision framework*, no such interim reference points, nor harvest control rules have been established for blue marlin.

- **Main fishing gear (average catches 2012–16)**: Blue marlin are largely considered to be a non-target species of industrial and artisanal fisheries. Longline catches account for around 72% of total catches in the Indian Ocean, followed by gillnets (25%), with remaining catches recorded under troll and handlines (Fig. 1).
- **Main fleets (average catches 2012-16):** Taiwan,China: 33%; Indonesia: 30%; Pakistan: 12%; I.R. Iran: 9%, and Sri Lanka (5%).

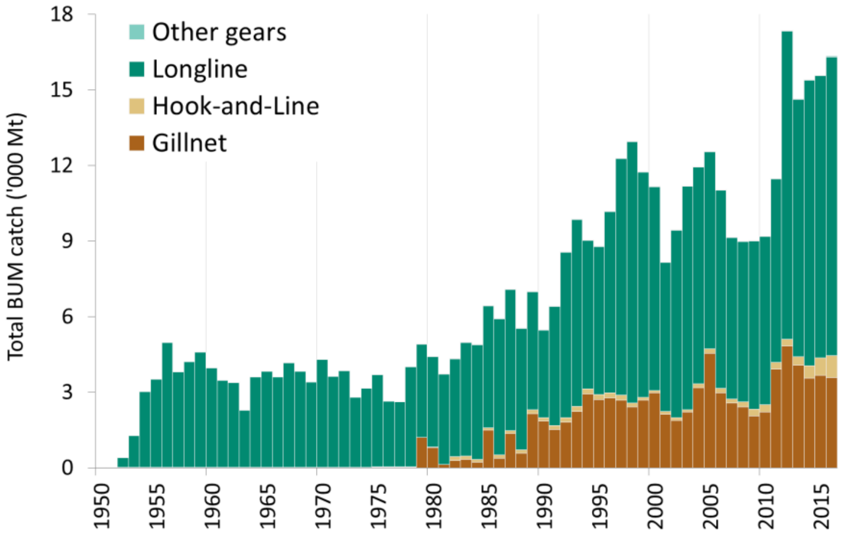
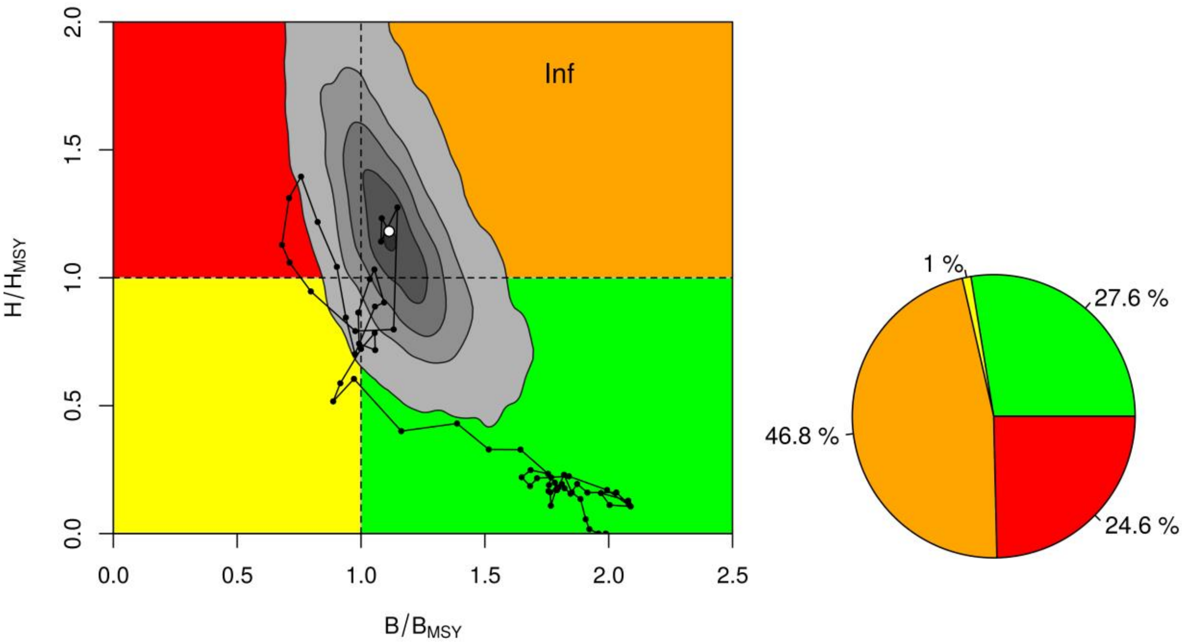


Fig. 1. Blue marlin: catches by gear and year recorded in the IOTC Database (1950–2016)[9].



[9] **Definition of fisheries:** Longline; Gillnet; Hook-and-Line (includes handline, trolling, baitboat, and sport fisheries); Other gears (includes coastal purse seine, Danish purse seine, beach seine, and purse seine).

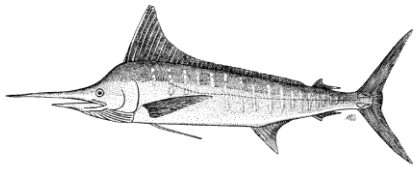
Fig. 2. Blue marlin: BSP-SS Aggregated Indian Ocean assessment Kobe plot for blue marlin (90% bootstrap confidence surfaces shown around 2015 estimate). Black line indicates the trajectory of the point estimates for the total biomass (B) ratio and Harvest ratio for each year 1950–2015.

Table 2. Blue Marlin: Indian Ocean BSP-SS Kobe II Strategy Matrix. Probability (percentage) violating the MSY-based reference points for nine constant catch projections (average catch level from 2013 to 2015 - 15,401 t ± 10%, ± 20%, ± 30% ± 40%) projected for 3 and 10 years.

Reference point and projection timeframe	**Alternative catch projections (relative to the average catch from 2013 to 2015 (15,401 t)) and probability (%) of violating MSY-based reference points**								
	60%	**70%**	**80%**	**90%**	**100%**	**110%**	**120%**	**130%**	**140%**
	9,240 t	10,780 t	12,321t	13,861 t	15,401 t	16,941 t	18,481 t	20,021 t	21,561 t
$B_{2018}<B_{MSY}$	26	31	37	43	48	54	59	64	69
$F_{2018}> F_{MSY}$	14	30	47	63	75	84	90	94	96
$B_{2025}<B_{MSY}$	16	30	46	60	73	82	88	93	95
$F_{2025}> F_{MSY}$	12	30	51	68	80	89	93	96	98

APPENDIX XV
EXECUTIVE SUMMARY: STRIPED MARLIN

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



Status of the Indian Ocean striped marlin (MLS: *Tetrapturus audax*) resource

TABLE 1. Striped marlin: Status of striped marlin (*Tetrapturus audax*) in the Indian Ocean.

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2016[2]:	5,299 t	
	Average catch 2012-2016:	4,854 t	
	MSY (1,000 t) (estimates):	(3.26–5.40)[3]	
	F_{MSY} (estimates):	(0.05–0.9)	
	B_{MSY} (1,000 t) (Estimates):	(1.82–61.0)	
	F_{2015}/F_{MSY} (estimates):	(1.32–3.40)	
	B_{2015}/B_{MSY} (estimates):	(0.24–0.62)	
	SB_{2015}/SB_{MSY} (SS3)[4]:	0.373	
	B_{2015}/B_{1950} (estimates):	(0.09–0.32)	
	SB_{2015}/SB_{1950} (SS3):	0.06	

[1] Boundaries for the Indian Ocean = IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 41%
[3] Estimates are the range of central values shown in Figure 2.
[4]SS3 is the only model that used SB/SB_{MSY}, all others used B/B_{MSY}.

Colour key	Stock overfished(B_{year}/B_{MSY}< 1)	Stock not overfished (B_{year}/B_{MSY}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)		
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new stock assessment for striped marlin was carried out in 2017, based on four different models, specifically a data-limited catch only method, two production models and an integrated length-based model. The ASPIC assessment confirmed the results from 2012, 2013 and 2015 that indicated the stock is subject to overfishing ($F>F_{MSY}$) and that biomass is below the level which would produce MSY ($B<B_{MSY}$). The other models examined in 2017 came to similar conclusions. All models were consistent in indicating that the stock has been subject to overfishing in the last two decades, and that as a result, the stock biomass is well below the B_{MSY} level. In 2016 reported catches increased to 5,299 t. On the weight-of-evidence available in 2017, the stock status of striped marlin is determined to be ***overfished*** and ***subject to overfishing*** (**Table 1**; **Fig. 2**).

Outlook. The decrease in longline catch and effort in the years 2009–11 lowered the pressure on the Indian Ocean stock, however, given the increased catches reported since 2011, combined with the concerning results obtained from the last stock assessments conducted in 2012, 2013, 2015 and 2017, the outlook is pessimistic for the stock and management action for striped marlin should be considered. K2SM probabilities are not provided because of uncertainty in quantitative results of the stock assessment models, which affected the projections estimates.

Management advice. Current or increasing catches have a very high risk of further decline in stock status. In order to enable the stock to start rebuilding, the Commission should consider a substantial reduction of catches. Quantitative advice will be provided after the next stock assessment which will be carried out in 2018.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: estimates for the Indian Ocean stock are highly uncertain and point estimates range between 3,270 t – 5,400 t. However, the current biomass is well below the B_{MSY} reference point and fishing mortality is in excess of F_{MSY} at recent catch levels of around 5,299 t.

- **Provisional reference points**: Although the Commission adopted reference points for swordfish in Resolution 15/10 *on target and limit reference points and a decision framework*, no such interim reference points have been established for striped marlin.
- **Main fishing gear (average catches 2012–16)**: Striped marlin are largely considered to be a non-target species of industrial fisheries. Longlines account for around 69% of total catches in the Indian Ocean, followed by gillnets (24%), with remaining catches recorded under troll and handlines (Fig. 1).
- **Main fleets (average catches 2012-16):** Indonesia: 35%; Taiwan,China: 24%; I.R. Iran: 14%; and Pakistan: 8%.

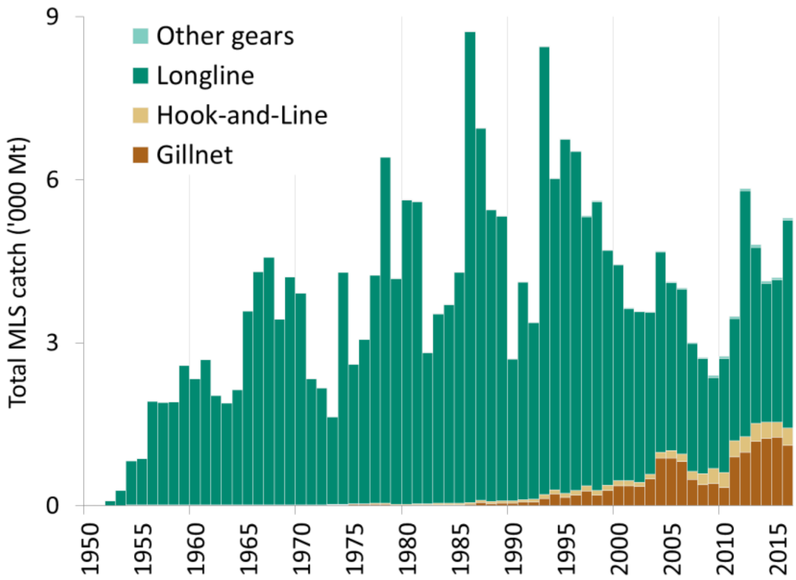


Fig.1. Striped marlin: catches by gear and year recorded in the IOTC Database (1950–2016)[10].

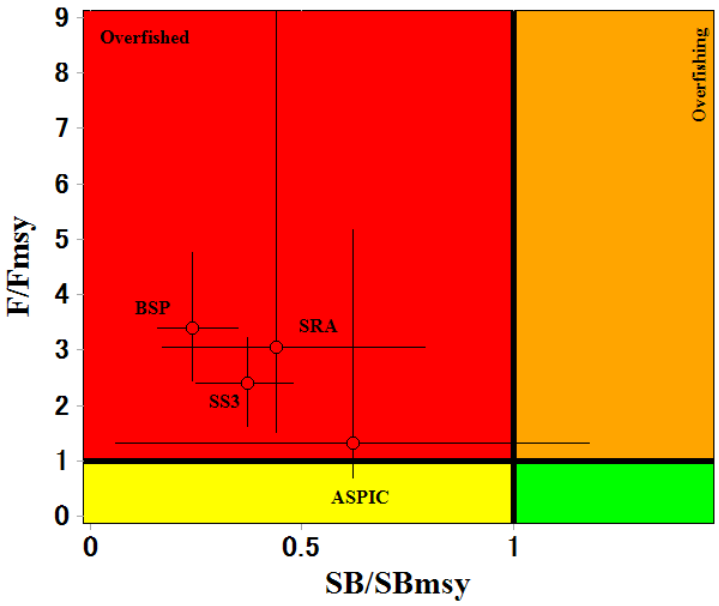
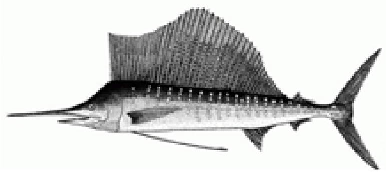


Fig. 2. Striped marlin: Stock status from the aggregated Indian Ocean assessment models with the confidence intervals. NB: SS3 refers to SB/SB$_{MSY}$ while all other models correspond to B/B$_{MSY}$.

[10] **Definition of fisheries:** Longline; Gillnet; Hook-and-Line (includes handline, trolling, baitboat, and sport fisheries); Other gears (includes coastal purse seine, Danish purse seine, beach seine, and purse seine).

APPENDIX XVI
EXECUTIVE SUMMARY: INDO-PACIFIC SAILFISH

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



Status of the Indian Ocean Indo-Pacific sailfish (SFA: *Istiophorus platypterus*) resource

TABLE 1. Indo-Pacific sailfish: Status of Indo-Pacific sailfish (*Istiophorus platypterus*) in the Indian Ocean.

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2016[2]: Average catch 2012-2016:	27,975 t 28,498 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): $F_{current}/F_{MSY}$ (80% CI): $B_{current}/B_{MSY}$ (80% CI): $B_{current}/B_0$ (80% CI):	25.00 (16.18–35.17) 0.26 (0.15–0.39) 87.52 (56.30–121.02) 1.05 (0.63–1.63) 1.13 (0.87–1.37) 0.56 (0.44–0.67)	

[1] Boundaries for the Indian Ocean = IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 57%

Colour key	Stock overfished(B_{year}/B_{MSY}< 1)	Stock not overfished (B_{year}/B_{MSY}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)		
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. In 2015, data poor methods for stock assessment using Stock reduction analysis (SRA) techniques indicate that the stock is not yet overfished, but is subject to overfishing (Table 1). In addition, a Bayesian Surplus Production Model indicated that the stock could be severely overfished so this is a less pessimistic outlook on the stock status. The stock appears to show a continued increase in catch which is a cause of concern (**Fig. 1**), indicating that fishing mortality levels may be becoming too high (**Fig. 2**). Aspects of the biology, productivity and fisheries for this species combined with the data poor status on which to base a more formal assessment are a cause for concern. Research emphasis on further developing possible CPUE indicators from gillnet fisheries, and further exploration of stock assessment approaches for data poor fisheries are warranted. Given the limited data being reported for coastal gillnet fisheries, and the importance of sports fisheries for this species, efforts must be made to rectify these information gaps. The lack of catch records in the Persian Gulf should also be examined to evaluate the degree of localised depletion in Indian Ocean coastal areas. On the weight-of-evidence available in 2016, the stock is determined to be still **not overfished** but **subject to overfishing**.

Outlook. The estimated increase in coastal gillnet catch and effort in recent years is a substantial cause for concern for the Indian Ocean stock, however there is not sufficient information to evaluate the effect this will have on the resource.

Management advice. The same management advice for 2017 (catches below a MSY of 25,000 t) is kept for the next year (2018).

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the Indian Ocean stock is 25,000 t.
- **Provisional reference points**: Although the Commission adopted reference points for swordfish in Resolution 15/10 *on target and limit reference points and a decision framework*, no such interim reference points have been established for I.P. sailfish.

- **Main fishing gear (average catches 2012–16)**: Gillnets account for around 75% of total catches of Indo-Pacific sailfish in the Indian Ocean, followed by troll and hand lines (20%), with remaining catches recorded under longlines and other gears (Fig. 1).
- **Main fleets (average catches 2012-16):** Three quarters of the total catches of Indo-Pacific sailfish are accounted for by four countries situated in the Arabian Sea: Iran: 30%; Pakistan: 18%; India: 18%; and Sri Lanka: 9%.

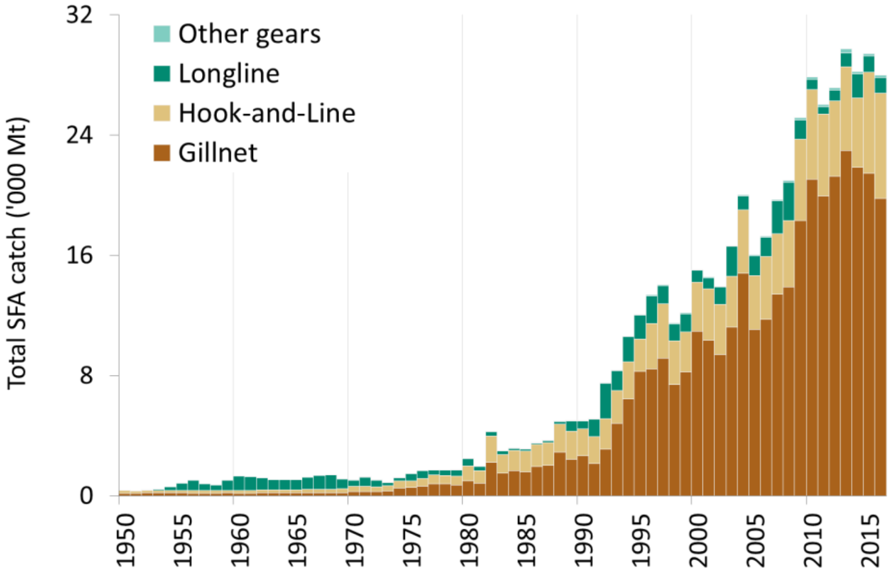


Fig. 1. Indo-Pacific sailfish: catches by gear and year recorded in the IOTC Database (1950–2016)[11].

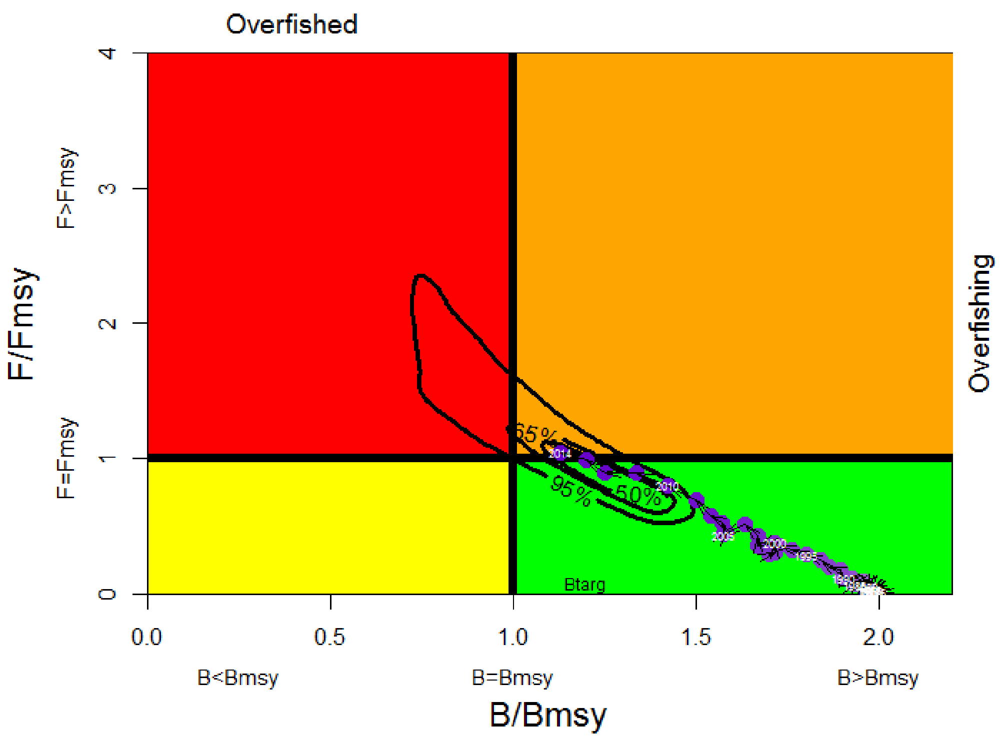


Fig. 2. Indo-Pacific sailfish: Stock reduction analysis (Catch MSY Method) of aggregated Indian Ocean assessment

[11] **Definition of fisheries:** Longline; Gillnet; Hook-and-Line (includes handline, trolling, baitboat, and sport fisheries); Other gears (includes coastal purse seine, Danish purse seine, beach seine, and purse seine).

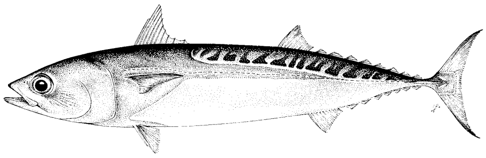
Kobe plot (contours are the 50, 65 and 90 percentiles of the 2014 estimate). Black lines indicate the trajectory of the point estimates (blue circles) for the B ratio and F ratio for each year 1950–2014.

Table 2. Indo-Pacific sailfish: Indian Ocean stock reduction analysis Kobe II Strategy Matrix.Probability (percentage) of violating the MSY-based reference points for nine constant catch projections (average catch level from 2012–2014 (29,164 t), ± 10%, ± 20%, ± 30% ± 40%) projected for 3 and 10 years.

Reference point and projection timeframe	Alternative catch projections (relative to the average catch level from 2012–14, 29,164 t) and probability (%) of violating MSY-based reference points								
	60%	**70%**	**80%**	**90%**	**100%**	**110%**	**120%**	**130%**	**140%**
	17,498 t	20,415 t	23,331 t	26,248 t	29,164 t	32,080 t	34,997 t	37,913 t	40,830 t
$B_{2017}<B_{MSY}$	10	15	20	25	30	35	41	47	53
$F_{2017}>F_{MSY}$	16	27	38	49	61	72	83	94	99
$B_{2024}<B_{MSY}$	6	16	28	41	55	68	81	91	97
$F_{2024}>F_{MSY}$	12	23	36	52	68	84	97	100	100

APPENDIX XVII
EXECUTIVE SUMMARY: BULLET TUNA

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



Status of the Indian Ocean bullet tuna (BLT: *Auxis rochei*) resource

TABLE 1. Bullet tuna: Status of bullet tuna (*Auxis rochei*) in the Indian Ocean.

Area[1]	Indicators		2017 stock status determination
Indian Ocean	Catch 2016[2]: Average catch 2012–2016:	8,900 t 9,099 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): $F_{current}/F_{MSY}$ (80% CI): $B_{current}/B_{MSY}$ (80% CI): $B_{current}/B_0$ (80% CI):	unknown unknown unknown unknown unknown unknown	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 85%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.

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		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No quantitative stock assessment is currently available for bullet tuna in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock status indicators can be used. Aspects of the fisheries for bullet tuna combined with the lack of data on which to base an assessment of the stock are a cause for concern. Stock status in relation to the Commission's B_{MSY} and F_{MSY} reference points remains unknown (Table 1).

Outlook. Total annual catches for bullet tuna over the past six years have fluctuated but remained around 9,000 t (Fig.1). There is insufficient information to evaluate the effect that these levels of catches, or an increase in catches, may have on the resource. Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered of high priority for the Commission.

Management advice.

For assessed species of neritic tunas in Indian Ocean (longtail tuna, kawakawa and narrow barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011. Therefore, in the absence of a stock assessment of bullet tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (8,870 t). The reference period (2009-2011) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available under the assumption that also for bullet tuna MSY was reached between 2009 and 2011. This catch advice should be maintained until an assessment of bullet tuna is available. Considering that MSY-based reference points for assessed species can change over time, 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 requirements, so as to better inform scientific advice.

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean stock is unknown.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, where they are believed to be gaps, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered a high priority for the Commission.
- Species identification, data collection and reporting urgently need to be improved.
- There is limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2016 catches, 85% of the total catches were either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs need to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2012–16)**: bullet tuna is mainly caught using gillnets (≈31%, handlines and trolling (≈22%). This species is also an important catch for coastal purse seiners (Fig. 1).
- **Main fleets (average catches 2012–16)**: Catches are highly concentrated: in recent years over 90% of catches in the Indian Ocean have been accounted for by fisheries in Sri Lanka, Indonesia and India

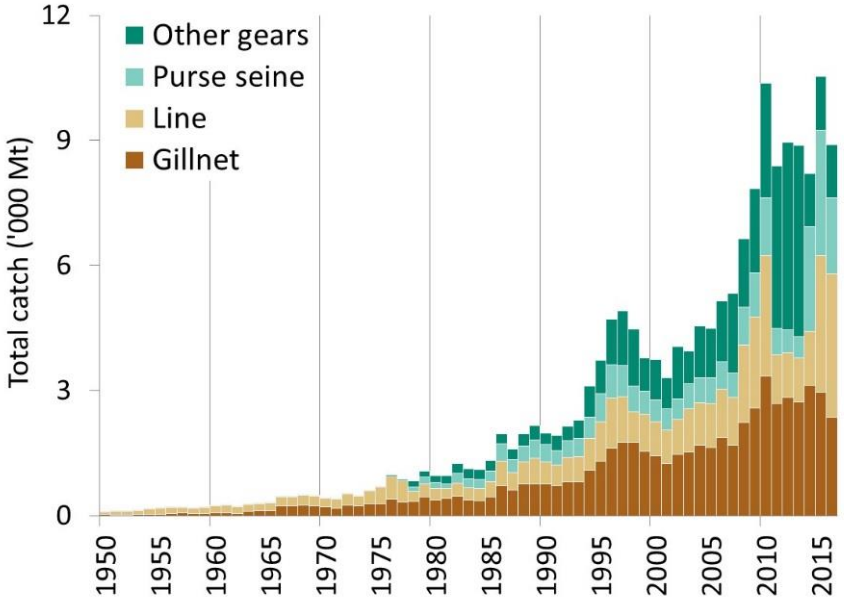
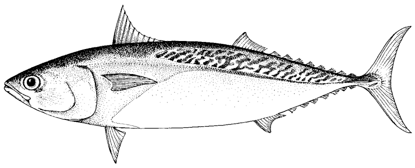


Fig. 1. Bullet tuna: Annual catches of bullet tuna by gear recorded in the IOTC Database (1950–2016)[12].

[12] **Definition of fisheries: Gillnet:** gillnet, including offshore gillnet; **Line:** coastal longline, hand line, troll line; **Purse seine:** coastal purse seine, purse seine, ring net; **Other gears**: baitboat, Danish seine, liftnet, longline, longline fresh, trawling.

APPENDIX XVIII
EXECUTIVE SUMMARY: FRIGATE TUNA

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



Status of the Indian Ocean frigate tuna (FRI: *Auxis thazard*) resource

TABLE 1. Frigate tuna: Status of frigate tuna (*Auxis thazard*) in the Indian Ocean.

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2016[2]: Average catch 2012–2016:	83,300 t 91,844 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): $F_{current}/F_{MSY}$ (80% CI): $B_{current}/B_{MSY}$ (80% CI): $B_{current}/B_0$ (80% CI):	unknown unknown unknown unknown unknown unknown	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 77%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.

Colour key	Stock overfished(SB_{year}/SB_{MSY}< 1)	Stock not overfished (SB_{year}/SB_{MSY}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)		
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No quantitative stock assessment is currently available for frigate tuna in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock status indicators can be used. Aspects of the fisheries for frigate tuna combined with the lack of data on which to base an assessment of the stock are a cause for considerable concern. Stock status in relation to the Commission's B_{MSY} and F_{MSY} reference points remains **unknown** (Table 1).

Outlook. Total annual catches for frigate tuna have increased substantially in recent years with peak catches taken in 2010 (~100,000 t) which have been maintained at that level until 2014 (Fig.1). There is insufficient information to evaluate the effect that this level of catch or a further increase in catches may have on the resource. Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered of high priority for the Commission.

Management advice. For assessed species of neritic tunas in Indian Ocean (longtail tuna, kawakawa and narrow barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both F_{MSY} and B_{MSY} were breached thereafter. Therefore, in the absence of a stock assessment of frigate tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (94,921 t). The reference period (2009-2011) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available under the assumption that also for frigate tuna MSY was reached between 2009 and 2011. This catch advice should be maintained until an assessment of frigate tuna is available. Considering that MSY-based reference points for assessed species can change over time, 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 requirements, so as to better inform scientific advice.

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean stock is unknown.

- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.
- Further work is needed to improve the reliability of the catch series, such as verification or estimation based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered of high priority for the Commission.
- Species identification, data collection and reporting urgently need to be improved.
- There is limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2016 catches, 77% of the total catches were either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs need to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2012–16)**: frigate tuna is mainly caught using gillnets (≈34%), coastal longline and trolling, handlines and trolling (≈38%), and to a lesser extent coastal purse seine nets (Table 3; Fig.12). The species is also a bycatch for industrial purse seine vessels and is the target of some ring net fisheries.
- **Main fleets (average catches 2012–16)**: Catches of frigate tuna are highly concentrated: Indonesia accounts for around two-thirds of catches, while over 90% of catches are accounted for by four countries (Indonesia, India, Sri Lanka and I.R. Iran).

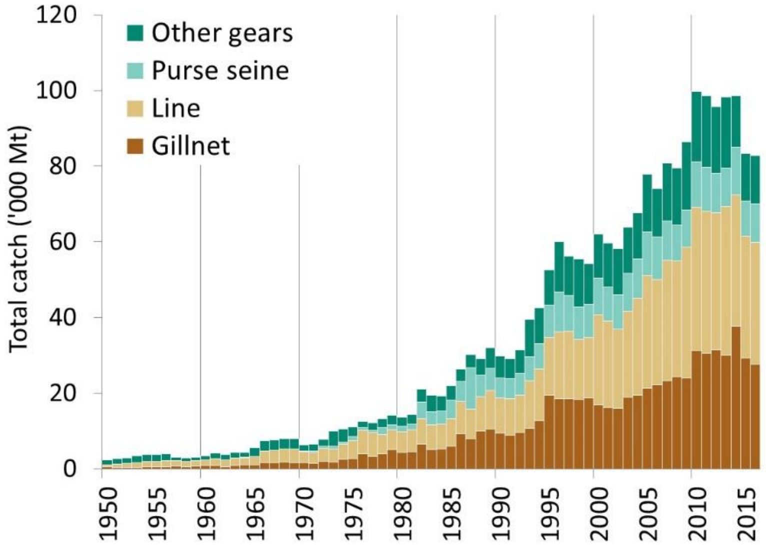
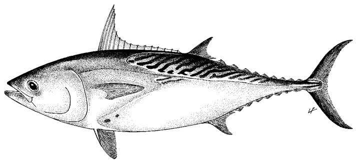


Fig. 1. Frigate tuna: Annual catches of frigate tuna by gear recorded in the IOTC Database (1950–2016)[13].

[13] **Definition of fishery: Gillnet:** gillnet, including offshore gillnet; Line: coastal longline, hand line, troll line; **Purse seine:** coastal purse seine, purse seine, ring net; **Other gears:** baitboat, Danish seine, liftnet, longline, longline fresh, trawling.

APPENDIX XIX
EXECUTIVE SUMMARY: KAWAKAWA

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



Status of the Indian Ocean Kawakawa (KAW: *Euthynnus affinis*) resource

TABLE 1. Kawakawa: Status of kawakawa (*Euthynnus affinis*) in the Indian Ocean.

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2016[2]: Average catch 2012-2016:	156,831 t 158,990 t	(green)
	MSY (1,000 t) [*] F_{MSY} [*] B_{MSY} (1,000 t) [*] F_{2013}/F_{MSY} [*] B_{2013}/B_{MSY} [*] B_{2013}/B_0 [*]	152 [125 –188] 0.56 [0.42–0.69] 202 [151–315] 0.98 [0.85–1.11] 1.15 [0.97–1.38] 0.58 [0.33–0.86]	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 63%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.
*Range of plausible values of biologically realistic OCOM model realizations (see IOTC-2015-WPNT05-R)

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A stock assessment was not undertaken for kawakawa in 2017 and the status is determined on the basis of the 2015 assessment, which used catch data from 1950 to 2013. Analysis using an Optimised Catch Only Method (OCOM) approach in 2015 indicates that the stock is near optimal levels of F_{MSY}, and stock biomass is near the level that would produce MSY (B_{MSY}). Due to the quality of the data being used, the simple modelling approach employed in 2015, and the large increase in kawakawa catches over the last decade (Fig. 1), measures need to be taken in order to decrease the level of catches which surpassed the estimated MSY levels since 2011. Catches between 2014 and 2016 are lower than those estimated in 2013. Based on the weight-of-evidence available, the kawakawa stock for the Indian Ocean is classified as **not overfished** and **not subject to overfishing** (Table 1, Fig. 2).

Outlook. There is considerable uncertainty about stock structure and the estimate of total catches. Due to the uncertainty associated with catch data (e.g.,63% of catches partially or fully estimated by the IOTC Secretariat in 2016) and the limited number of CPUE series available for fleets representing a small proportion of total catches, only data poor assessment approaches can currently be used. Aspects of the fisheries for this species, combined with the lack of data on which to base a more complex assessment (e.g. integrated models) are a cause for considerable concern. In the interim, until more traditional approaches are developed, data-poor approaches will be used to assess stock status. The continued increase in annual catches for kawakawa is likely to have further increased the pressure on the Indian Ocean stock. Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered a high priority for the Commission. There is a high risk of exceeding MSY-based reference points if catches are maintained at 2013 levels (96% risk that $B_{2016}<B_{MSY}$, and 100% risk that $F_{2016}>F_{MSY}$) (Table 2).

Management Advice. Although the stock status is classified as not overfished and not subject to overfishing, the Kobe strategy II matrix developed in 2015 showed that there is a 96% probability that biomass is below MSY levels and 100%

probability that $F>F_{MSY}$ by 2016 and 2023 if catches are maintained at the 2013 levels. There is a 55 % probability that biomass is below MSY levels and 91 % probability that $F>F_{MSY}$ by 2023 if catches are maintained at around 2016 levels. The modelled probabilities of the stock achieving levels consistent with the MSY reference points (e.g. $SB > SB_{MSY}$ and $F<F_{MSY}$) in 2023 are 100% for a future constant catch at 80% of 2013 catch levels. If catches are reduced by 20% based on 2013 levels at the time of the assessment (170,181 t)[14], the stock is expected to recover to levels above MSY reference points with a 50% probability by 2023.

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean is estimated to be 152,000 with a range between 125,000 and 188,000 t and so catch levels should be reduced in future to prevent the stock becoming overfished.
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, where they are believed to be gaps, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Improvement in data collection and reporting is required if the stock is to be assessed using integrated stock assessment models.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate
- Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered of high priority for the Commission.
- Given the limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status, the IOTC Secretariat was required to estimate 63% of the catches (in 2016), which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs need to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2012–16)**: Kawakawa are caught mainly by gillnets (≈51%), handlines and trolling (≈18%), and coastal purse seiners, may be also an important bycatch of the industrial purse seiners (Fig. 1).
- **Main fleets (average catches 2012–16)**: Catches are highly concentrated: Indonesia, India, and I.R. Iran account for over two thirds of catches in recent years.

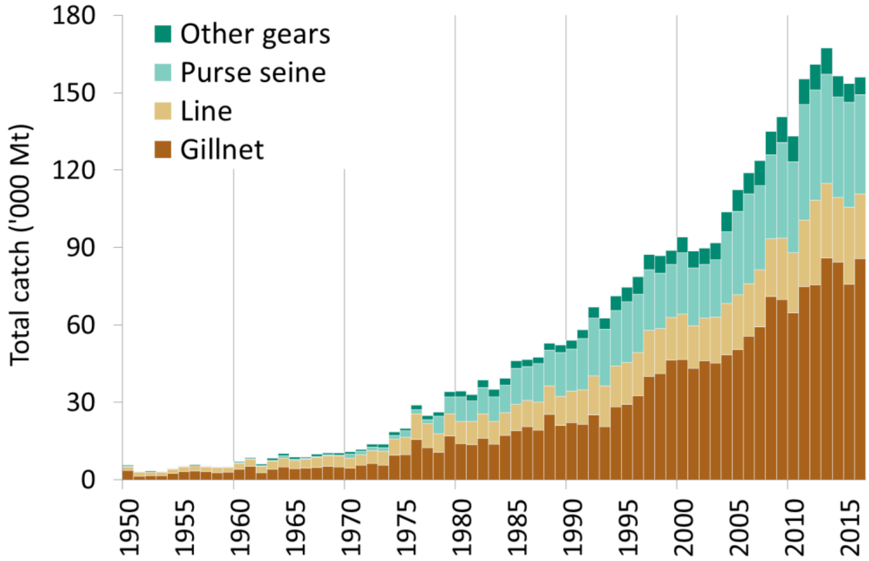


Fig.1. Kawakawa: Annual catches of kawakawa by gear recorded in the IOTC database (1950–2016)[15].

[14] as estimated in 2015

[15] **Definition of fishery: Gillnet:** gillnet, including offshore gillnet; **Line:** coastal longline, hand line, troll line; **Purse seine:** coastal purse seine, purse seine, ring net; **Other gears:** baitboat, Danish seine, liftnet, longline, longline fresh, trawling.

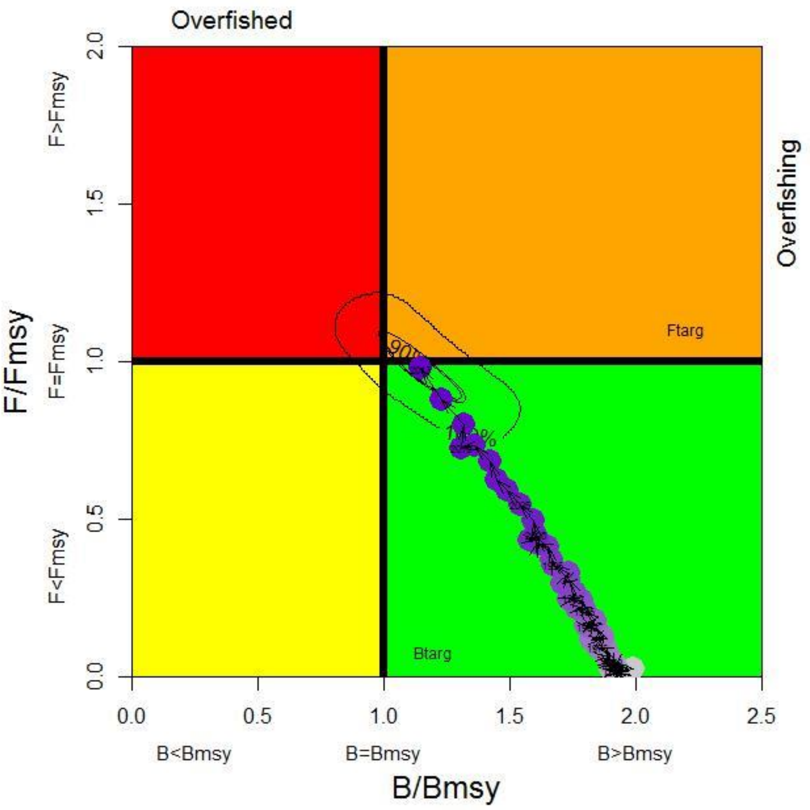


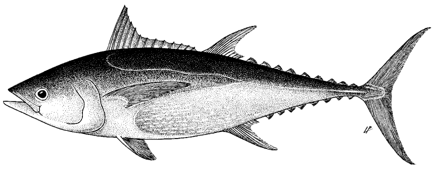
Fig.2. Kawakawa. OCOM aggregated Indian Ocean assessment. Blue circles indicate the trajectory of the point estimates for the B ratio and F ratio for each year between 1950 and 2013 (the black lines represent all plausible model runs shown around 2015 estimate).

Table 2. Kawakawa: OCOM Aggregated Indian Ocean assessment Kobe II Management Strategy Matrix. Probability (percentage) of plausible models violating the MSY-based reference points for five constant catch projections (2013 catch level, -10%, -20%, -30%, +10% and +20%) projected for 3 and 10 years. Note: from the 2015 stock assessment using catch estimates (i.e. 1950-2013) at that time.

Reference point and projection timeframe	Alternative catch projections (relative to 2013) and weighted probability (%) scenarios that violate MSY-based reference point					
	70% (119,126 t)	**80%** (136,144 t)	**90%** (153,162 t)	**100%** (170,181 t)	**110%** (187,199 t)	**120%** (204,216 t)
$B_{2016} < B_{MSY}$	0	1	37	96	n.a.	100
$F_{2016} > F_{MSY}$	0	18	87	100	100	100
$B_{2023} < B_{MSY}$	0	0	55	100	100	100
$F_{2023} > F_{MSY}$	0	0	91	100	100	100

APPENDIX XX
EXECUTIVE SUMMARY: LONGTAIL TUNA

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



Status of the Indian Ocean longtail tuna (LOT: *Thunnus tonggol*) resource

TABLE 1. Longtail tuna: Status of longtail tuna (*Thunnus tonggol*) in the Indian Ocean.

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2016[2]: Average catch 2012–2016:	133,334 t 149,224 t	**67%**
	MSY (1,000 t) (*): F_{MSY} (*): B_{MSY} (1,000 t) (*): F_{2015}/F_{MSY} (*): B_{2015}/B_{MSY} (*): B_{2015}/B_0 (*):	140 (103–184) 0.43 (0.28–0.69) 319 (200–623) 1.04 (0.84–1.46) 0.94 (0.68–1.16) 0.48 (0.34–0.59)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catches estimated or partially estimated by IOTC Secretariat in 2016: 40%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.
*Range of plausible values of biologically realistic OCOM model realizations (IOTC-2017-WPNT07-R)

Colour key	Stock overfished(SB_{year}/SB_{MSY}< 1)	Stock not overfished (SB_{year}/SB_{MSY}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)	67%	0%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	6%	27%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. Analysis using the Optimised Catch-Only Method (OCOM) indicates that the stock is being exploited at a rate that exceeded F_{MSY} in recent years and the stock appears to be below B_{MSY} and above F_{MSY} (67% of plausible models runs) (Fig. 2). Catches were above MSY between 2010 and 2014, however catches have decreased between 2012 and 2016 from 175,459 to 133,334 t (Fig. 1) and were below estimated MSY in 2015 and 2016. The F_{2015}/F_{MSY} ratio is slightly lower than previous estimates, reflecting the decrease in catches reported in the last few years. Nevertheless, the estimate of the B_{2015}/B_{MSY} ratio (0.94) was also slightly lower than in previous years. An assessment using the revised Catch-MSY method was also undertaken in 2017 and results were consistent with OCOM in terms of status. Therefore, based on the weight-of-evidence currently available, the stock is considered to be both **overfished** and **subject to overfishing** (Table 1; Fig. 2).

Outlook. There remains considerable uncertainty about stock structure and the total catches in the Indian Ocean. The increase in annual catches to a peak in 2012 increased the pressure on the longtail tuna Indian Ocean stock, although the catch trend has reversed since then. As noted in 2015, the apparent fidelity of longtail tuna to particular areas/regions is a matter for concern as overfishing in these areas can lead to localised depletion. Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered a high priority for the Commission.

Management advice. There is a substantial risk of exceeding MSY-based reference points by 2018 if catches are maintained at current (2015) levels (63% risk that B_{2018}<B_{MSY}, and 55% risk that F_{2018}>F_{MSY}) (Table 2). If catches are reduced by 10% this risk is lowered to 33% probability B_{2018}<B_{MSY} and 28% probability F_{2018}>F_{MSY}). If catches are capped at current (2015) levels at the time of the assessment (i.e. 136,849 t), the stock is expected to recover to levels above MSY reference points with at least a 50% probability by 2025.

The following should be also noted:

- The Maximum Sustainable Yield estimate of around 140,000 t was exceeded between 2010 and 2014. Limits to catches are warranted to recover the stock to the B_{MSY} level.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, where they are believed to be gaps, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Improvements in data collection and reporting are required if the stock is to be assessed using integrated stock assessment models.
- Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets (I.R.Iran, Indonesia, Pakistan, India and Oman), size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered a high priority for the Commission.
- There is limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2016 catches, 40% of the total catches were either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs need to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2012–16)**: Longtail tuna are caught mainly using gillnets and, to a lesser extent, coastal purse seine nets and trolling (Fig. 1).
- **Main fleets (average catches 2012–16)**: Over 40% of the catches of longtail in the Indian Ocean are accounted for by I.R. Iran, followed by Indonesia (≈20%), and Pakistan (≈19%).

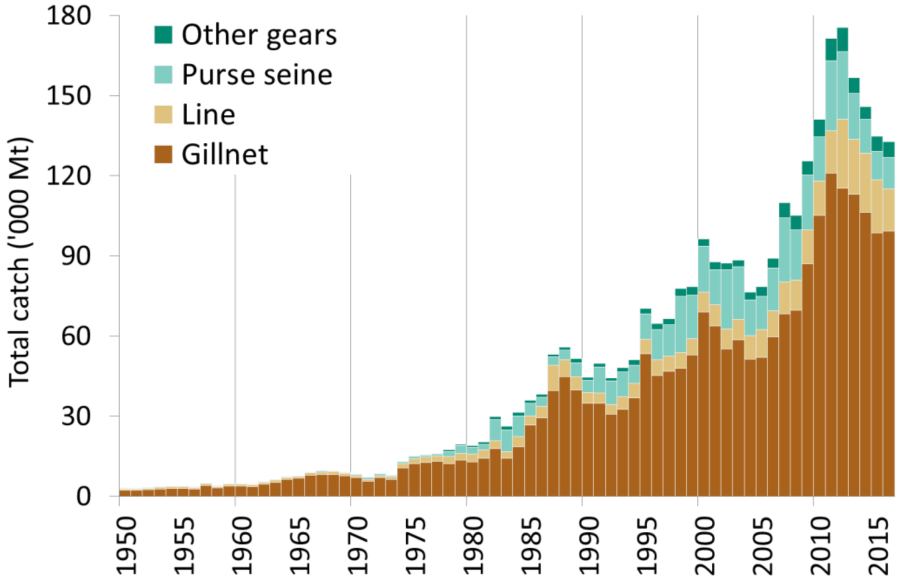


Fig. 1. Longtail tuna: Annual catches by gear recorded in the IOTC Database (1950–2016)[16].

[16] **Definition of fishery: Gillnet:** gillnet, including offshore gillnet; **Line:** coastal longline, hand line, troll line; **Purse seine:** coastal purse seine, purse seine, ring net; **Other gears:** baitboat, danish seine, liftnet, longline, longline fresh, trawling.

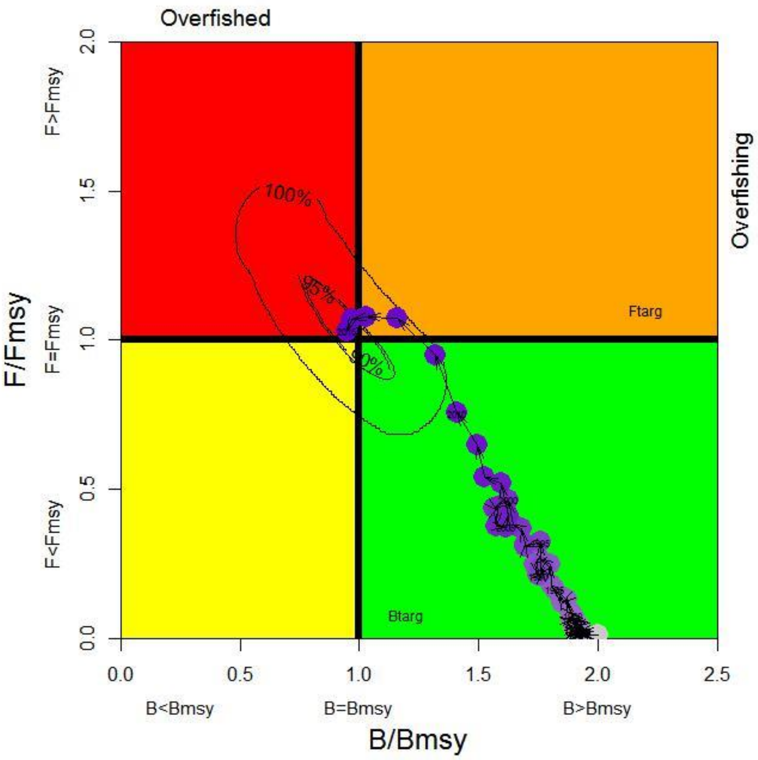


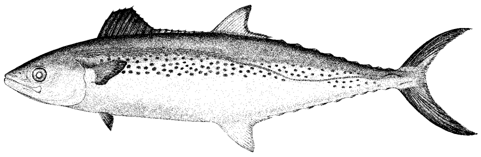
Fig. 2. Longtail tuna. OCOM Indian Ocean assessment Kobe plot. Blue circles indicate the trajectory of the point estimates for the B ratio and F ratio for each year between 1950 and 2015 (the black lines represent all plausible model runs shown around 2015 estimate).

Table 2. Longtail tuna: OCOM aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based reference points for constant catch projections (2015 +20%,+10%, -10%, - 20%, -30% projected for 3 and 10 years). Note: from the 2017 stock assessment using catch estimates (i.e. 1950-2015) at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2015) and weighted probability (%) scenarios that violate MSY-based reference points**					
	70 % (95,794 t)	80% (109,479 t)	90% (123,164 t)	100% (136,849 t)	110% (150,534 t)	120% (164,219 t)
$B_{2018} < B_{MSY}$	4	9	33	63	92	99
$F_{2018} > F_{MSY}$	2	7	28	55	86	98
$B_{2025} < B_{MSY}$	0	0	1	48	100	100
$F_{2025} > F_{MSY}$	0	0	1	41	100	100

APPENDIX XXI
EXECUTIVE SUMMARY: INDO-PACIFIC KING MACKEREL

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



Status of the Indian Ocean Indo-Pacific king mackerel (GUT: *Scomberomorus guttatus*) resource

TABLE 1. Indo-Pacific king mackerel: Status of Indo-Pacific king mackerel (*Scomberomorus guttatus*) in the Indian Ocean.

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2016[2]: Average catch 2012-2016:	45,978 t 45,819 t	
	MSY (1,000 t): F_{MSY}: B_{MSY} (1,000 t) : $F_{current}/F_{MSY}$: $B_{current}/B_{MSY}$: $B_{current}/B_0$:	Unknown Unknown Unknown Unknown Unknown Unknown	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 41%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.

Colour key	Stock overfished(SB_{year}/SB_{MSY}< 1)	Stock not overfished (SB_{year}/SB_{MSY}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)		
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A preliminary assessment was undertaken for Indo-Pacific king mackerel using catch-only methods techniques (Catch-MSY and OCOM) in 2016. The OCOM model, which was considered the more robust of the two catch-only models in terms of assumptions and treatment of priors, indicated that overfishing was not occurring and the stock was not overfished. The continuing uncertainty in catches (41% estimated) for this species, coupled with the highly variable and uncertain estimates of growth parameters used to estimate model priors, warrant caution in interpreting model results for Indo-Pacific king mackerel. Given that no new assessment was undertaken in 2017, the WPNT considered that stock status in relation to the Commission's B_{MSY} and F_{MSY} target reference points remains **unknown** (Table1).

Outlook. Total annual catches for Indo-Pacific king mackerel increased between 2012 and 2014 from 42,000 t to 48,000 t, however they decreased to ~46,000 t since 2015. There is considerable uncertainty about stock structure and total catches. Aspects of the fisheries for this species, combined with the limited data on which to base a more complex assessment (e.g. integrated models), are a cause for concern. Although data-poor methods are yet to be used to provide stock status advice, further refinements to the catch-only methods and application of additional data-poor approaches may improve confidence in the results. Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered a high priority for the Commission.

Management advice. For assessed species of neritic tunas in Indian Ocean (longtail tuna, kawakawa and narrow barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both F_{MSY} and B_{MSY} were breached thereafter. Therefore, in the absence of a stock assessment of Indo-Pacific king mackerel a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (46,787 t). The reference period (2009-2011) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available under the assumption that also for Indo-Pacific king mackerel MSY was reached between 2009 and 2011. This catch advice should be maintained until an assessment of Indo-Pacific king mackerel is available. Considering that MSY-based reference points for assessed species can change over time, 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 requirements, so as to better inform scientific advice.

The following should be also noted:

- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.
- Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered of high priority for the Commission.
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, where they are believed to be gaps, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Data collection and reporting urgently need to be improved.
- Given the limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2016 catches 41% of the total catches were either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs need to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2012–16)**: Indo-Pacific King mackerel are caught mainly by gillnets (≈66%), however significant numbers are also caught trolling (Fig. 1).
- **Main fleets (average catches 2012–16)**: Almost two-thirds of catches are accounted for by fisheries in India and Indonesia; with important catches also reported by I.R. Iran.

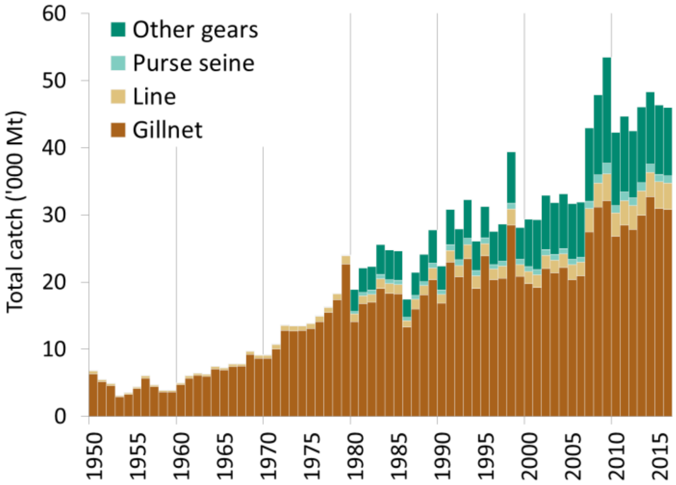
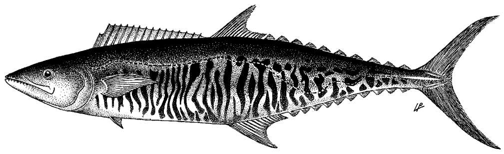


Fig. 1. Indo-Pacific king mackerel: Annual catches of Indo-Pacific king mackerel by gear recorded in the IOTC database (1950–2016)[17].

[17] **Definition of fishery: Gillnet:** gillnet, including offshore gillnet; **Line:** coastal longline, hand line, troll line; **Purse seine:** coastal purse seine, purse seine, ring net; **Other gears:** baitboat, Danish seine, liftnet, longline, longline fresh, trawling.

APPENDIX XXII
EXECUTIVE SUMMARY: NARROW-BARRED SPANISH MACKEREL

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



Status of the Indian Ocean narrow-barred Spanish mackerel (COM: *Scomberomorus commerson*) resource

TABLE 1. Narrow-barred Spanish mackerel: Status of narrow-barred Spanish mackerel (*Scomberomorus commerson*) in the Indian Ocean.

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2016[2]: Average catch 2012-2016:	168,350 t 161,951 t	**89%**
	MSY (1,000 t) [*]: F_{MSY} [*]: B_{MSY} (1,000 t) [*]: F_{2015}/F_{MSY} [*]: B_{2015} B_{MSY} [*]: B_{2015}/B_0 [*]:	131 [96–180] 0.35 [0.18–0.7] 371 [187–882] 1.28 [1.03–1.69] 0.89 [0.63–1.15] 0.44 [0.31–0.57]	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2016: 75%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.
*Range of plausible values of biologically realistic OCOM model realizations (IOTC-2017-WPNT07-R)

Colour key	Stock overfished(SB_{year}/SB_{MSY}< 1)	Stock not overfished (SB_{year}/SB_{MSY}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)	89%	11%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	0%	0%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. Analysis using the Optimised Catch-Only Method (OCOM) indicates that the stock is being exploited at a rate exceeding F_{MSY} in recent years, and the stock appears to be below B_{MSY}. An analysis undertaken in 2013 in the Northwest Indian Ocean (Gulf of Oman) indicated that overfishing is occurring in this area and that localised depletion may also be occurring[18], though the degree of connectivity of the stock remains unknown. Stock structure remains to be clarified for this stock. Based on the weight-of-evidence available, the stock appears to be **overfished** and **subject to overfishing** (Table 1, Fig. 2). Catches since 2009 and also recent average catches (2012-2016) are well above the current MSY estimate (131,000 t) (Fig. 1).

Outlook. There is considerable uncertainty about stock structure and the estimate of total catches. The continue increase in annual catches in recent years has further increased the pressure on the Indian Ocean narrow-barred Spanish mackerel stock. The apparent fidelity of narrow-barred Spanish mackerel to particular areas/regions is a matter for concern as overfishing in these areas can lead to localised depletion. Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered of high priority for the Commission. There is a very high risk of exceeding MSY-based reference points by 2018 and 2025 if catches are maintained at or even reduced by 10 % from current (2015) levels at the time of the assessment (100% risk that B_{2018}<B_{MSY}, and 100% risk that F_{2018}>F_{MSY}) (Table 2).

[18] IOTC-2013-WPNT03-27

Management advice. There is a continued high risk of exceeding MSY-based reference points by 2025, even if catches are reduced to 80% of the 2015 levels (73% risk that $B_{2025}<B_{MSY}$, and 99% risk that $F_{2025}>F_{MSY}$). The modelled probabilities of the stock achieving levels consistent with the MSY reference levels (e.g. $B > B_{MSY}$ and $F<F_{MSY}$) in 2025 are 93% and 70%, respectively, for a future constant catch at 70% of current catch level. If catches are reduced by 30% of the 2015 levels at the time of the assessment, which corresponds to catches below MSY, the stock is expected to recover to levels above the MSY reference points with at least a 50% probability by 2025 (Table 2).

The following should also be noted:

- Maximum Sustainable Yield estimate for the Indian Ocean stock was estimated at 131,000, while 2016 catches (168,350 t) are exceeding this level.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, where they are believed to be gaps, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Improvement in data collection and reporting is required if the stock is to be assessed using integrated stock assessment models.
- Given the increase in narrow-barred Spanish mackerel catch in the last decade, measures need to be taken to reduce catches in the Indian Ocean (Table 2).
- Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered of high priority for the Commission.
- There is a lack of information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2016 catches 75% of the total catches were either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs need to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2012–16)**: Narrow-barred Spanish mackerel are caught mainly using gillnet, however significant numbers are also caught using troll lines (Fig. 1).
- **Main fleets (average catches 2012–16)**: Fisheries in Indonesia, India, and I.R. Iran account for around two-thirds of catches. Spanish mackerel is also targeted throughout the Indian Ocean by artisanal and sports/recreational fisheries.

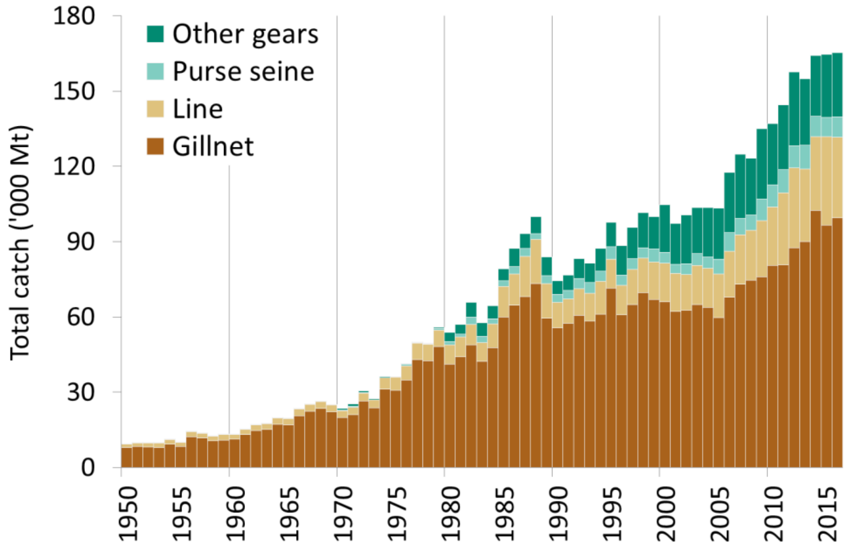


Fig. 1. Narrow-barred Spanish mackerel: Annual catches of narrow-barred Spanish mackerel by gear recorded in the IOTC database (1950–2016)[19].

[19] **Definition of fishery: Gillnet:** gillnet, including offshore gillnet; **Line:** coastal longline, hand line, troll line; **Purse seine:** coastal purse seine, purse seine, ring net; **Other gears:** baitboat, Danish seine, liftnet, longline, longline fresh, trawling.

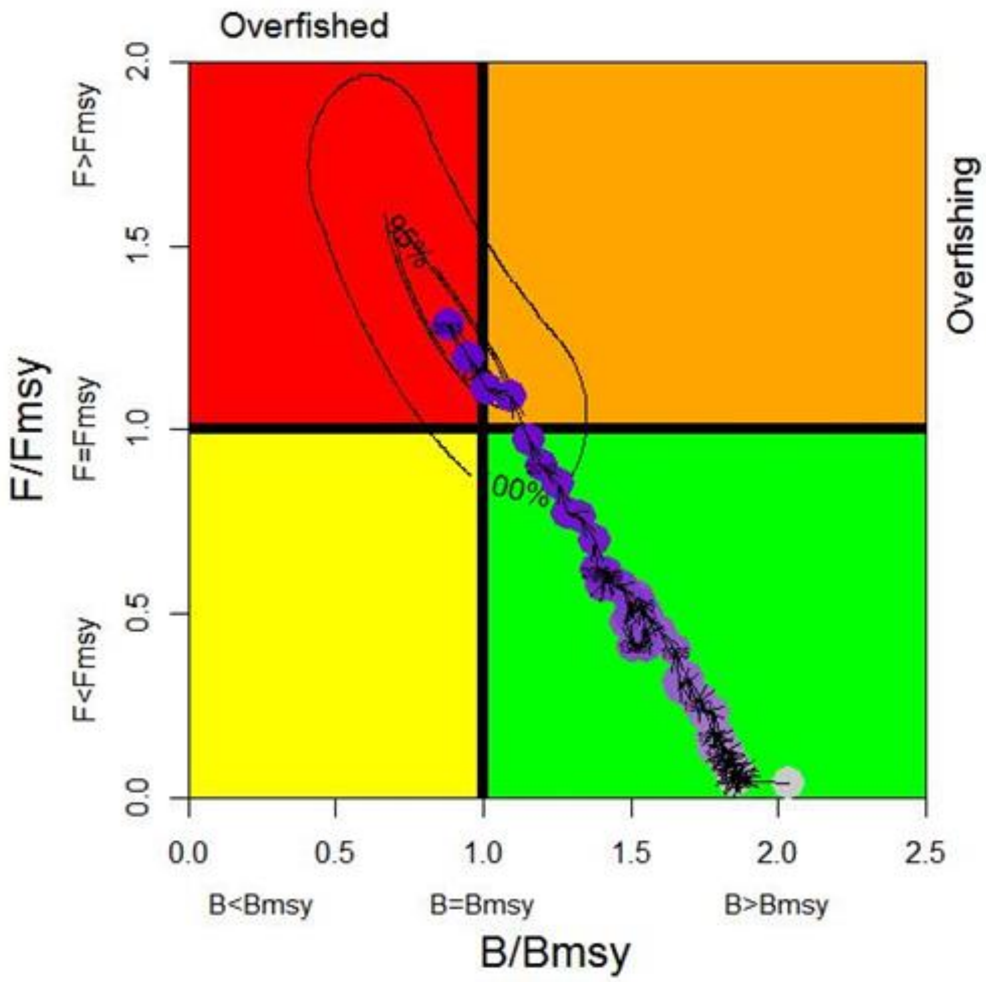


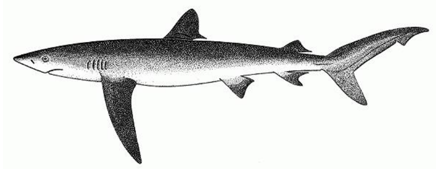
Fig. 2. Narrow-barred Spanish mackerel. OCOM Indian Ocean assessment Kobe plot. Blue circles indicate the trajectory of the point estimates for the B ratio and F ratio for each year between 1950 and 2015 (the black lines represent all plausible model runs shown around 2015 estimate).

Table 2. Narrow-barred Spanish mackerel: OCOM Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based reference points for five constant catch projections (2015 catch level, -10%, -20%, -30%, +10% and + 20%) projected for 3 and 10 years. Note: Results are from the 2017 assessment using data up to 2015, available at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2015) and weighted probability (%) scenarios that violate MSY-based reference point**					
	70% (107,924 t)	**80%** (123,342 t)	**90%** (138,759 t)	**100%** (154,177 t)	**110%** (169,595 t)	**120%** (185,012 t)
$B_{2018} < B_{MSY}$	71	90	99	100	100	100
$F_{2018} > F_{MSY}$	100	100	100	100	100	100
$B_{2025} < B_{MSY}$	7	73	100	100	100	100
$F_{2025} > F_{MSY}$	30	99	100	100	100	100

APPENDIX XXIII
EXECUTIVE SUMMARY: BLUE SHARK

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



Status of the Indian Ocean blue shark (BSH: *Prionace glauca*)

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

Area[20]	**Indicators**		**2017 stock status determination**
Indian Ocean	Reported catch 2016:	32,312 t	**72.6%**
	Estimated catch 2015:	54,735 t	
	Not elsewhere included (nei) sharks[21] 2016:	54,495 t	
	Average reported catch 2012-16:	30,563 t	
	Average estimated catch 2011–15	54,993 t	
	Ave. not elsewhere included (nei) sharks[2] 2012-16:	49,152 t	
	MSY (1,000 t) (80% CI)[3]:	33.0 (29.5 - 36.6)	
	F_{MSY} (80% CI)[3]:	0.30 (0.30 - 0.31)	
	SB_{MSY} (1,000 t) (80% CI)[3,4]:	39.7 (35.5 - 45.4)	
	F_{2015}/F_{MSY} (80% CI)[3]:	0.86 (0.67 - 1.09)	
	SB_{2015}/SB_{MSY} (80% CI)[3]:	1.54 (1.37 - 1.72)	
	SB_{2015}/SB_0 (80% CI)[3]:	0.52 (0.46 - 0.56)	

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).
3 Estimates refer to the base case model using estimated catches.
4 Refers to fecund stock biomass

Colour key	Stock overfished ($SB_{year}/SB_{MSY} < 1$)	Stock not overfished ($SSB_{year}/SB_{MSY} \geq 1$)
Stock subject to overfishing ($F_{year}/F_{MSY} > 1$)	0%	27.4%
Stock not subject to overfishing ($F_{year}/F_{MSY} \leq 1$)	0%	72.6%
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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. Considerable progress was made since the last Indian Ocean blue shark assessment on the integration of new data sources and modelling approaches. Uncertainty in data inputs and model configuration were explored through sensitivity analysis. Four stock assessment models were applied to the blue shark in 2017, specifically a data-limited catch only model (SRA), two Bayesian biomass dynamic models (JABBA with process error and a Pella-Tomlinson production model without process error) and an integrated age-structured model (SS3) (Fig. 1). All models produced similar results suggesting the stock is currently not overfished nor subject to overfishing, but with the trajectories showing consistent trends towards the overfished and subject to overfishing quadrant of the Kobe plot (Fig 1). A base case model was selected based on the best Indian Ocean biological data, consistency of CPUE standardized relative abundance series, model fits and spatial extent of the data (Fig. 1, Table 1). The major change in biological parameters since the previous stock assessment is the stock recruitment relationship, i.e., steepness = 0.79 due to the update of the key biological parameters calculated specific to the Indian Ocean. The major axes of uncertainties identified in the current model are catches and CPUE indices of abundance. Model results were explored with respect to their sensitivity to the major axes of uncertainty identified. If the alternative CPUE groupings were used then the stock status was somewhat more positive (B>>Bmsy and F<<Fmsy), while if the alternative catch series (trade and EUPOA) were used then the estimated stock status resulted in F>Fmsy. The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2012[22] 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 live until at least 25 years, mature at 4–6 years, and have 25–50 pups every year and are considered to be the most productive of the pelagic sharks. On the weight-of-evidence available in 2017, the stock status is determined to be not overfished and not subject to overfishing (Table 1).

Outlook. Increasing effort could result in declines in biomass. The Kobe II Strategy Matrix (Table 3) provides the probability of exceeding reference levels in the short (3 years) and long term (10 years) given a range of percentage changes in catch.

Management advice. Even though the blue shark in 2017 is assessed to be not overfished nor subject to overfishing, maintaining current catches is likely to result in decreasing biomass and the stock becoming overfished and subject to overfishing in the near future (Table 3). If the catches are reduced at least 10%, the probability of maintaining stock biomass above MSY reference levels ($B>B_{MSY}$) over the next 8 years will be increased (Table 3). The stock should be closely monitored. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission, so as to better inform scientific advice in the future.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the Indian Ocean stock is 33,000 t.
- **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.

[22] Murua et al., 2012

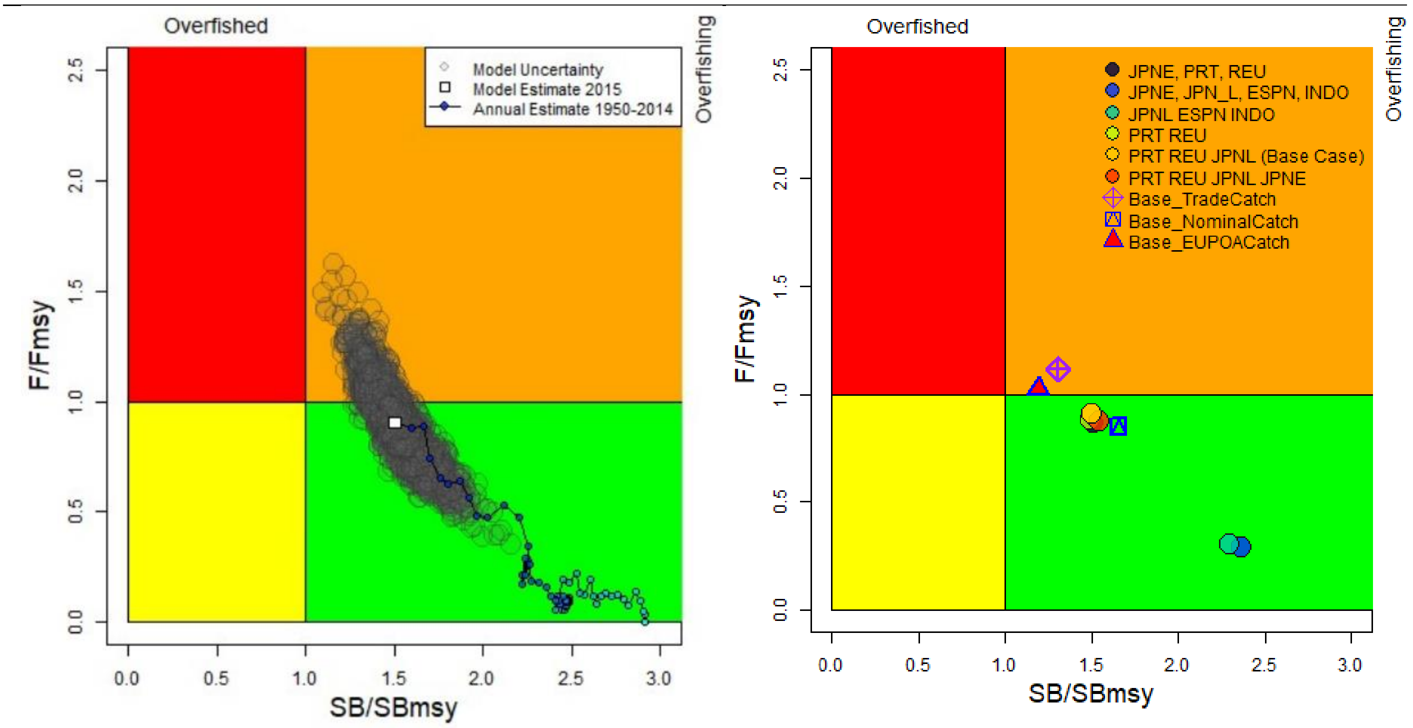


Fig. 1. Blue shark: Aggregated Indian Ocean stock assessment Kobe plot for the 2017 estimate based on the base case model and a range of sensitivity models explored with several catch reconstructions and fits to CPUE series. (Left panel: base case model with trajectory and MCMC uncertainties in the terminal year; Right panel: terminal year estimates of the sensitivity model runs). All models shown are run using SS3 - Stock Synthesis III.

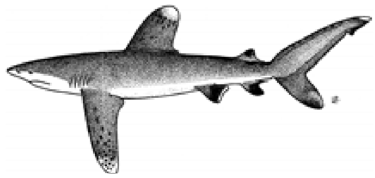
TABLE 3. Blue shark: Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based reference points for nine constant catch projections using the base case model (catch level from 2015* (54,735t), ± 10%, ± 20%, ± 30% and ± 40%) projected for 3 and 10 years.

Reference point and projection time frame	**Alternative catch projections (relative to the catch level* from 2015) and probability (%) of violating MSY-based reference points**								
Catch Relative to 2015	60%	70%	80%	90%	100%	110%	120%	130%	140%
Catch (t)	(32,841)	(38,315)	(43,788)	(49,262)	(54,735)	(60,209)	(65,682)	(71,156)	(76,629)
$B_{2018} < B_{MSY}$	0%	0%	0%	0%	0%	0%	1%	1%	3%
$F_{2018} > F_{MSY}$	0%	1%	7%	25%	49%	69%	83%	91%	95%
$B_{2025} < B_{MSY}$	0%	1%	8%	25%	48%	68%	82%	89%	92%
$F_{2025} > F_{MSY}$	0%	7%	35%	67%	87%	95%	97%	94%	90%

*: average catch level and respective % changes refer to the estimated catch series used in the final base case model (IOTC-2017-WPEB13-23)

APPENDIX XXIV
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		2017 stock status determination
Indian Ocean	Reported catch 2016:	503 t	
	Not elsewhere included (nei) sharks[2] 2016:	54,495 t	
	Average reported catch 2012-2016:	303 t	
	Av. not elsewhere included 2012-2016 (nei) sharks[2]:	49,152 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. 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[23] 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

[23] Murua et al., 2012

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 to the gear. 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 limited amount of data, recent studies (Tolotti et al., 2016) suggest that oceanic whitetip shark abundance has declined in recent years (2000-2015) compared with historic years (1986-1999). Available pelagic longline standardised CPUE indices from Japan and EU,Spain indicate conflicting trends as discussed in the IOTC Supporting Information 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 **unknown** (Table 1).

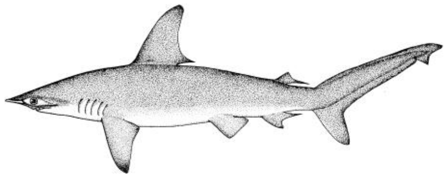
Outlook. Maintaining or increasing effort with associated fishing mortality can result in declines in biomass, productivity and CPUE. Piracy in the western Indian Ocean resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into certain areas in the southern and eastern Indian Ocean. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort on oceanic whitetip sharks declined in the southern and eastern areas, and may have resulted in localised depletion there.

Management advice. A cautious 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. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission, so as to better inform scientific advice. 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.
The following key points should be also noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2012–16): Gillnet; gillnet-longline.
- **Main fleets** (2012-2016): I.R. Iran; Sri Lanka; Comoros, Seychelles, and India; (Reported as discarded/released alive by China, Australia, France, Maldives, Korea, Japan, South Africa).

APPENDIX XXV
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		2017 stock status determination
Indian Ocean	Reported catch 2016: Not elsewhere included (nei) sharks[2]2016: Average reported catch 2012-2016: Av. not elsewhere included (nei) sharks[2] 2012-2016:	77 t 54,495t 69 t 49,152 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}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 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[24] 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 to be 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

[24] Murua et al., 2012

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 **unknown** (Table 1).

Outlook. Maintaining or increasing effort can result in declines in biomass and productivity. 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. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort on scalloped hammerhead shark declined in the southern and eastern areas during this time period, and may have resulted in localised depletion there.

Management advice. Despite the absence of stock assessment information, the Commission should consider taking a cautious approach by implementing some management actions for scalloper hammerhead sharks. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission 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** (2012-2016): Gillnet-longline; longline-gillnet; longline (fresh), longline-coastal, gillnet.
- **Main fleets** (2012–16): Sri Lanka; Seychelles; NEI-Fresh (report as released alive/discarded by EU-France, South Africa, Indonesia)

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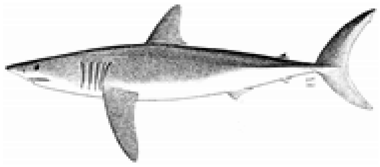
APPENDIX XXVI
EXECUTIVE SUMMARY: SHORTFIN MAKO SHARK

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**		**2017 stock status determination**
Indian Ocean	Reported catch 2016:	1,631 t	
	Not elsewhere included (nei) sharks[2] 2016:	54,495 t	
	Average reported catch 2012-16:	1,503 t	
	Av. not elsewhere included (nei) sharks[2] 2012-16:	49,152 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}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 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[25] 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 has a high susceptibility to longline gear. Shortfin mako sharks were estimated to be the third most vulnerable shark species in the ERA ranking for purse seine gear, but had lower levels of vulnerability than to longline gear, because of the lower susceptibility of the species to 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 (see IOTC Supporting Information). 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.

[25] Murua et al., 2012

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 **unknown**.

Outlook. Maintaining or increasing effort can result in declines in biomass, productivity and CPUE. 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. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort on shortfin mako shark has declined in the southern and eastern areas, and may have resulted in localised depletion there.

Management advice. Despite the absence of stock assessment information, the Commission should consider taking a cautious approach by implementing some management actions for shortfin mako sharks. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission 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** (2012–16): Longline targeting swordfish; longline (deep-freezing); longline (targeting sharks); gillnet.
- **Main fleets** (2012–16): EU,Spain; South Africa; EU,Portugal; Japan, Iran, China (Reported as discarded/released alive: Australia, EU-France, Indonesia, Japan, Korea, South Africa)

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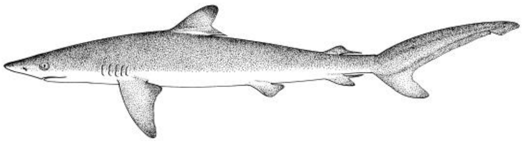
Murua H, Coelho, R., Santos, M.N., Arrizabalaga, H., Yokawa, K., Romanov, E., Zhu, J.F., Kim, Z.G., Back, P., Chavance, P., Delgado de Molina and Ruiz, J. (2012). Preliminary Ecological Risk Assessment (ERA) for shark species caught in fisheries managed by the Indian Ocean Tuna Commission (IOTC). IOTC–2012–SC15–INF10 Rev_1.

APPENDIX XXVII
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		2017 stock status determination
Indian Ocean	Reported catch 2016: Not elsewhere included (nei) sharks[2] 2016: Average reported catch 2012-16: Av. not elsewhere included (nei) sharks[2] 2012-16:	2,189 t 54,495 t 3,278 t 49,152 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): $F_{current}/F_{MSY}$ (80% CI): $SB_{current}/SB_{MSY}$ (80% CI): $SB_{current}/SB_0$ (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}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 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[26] 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 to be one of the least productive shark species, and with a high susceptibility to longline gear. Silky shark was estimated to be the second most vulnerable shark species in the ERA ranking for purse seine gear, due to its low productivity and high susceptibility to purse seine gear. The current IUCN threat status of 'Near Threatened' applies to silky shark in the western and eastern Indian Ocean and globally (Table 2). There is a paucity of information available on this species but several 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–

[26] Murua et al., 2012

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 are described in the IOTC Supporting Information 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 **unknown**.

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. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort on silky shark has declined in the southern and eastern areas, and may have resulted in localised depletion there.

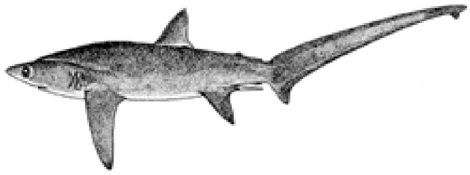
Management advice. Despite the absence of stock assessment information, the Commission should consider taking a cautious approach by implementing some management actions for silky sharks. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission 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** (2012-16): Gillnet; gillnet-longline; longline (fresh); longline-gillnet.
- **Main fleets** (2012-16): Sri Lanka; I.R. Iran; Taiwan,China (reported as discarded/released alive).

APPENDIX XXVIII
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		2017 stock status determination
Indian Ocean	Reported catch 2016: Not elsewhere included (nei) sharks[2] 2016: Average reported catch 2012–16: Av. not elsewhere included (nei) sharks[2] 2012–16:	0 t 54,495t 93 t 49,152 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): $F_{current}/F_{MSY}$ (80% CI): $SB_{current}/SB_{MSY}$ (80% CI): $SB_{current}/SB_0$ (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

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[27] 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 to this particular gear. 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

[27] Murua et al., 2012

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 has been no quantitative stock assessment and limited basic fishery indicators are available for bigeye thresher shark in the Indian Ocean. Therefore the stock status is **unknown**.

Outlook. Current longline fishing effort is directed at other species, however, bigeye thresher sharks are commonly taken as bycatch in these fisheries. Hooking mortality is apparently very high, therefore IOTC Resolution 12/09 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 and a reluctance of fishing fleets to report information on discards/non-retained catch. Piracy in the western Indian Ocean 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. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort on bigeye thresher shark declined in the southern and eastern areas over that time period, potentially resulting in localised depletion.

Management advice. The prohibition on retention of bigeye thresher shark should be maintained. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission, so as to better inform scientific advice. 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[28].

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2012–16): Gillnet-longline; longline-gillnet.
- **Main fleets** (2012–16): Sri Lanka (reported as discarded/released alive).

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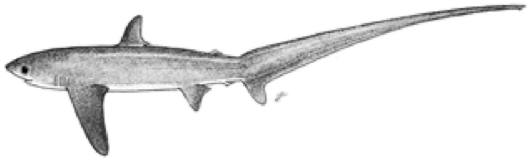
Murua H, Coelho, R., Santos, M.N., Arrizabalaga, H., Yokawa, K., Romanov, E., Zhu, J.F., Kim, Z.G., Back, P., Chavance, P., Delgado de Molina and Ruiz, J. (2012). Preliminary Ecological Risk Assessment (ERA) for shark species caught in fisheries managed by the Indian Ocean Tuna Commission (IOTC). IOTC–2012–SC15–INF10 Rev_1

[28]Scientific observers shall be allowed to collect biological samples from thresher sharks that are dead at haulback, provided that the samples are part of the research project approved by the Scientific Committee (or the Working Party on Ecosystems and Bycatch).

APPENDIX XXIX
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 2016: Not elsewhere included (nei) sharks[2] 2016: Average reported catch 2012-16: Av. not elsewhere included (nei) sharks[2] 2012-16:	0 t 54,495 t 66 t 49,152 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): $F_{current}/F_{MSY}$ (80% CI): $SB_{current}/SB_{MSY}$ (80% CI): $SB_{current}/SB_0$ (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}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 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

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 (Table 1). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2012[29] consisted of a semi-quantitative analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and susceptibility to each fishing gear type. Pelagic thresher shark received a high vulnerability ranking (No. 3) in the ERA 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 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

[29] Murua et al., 2012

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 are currently available for pelagic thresher shark in the Indian Ocean. Therefore the stock status is **unknown.**

Outlook. Current longline fishing effort is directed at other species, however, pelagic thresher sharks are commonly taken as bycatch in these fisheries. Hooking mortality is apparently very high, therefore IOTC Resolution 12/09 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, and a reluctance of fishing fleets to report information on discards/non-retained catch. Piracy in the western Indian Ocean 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. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort on pelagic thresher shark declined in the southern and eastern areas over that time period, potentially resulting in localised depletion there.

Management advice. The prohibition on the retention of pelagic thresher shark should be maintained. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission s, so as to better inform scientific advice. 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[30].

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2012-16): Gillnet-longline; longline-gillnet.
- **Main fleets** (2012-16): Sri Lanka (reported as discarded/released alive).

LITERATURE CITED

Murua H, Coelho, R., Santos, M.N., Arrizabalaga, H., Yokawa, K., Romanov, E., Zhu, J.F., Kim, Z.G., Back, P., Chavance, P., Delgado de Molina and Ruiz, J. (2012). Preliminary Ecological Risk Assessment (ERA) for shark species caught in fisheries managed by the Indian Ocean Tuna Commission (IOTC). IOTC–2012–SC15–INF10 Rev_1.

[30]Scientific observers shall be allowed to collect biological samples from thresher sharks that are dead at haulback, provided that the samples are part of the research project approved by the Scientific Committee (or the Working Party on Ecosystems and Bycatch).

APPENDIX XXX
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[31]
Flatback turtle	*Natator depressus*	Data deficient
Green turtle	*Chelonia mydas*	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Critically Endangered
Leatherback turtle	*Dermochelys coriacea*	
	(N. East Indian Ocean subpopulation)	Data deficient
	(S. West Indian Ocean subpopulation)	Critically Endangered
Loggerhead turtle	*Caretta caretta*	
	(N. West Indian Ocean subpopulation)	Critically Endangered
	(S. East Indian Ocean subpopulation)	Near Threatened
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.

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 relatively recent Ecological Risk Assessment (ERA)[32], and an order of magnitude higher than longline and purse seine gears for which mitigation measures are in place. Stock assessments of all species of marine turtles in the Indian Ocean are limited due to data insufficiencies as well as limited data quality[33]. Bycatch and mortality from gillnet fisheries has greater population-level impacts on marine turtles relative to other gear types, such as longline, purse seine and trawl fisheries in the Indian Ocean[34]. Population levels of impacts of leatherback turtles caught in longline gear in the Southwest Indian Ocean were also identified as a conservation priority.

[31] IUCN, 2017. The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

[32] R. Nel, R.M. Wanless, A. Angel, B. Mellet & L. Harris, 2013. Ecological Risk Assessment and Productivity - Susceptibility Analysis of sea turtles overlapping with fisheries in the IOTC regionIOTC–2013–WPEB09–23

[33] Wallace BP, DiMatteo AD, Bolten AB, Chaloupka MY, Hutchinson BJ, et al. (2011) Global Conservation Priorities for Marine Turtles. PLoS ONE 6(9): e24510. doi:10.1371/journal.pone.0024510

[34] Wallace, B. P., C. Y. Kot, A. D. DiMatteo, T. Lee, L. B. Crowder, and R. L. Lewison. 2013. Impacts of fisheries bycatch on marine turtle populations worldwide: toward conservation and research priorities. Ecosphere 4(3):40. http:// dx.doi.org/10.1890/ES12-00388.1 (figure 13)

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 will increase as fishing pressure increases, and that the status of the marine turtle populations will continue to worsen due to other factors such as an increase in fishing pressure from other fisheries or anthropological or climatic impacts.

The following should also be noted:

- The available evidence indicates considerable risk to marine turtles in the Indian Ocean.
- Given the high mortality rates associated with marine turtle interactions with gillnet fisheries and the increasing use of gillnets in the Indian Ocean[35] there is a need to both assess and mitigate impacts on threatened and endangered marine turtle populations.
- The primary sources of data that drive the ability of the WPEB to determine a status for the Indian Ocean, total interactions by fishing vessels or in net fisheries, are highly uncertain and should be addressed as a matter of priority.
- Current reported interactions are known to be a severe underestimate.
- The Ecological Risk Assessment[32] estimated that ~3,500 and ~250 marine turtles are caught by longline and purse seine vessels, respectively, per annum, with an estimated 75% of turtles released alive[36]. The ERA[32] 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, leatherback and olive Ridley turtles are caught in varying proportions depending on the region, season and type of fishing gear.
- Maintaining or increasing fishing effort in the Indian Ocean without appropriate mitigation measures in place, will likely result in further declines in marine turtle populations.
- Efforts should be undertaken to encourage CPCs to investigate means to reduce marine turtle bycatch and mortality in IOTC fisheries.
- That appropriate mechanisms are developed by the Compliance Committee to ensure CPCs comply with their data collection and reporting requirements for marine turtles.

[35] IOTC-2017-WPEB13-18

[36] Bourjea et al. 2014

APPENDIX XXXI
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[37]
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 received seabird bycatch data from 6 CPCs, out of the 15 with reported or expected longline effort South of 25ºS[38]. Due to the lack of data submissions from other CPCs, and the limited information provided on the use of seabird bycatch mitigations, it has not yet been possible to undertake an assessment for seabirds. 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

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

[38] IOTC-2016-SC19-INF02

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.

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 Resolution 12/06 and the frequency of use of each of the 3 measures (because vessels can choose two out of three possible options) are still poorly known. 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. Following the data call in 2016 it was possible to carry out a preliminary and qualitative analysis. The information provided suggests higher sea bird catch rates at higher latitudes, even within the area south of 25°S, and higher catch rates in the coastal areas in the eastern and western parts of the southern Indian Ocean. In terms of mitigation measures, the preliminary information available suggests that those currently in use (Resolution 12/06) may be proving effective in some cases, but there are also some conflicting aspects that need to be explored further. 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 fully address this issue.

The following should also 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 XXXII
EXECUTIVE SUMMARY: CETACEANS

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
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Status of cetaceans in the Indian Ocean

TABLE 1. Cetaceans: IUCN Red List status and records of interaction (including entanglements and, for purse seines, encirclements) with tuna fishery gear types for all cetacean species that occur within the IOTC area of competence.

Family	Common name	Species	IUCN Red List status	Interactions by Gear Type*
Balaenidae	Southern right whale	*Eubalaena australis*	LC	GN
Neobalaenidae	Pygmy right whale	*Caperea marginata*	DD	-
Balaenopteridae	Common minke whale	*Balaenoptera acutorostrata*	LC	-
	Antarctic minke whale	*Balaenoptera bonaerensis*	DD	-
	Sei whale	*Balaenoptera borealis*	EN	PS
	Bryde's whale	*Balaenoptera edeni/brydei*	DD	-
	Blue whale	*Balaenoptera musculus*	EN	-
	Fin whale	*Balaenoptera physalus*	EN	-
	Omura's whale	*Balaenoptera omurai*	DD	-
	Humpback whale	*Megaptera novaeangliae*	LC**	GN
Physeteridae	Sperm whale	*Physeter macrocephalus*	VU	GN
Kogiidae	Pygmy sperm whale	*Kogia breviceps*	DD	GN
	Dwarf sperm whale	*Kogia sima*	DD	GN
Ziphiidae	Arnoux's beaked whale	*Berardius arnuxii*	DD	-
	Southern bottlenose whale	*Hyperoodon planifrons*	LC	-
	Longman's beaked whale	*Indopacetus pacificus*	DD	GN
	Andrew's beaked whale	*Mesoplodon bowdini*	DD	-
	Blainville's beaked whale	*Mesoplodon densirostris*	DD	-
	Gray's beaked whale	*Mesoplodon grayi*	DD	-
	Hector's beaked whale	*Mesoplodon hectori*	DD	-
	Deranigala's beaked whale	*Mesoplodon hotaulata*	NA	-
	Strap-toothed whale	*Mesoplodon layardii*	DD	-
	True's beaked whale	*Mesoplodon mirus*	DD	-
	Spade-toothed whale	*Mesoplodon traversii*	DD	-
	Shepherd's beaked Whale	*Tasmatecus shepherdi*	DD	-
	Cuvier's beaked whale	*Ziphius cavirostris*	LC	GN

Delphinidae	Long-beaked common dolphin	*Delphinus capensis*	DD	GN
	Short-beaked common dolphin	*Delphinus delphis*	LC	GN
	Pygmy killer whale	*Feresa attenuata*	DD	GN
	Short-finned pilot whale	*Globicephala macrorhynchus*	DD	LL, GN
	Long-finned pilot whale	*Globicephala melas*	DD	-
	Risso's dolphin	*Grampus griseus*	LC	LL, GN
	Fraser's dolphin	*Lagenodelphis hosei*	LC	-
	Irrawaddy dolphin	*Orcaella brevirostris*	VU	GN
	Australian snubfin dolphin	*Orcaella heinshoni*	NT	GN
	Killer whale	*Orcinus orca*	DD	LL, GN
	Melon-headed whale	*Peponocephala electra*	LC	LL, GN
	False killer whale	*Pseudorca crassidens*	DD	LL, GN
Delphinidae	Indo-Pacific humpback dolphin	*Sousa chinensis*	VU	GN
	Indian Ocean humpback dolphin	*Sousa plumbea*	EN	GN
	Australian humpback dolphin	*Sousa sahulensis*	VU	GN
	Pantropical spotted dolphin	*Stenella attenuata*	LC	PS, GN, LL
	Striped dolphin	*Stenella coeruleoalba*	DD	-
	Spinner dolphin	*Stenella longirostris*	DD	GN
	Rough-toothed dolphin	*Steno bredanensis*	LC	GN
	Indo-Pacific bottlenose dolphin	*Tursiops aduncus*	DD	GN
	Bottlenose dolphin	*Tursiops truncatus*	LC	LL, GN
Phocoenidae	Indo-Pacific finless porpoise	*Neophocaena phocaenoides*	VU	GN

* Published bycatch records only (reference at the end of the document)
** Arabian Sea population: EN
The IUCN Red List of Threatened species. Version 2017-01. <www.iucnredlist.org>.
Downloaded on 6 September 2017.

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. The current[39] International Union for Conservation of Nature (IUCN) Red List status for each of the cetacean species reported in the IOTC Area of Competence is provided in Table 1. Information on their interactions with IOTC fisheries is also provided. 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), International Whaling Commission (IWC)), as well as numerous fisheries agreements obligate States to provide protection for these species. The status of cetaceans is affected by a range of factors such as direct harvesting and habitat degradation, but the level of cetacean mortality due to capture in tuna drift gillnets is likely to be substantial and is also a major cause for concern[40]. Many reports[41] also suggest some level of cetacean mortality for species involved in depredation of pelagic longlines,

[39] October 2017

[40] Anderson 2014

[41] E.g. IOTC-2013-WPEB07-37

and these interactions need to be further documented throughout the IOTC Area of Competence. Recently published information suggests that the incidental capture of cetaceans in purse seines is low[42], but should be further monitored.

Outlook. Resolution 13/04 *On the conservation of cetaceans* highlights the concerns of the IOTC regarding the lack of accurate and complete data collection and reporting to the IOTC Secretariat of interactions and mortalities of cetaceans in association with tuna fisheries in the IOTC Area of Competence. In this resolution, the IOTC have agreed that CPCs shall prohibit their flagged vessels from intentionally setting a purse seine net around a cetacean if the animal is sighted prior to the commencement of the set. The IOTC also agreed that CPCs using other gear types targeting tuna and tuna-like species found in association with cetaceans shall report all interactions with cetaceans to the relevant authority of the flag State and that these will be reported to the IOTC Secretariat by 30 June of the following year. It is acknowledged that the impact on cetacean populations from fishing for tuna and tuna-like species may increase if fishing pressure increases (which is already clear for tuna gillnet fisheries from IOTC data) or if the status of cetacean populations worsens due to other factors such as an increase in external fishing pressure or other anthropogenic or climatic impacts.

The following should be noted:

- The number of fisheries interactions involving cetaceans is highly uncertain and should be addressed as a matter of priority as it is a prerequisite for the WPEB to determine a status for any Indian Ocean cetacean species.
- Available evidence indicates considerable risk to cetaceans in the Indian Ocean, particularly from tuna drift gillnets[43].
- Current reported interactions and mortalities are scattered, but are most likely severely underestimated.
- Maintaining or increasing fishing effort in the Indian Ocean without appropriate mitigation measures in place will likely result in further declines in a number of cetacean species. An increasing effort by tuna drift gillnet fisheries has been reported to the IOTC, which is a major cause of concern for a number of species, particularly in the northern Indian Ocean.
- Appropriate mechanisms should be developed by the Compliance Committee to ensure CPCs comply with their data collection and reporting requirements for cetaceans.

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[42] e.g. Escalle *et al.* 2015

[43] Anderson 2014

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APPENDIX XXXIII
UPDATE ON THE IMPLEMENTATION OF THE IOTC REGIONAL OBSERVER SCHEME

CPCs	Active Vessels LOA≥24m or High Seas vessels[44]				Progress	List of accredited observers submitted	Number of observer reports provided[45]						
	LL	PS	GN	BB			2010	2011	2012	2013	2014	2015	2016
MEMBERS													
Australia	2	6		1	Australia has implemented an observer programme for the longline fleet	**YES: 21**	2(O)	1(O)	3(O)	No	2(O) + 4(E)	11(E)	No
China –Taiwan,China	67 344				China has implemented an observer programme	**YES: 3** **YES: 54**	1(O) No	No No	1(O) 1(O)	1(O) 19(O)	2(O) 17(O)	1(O) 13(O)	4(0) 14(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	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	N/A
European Union	17 0 7 19 1	12 1 0 18 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,Italy : No** **EU,Portugal: 4** **EU,Spain : 9** **EU,UK : 1**	FRA 6(E) N/A No No No	FRA 45(E) N/A PRT 1(O) No No	FRA 93 (E) N/A PRT 1(O) No No	FRA 89(E) N/A PRT 1(O) ESP 1(O) No	FRA 94(E) N/A PRT 1(O) ESP 2(O) No	FRA 109 (E) ITA 6(O) PRT 1(O) ESP 10(E) No	FRA 106 (E) ITA 4(O) PRT 1(O) ESP 15(E) No
France (OT)					N/A	**N/A**	No	9(O)	7(O)	7(O)	N/A	N/A	N/A
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	N/A
India					India has not yet developed an observer programme.	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Indonesia	246	11	13		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**	**No**
Iran, Isl. Rep. of	5	8	1192		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**	**No**
Japan	43	2			Japan started its observer programme on the 1st of July 2010.	**YES: 19**	8(E)	11(E)	10(E)	9(E)	15(E)	9(E)	**No**

[44] The number of active vessels is given for 2016
[45] Year in which the observed trip has started (E: Electronic; O: Other)

CPCs	Active Vessels LOA≥24m or High Seas vessels[44]				Progress	List of accredited observers submitted	Number of observer reports provided[45]						
	LL	PS	GN	BB			2010	2011	2012	2013	2014	2015	2016
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	1(E)
Korea, Rep. of	13	5			Korea has had an observer programme since 2002 and has 28 observers registered in the Indian Ocean.	**YES: 40**	**2(O)**	**No**	**2(O)**	**3(O)**	**3(O)**	4(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)** [46]	**8(O)**	**7(O)**	**No**	**No**
Malaysia	10				Malaysia is developing plans for the implementation of an observer programme.	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Maldives	47			325	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**	**No**
Mauritius	5	2			Mauritius has developed an observer scheme and started submitting data for 2015.	**YES: 8**	**No**	**No**	**No**	**No**	**No**	**5(O)**	**5(O+E)**
Mozambique	11				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**	**7(E)**	**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**	**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**	**No**
Philippines					No information received by the Secretariat.	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**
Seychelles	47	13			Seychelles initiated an observer programme in 2014 and has started to report observer data	**YES: 78**	**No**	**No**	**No**	**No**	**6(O)**	**46(O)**	**No**
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	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	N/A

[46] Reports from Madagascar include observers onboard foreign vessels

CPCs	Active Vessels LOA≥24m or High Seas vessels[44]				Progress	List of accredited observers submitted	Number of observer reports provided[45]						
	LL	PS	GN	BB			2010	2011	2012	2013	2014	2015	2016
South Africa	13				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)**	**10(O)** [47]	**16(O)**	**No**
Sri Lanka	1		1455		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)**	**No**
Sudan	No information received				No information received by the Secretariat.	**N/A**	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**	**1(O)**
Thailand		1			Thailand conducted observer training in 2015 but had no active LL vessels in 2016	**YES: 8**	**No**	**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	N/A
Yemen	No information received				No information received by the Secretariat.	**No**	**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	N/A
Liberia					No information received by the Secretariat.	**N/A**	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	N/A

[47] 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.

APPENDIX XXXIV
2017: UPDATE ON PROGRESS REGARDING RESOLUTION 16/03 – ON THE SECOND PERFORMANCE REVIEW FOLLOW–UP

(NOTE: NUMBERING AND RECOMMENDATIONS AS PER APPENDIX I OF RESOLUTION 16/03)

REFERENCE #	RECOMMENDATION	RESPONSIBILITY	UPDATE/STATUS	TIMELINE	PRIORITY
PRIOTC02.02 (para. 86)	***Status of living marine resources*** The PRIOTC02 **RECOMMENDED** that: a) while continuing to work on improving data collection and reporting, the Scientific Committee should continue to utilise qualitative stock assessment methodologies for species where these is limited data available, including ecological risk based approaches, and support the development and refinement of data poor fisheries stock assessment techniques to support the determination of stock status.	*Scientific Committee*	**Ongoing:** Since 2013, data-poor approaches to determining stock status have been applied to a range of billfish and neritic tuna species. The WPM has an item in their programme of work specifically related to this: 2.1 Explore potential methods of presenting stock status advice to managers from a range of data limited scenarios, e.g. through the development of a 'Tier' approach for providing stock status advice, based on the type of indicators used to determine stock status (e.g. CPUE series, stock assessment model) A project has been developed with EU funding to further this work. A capacity-building workshop was held in 2017 on data-poor approaches to stock assessment. An ecological risk assessment is scheduled to take place in 2018 for the main shark species as well as for marine turtles in the Indian Ocean.	Ongoing	Medium

	b) confidentiality provisions and issues of accessibility to data by the scientists involved needs to be clearly delineated, and/or amended if necessary, so that stock assessment analysis can be replicated.	*Scientific Committee & Commission*	**Ongoing**: Input, output and executable files for the assessment of major stocks are archived with the Secretariat to allow replication of analyses. Access to operational data under cooperative arrangements, and those subject to confidentiality rules is still limited. In some cases, the Secretariat is bound by the domestic data confidentiality rules of Members and Cooperating Non–Contracting Parties. Ongoing developments to the new integrated IOTC database are improving the accessibility of IOTC data sets for users outside the Secretariat, while ensuring that confidentiality rules are fully respected. IOTC is contributing to the BlueBridge project which set up a service to assist users with re-running stock assessments. The outputs of CPUE standardisation are available but access to the raw data may not be provided.	Ongoing	Mediu m
	c) chairpersons and Vice-Chairpersons of the Scientific Committee and respective Working Parties, in conjunction with the IOTC Secretariat, develop guiding principles for the provision of papers to ensure that they are directly related to the Program of Work of the respective Working Party and/or Scientific Committee, as endorsed by the Commission, while still encouraging for new and emerging issues to be presented.	*Scientific Committee & Working Party Chairs and Vice-Chairs*	**Ongoing:** Given the substantial increase in the quantity of documents submitted for WP meetings in recent years (often reaching 60) the IOTC Secretariat is working closely with Chairs to filter through the papers of most relevance to the agreed agenda items based on the priorities of the SC and Commission for that year, and requesting authors to resubmit their paper for an alternative meeting or as a reference “information” document.	Ongoing	Mediu m

	d) ongoing peer review and input by external scientific experts should be incorporated as standard best practice for Working Parties and included in the Commission's regular budget.	*Scientific Committee & Commission*	241. **Ongoing**: External experts (Invited Experts) are regularly invited to provide additional expertise at Working Party meetings. 242. The SC requested that at least one 'Invited Expert' be brought to each of the science Working Parties in 2017 and in each subsequent year, so as to further increase the capacity of the Working Parties to undertake the work detailed in the Program of Work (para 178 IOTC-2016-SC19-R) In 2017 an Invited Expert attended all the WP meetings except for WPDCS. Sufficient budget needs to be allocated to this by the Commission if it is considered a priority. The SC agreed that once stock assessment models were considered robust, that peer review would be advantageous and funds will be requested to undertake peer reviews of stock assessments.	Ongoing	High
PRIOTC02.03 (para. 96)	***Data collection and reporting*** The PRIOTC02 **RECOMMENDED** that: a) the Commission make further investments in data collection and targeted capacity building, which is necessary for further improvement in the provision and quality of data in support of the Commission's objectives, as well as to identify the sources of the uncertainty in data and work towards reducing that uncertainty.	*Commission*	**Ongoing:** There are multiple opportunities and sources of funding for capacity building on data collection and scientific analyses, both within the IOTC budget and in the context of other partnerships.	Ongoing	High

	b) while there are budgetary implications, the IOTC Secretariat staffing dedicated to data collection and data capacity building activities should be increased from 3 to 5 full-time data staff.	*Commission*	**Pending:** Recruitment of a P1 (Fisheries Officer) began in late-2017. However, the IOTC Data Section still remains severely understaffed given the increasing work loads. These include monitoring data compliance and technical support missions, support to the implementation of the Regional Observer Scheme, development of the IOTC database and dissemination systems, and new work streams taking place in 2017 (e.g., E-monitoring, ROS Pilot Project, support for implementation of skipjack HCR [Res 16/02], and yellowfin catch reduction [Res.17/01].	Ongoing	High
	c) the IOTC Secretariat should facilitate discussions with coastal State non-CPCs and other non-CPCs fishing within the IOTC area of competence to formalise long-term strategies for data submission to the IOTC Secretariat, including all relevant historical data sets.	*IOTC Secretariat*	**Ongoing:** This is partially being addressed by the programme of work allocated to the IOTC Data Compliance and Support missions.	Ongoing	High
	d) steps to gain access to fine-scale data to be used in joint analysis, with sufficient protection of confidentiality, should be taken.	*IOTC Secretariat*	**Ongoing:** This capability should be part of the improved functionalities provided by the new IOTC database, depending on the quality of these fine-scale data and confidentiality restrictions. The collaborative longline CPUE (involving Japan, Rep. of Korea, and Taiwan,China and an independent fisheries consultant) has involved the sharing of operational level data. While the results of analyses, and joint-CPUE, have been published, the fine-scale data remains confidential. In 2017, the collaborative workshop explored the feasibility of including data from other CPCs (i.e. Seychelles Industrial longline) and discussed the possibilities and potential options of allowing more flexibility in data access (e.g. the possibility of remote access).	Ongoing	High
	e) where budgets and other resources permit, to encourage data preparatory meetings preceding stock assessment review meetings (Working Parties).	*Scientific Committee*	**Ongoing:** The SC has considered this in previous years and for WPTmT a preparatory meeting in 2018 will be held one year before the stock assessment update.	Ongoing	Medium

	f) innovative and/or alternative means of data collection and reporting should be explored and, as appropriate, implemented, including a move towards electronic data collection and reporting for all fleets.	*Scientific Committee*	**Ongoing:** The IOTC Secretariat has developed an E-Reporting tool for the Regional Observer Scheme to facilitate reporting of ROS data. A pilot E-monitoring project is also planned for 2018, focused on small-scale fisheries (e.g., gillnet, gillnet-longline multi-gear vessels) for which there are practical difficulties placing on-board observers, and for which there is currently little or no data reported to the IOTC Secretariat. In October 2017 a consultation and validation workshop was held in South Africa to discuss with CPCs the future implementation of e-MARIS, an electronic Monitoring And Reporting Information System that will streamline - among others - the submission of mandatory statistical data to the Secretariat. The Scientific Committee is developing minimum standards for the implementation of electronic observation systems and determining how they can be used to increase levels of observer coverage for Indian Ocean fisheries as requested by Res. 16/04	2018	High
PRIOTC02.05 (para. 104)	***Capacity building (Data Collection)*** The PRIOTC02 **RECOMMENDED** that: a) the Commission expand its current data support and data compliance missions and that the IOTC Secretariat should be granted increased autonomy to seek and attract external donor funds to support the work approved by the Commission, including supporting actions and/or capacity building initiatives from Compliance Missions that are applicable to more than two CPCs.	*Commission*	**Ongoing:** The IOTC Secretariat is actively engaged in a programme of data compliance and support missions, but is constrained by current staffing resources within the Data Section. During 2017, data compliance and support missions were conducted in Sri Lanka (April), Reunion (August), Mauritius (August). Kenya (September) and Iran (November). A first training workshop for the adoption of the ROS electronic tool for data collection and reporting will be held in Sri Lanka in December. External funding for the missions was provided by EU DG-MARE.	Ongoing	High

	b) the IOTC should continue the workshop series aimed at Connecting the IOTC Science and Management processes. The aims of the workshop series should be to: 1) improve the level of comprehension among IOTC CPCs on how the scientific process informs the management process for managing of IOTC species and ecosystem-based management; 2) increase the awareness of IOTC Contracting Parties to their obligations, as stipulated in the Commissions' Conservation and Management Measures which are based on rigorous scientific advice; 3) improve the decision making process within the IOTC; and 4) to provide direct assistance in the drafting of proposals for Conservation and Management Measures.	*Commission & Secretariat*	**Ongoing:** Although this has been replaced by the IOTC Technical Committee on Management Procedures which met for first time in May 2017, TCMP recommended that this meeting is extended from its current one-day format and that more time is spent developing appropriate science-related capacity to facilitate mutual understanding. A Common Oceans ABNJ Tuna Project -funded capacity building workshop took place in 2017 and is planned for 2018 to support the TCMP with more direct capacity building for managers from developing CPCs.	Ongoing	High
PRIOTC02.06 (para. 106)	***Non-target species*** The PRIOTC02 **RECOMMENDED** that the Commission should continue to improve upon the requirements of data collection and reporting mechanisms of non-IOTC species that interact with IOTC fisheries.	*Commission and Scientific Committee*	**Ongoing:** A discard data reporting form has been established for the collection of data on non-retained bycatch species. Various aspects of the Pilot Project under Res 16/04 also intend to address this issue.	Ongoing	High
PRIOTC02.07 (para. 112)	***Quality and provision of scientific advice*** The PRIOTC02 **RECOMMENDED** that: a) the Scientific Committee should continue the good work undertaken since the PRIOTC01 and strive to make further improvements in the way it communicates information about stock status and future prospects for the stocks to the Commission.	*Scientific Committee & Working Parties*	**Ongoing:** Revisions and amendments to the Species Executive Summaries are ongoing through various proposals from the WPs and SC that are intended to improve communication. These have been discussed at every SC meeting for the last few years and changes to the documents have been made accordingly.	Ongoing	Medium
	b) an independent peer review process (and budgeting mechanism) for stock assessments should be implemented if IOTC science is to be considered to be in line with best practice and to maintain a high standard of quality assurance.	*Scientific Committee & Commission*	**Ongoing:** Invited external experts are routinely invited to participate in the meetings of the WP to provide additional expertise.	Ongoing	High

	c) the Scientific Committee, through its Working Party on Ecosystems and Bycatch should pursue the application of ecosystem modelling frameworks.	*Scientific Committee & Working Party on Ecosystems and Bycatch*	**Ongoing**: The WPEB has recently added an item into its Program of Work on the development for a plan for ecosystem based fisheries management approaches in the IOTC and has requested the development of a preliminary ecosystem report card template. SC representatives and the Secretariat participated in the tRFMO joint workshop on operationalisation of the EAFM in 2017 and are planning to do so in 2018 and at future meeting. The ecosystem report card results will be available in 2018.	Ongoing	Low
	d) continue to develop and adopt robust target and limit reference points, and species or fishery specific harvest control rules through management strategy evaluations, noting that this process has commenced for several species and is specified in IOTC Resolution 15/10 *on target and limit reference points and a decision framework*. The mandated Resolution 14/03 [superseded by Resolution 16/09] *on enhancing the dialogue between fisheries scientists and managers*, will benefit from having communication between the Scientific Committee and the Commission more formally structured, facilitated dialogue to enhance understanding and inform decision making.	*Scientific Committee & Commission*	**Ongoing:** The 1st Meeting of the Technical Committee on Management Procedures took place in 2017 and is due to continue to take place prior to each Commission meeting with the discussion of reference points on the agenda	Ongoing	High
	e) the Commission and its subsidiary bodies continue to ensure that meeting schedules and activities are rationalised so that the already heavy workload of those involved, and budgeting constraints, are taken into account.	*Commission & Scientific Committee*	**Ongoing**: All Working Parties have ranked the activities in their respective programs of work as high, medium or low and allocated a numerical ranking within the high priority category. These are further prioritised and summarised in paper IOTC-2017-SC20-09. The Scientific Committee will also discuss the potential to reduce the heavy yearly meeting schedule (by combining intersessional meetings with stock assessment meetings) to reduce the workload of the Secretariat and WPs.	Ongoing	Medium

	f) the Commission fully implements Resolution 12/01 *On the implementation of the precautionary approach*, so as to apply the precautionary approach, in accordance with relevant internationally agreed standards, in particular with the guidelines set forth in the UNFSA, and to ensure the sustainable utilisation of fisheries resources as set forth in Article V of the IOTC Agreement, including ensuring that a lack of information or increased uncertainty in datasets/stock assessment, is not used as a justification to delay taking management actions to ensure the sustainability of IOTC species and those impacted by IOTC fisheries.	*Commission*	**Ongoing:** The precautionary approach is used by SC in the provision of the scientific advice for fishery management. A harvest control rule was adopted for skipjack tuna, and work is progressing on yellowfin, bigeye and albacore tunas, with support of external funding (Common Oceans ABNJ Tuna Project) An MSE for swordfish is considered a high priority by the Commission (para. 40, IOTC-2017-S21-R).	Ongoing	High
	g) while there are budgetary implications, the IOTC Secretariat staffing dedicated to scientific analysis should be increased from 2 to 4 full-time science staff.	*Commission*	**Ongoing:** The IOTC science staff section has now increased to 2 persons again and the science manager position has been advertised and is expected to start in early 2018. A further science coordinator position will be advertised in mid-2018.	Ongoing	High
PRIOTC02.08 (para. 123)	***Adoption of Conservation and Management Measures*** The PRIOTC02 **RECOMMENDED** that: b) as the IOTC has faced the management of the main targeted stock under its purview only through a regulation of the fishing effort; other approaches should be explored, such as those envisioned in Resolutions 05/01 and 14/02, including catch limits, total allowable catch (TAC) or total allowable effort (TAE).	*Commission & Scientific Committee*	**Pending:** While TCAC has progressed this work, WPTT agenda has also included the option of alternative management tools. This should be continued in light of Res 17/01 and 16/02 revisions.	Pending	High

	c) the Science-Management Dialogue is strengthened to improve understanding of modern approaches to fisheries management, including the implementation of Harvest Strategies through the use of Management Strategy Evaluation. The Commission adopt a formal process of developing and implementing Harvest Strategies within a prescribed timeframe.	*Commission & Scientific Committee*	**Completed:** The Commission adopted Resolution 16/09, establishing a Technical Committee on Management Procedures, formalising a process to facilitate discussion and adoption of harvest strategies. The first meeting of the TCMP took place in May 2017. The Commission adopted the schedule of work of TCMP including the timelines and process for the development of MSE and adoption of HCR for IOTC Species (Appendix 9 of IOTC-2017-S21-R[E])	Done	High
PRIOTC02.21 (para. 204)	b) The IOTC should develop cooperative mechanisms, such as MoUs, to work in a coordinated manner on issues of common interest, in particular non-target species and an ecosystem approach with other RFMOs especially with SIOFA.	*Commission*	**Ongoing**: The IOTC is currently working with other tRFMOs, within the framework of the Kobe process, through joint meetings on the MSE, ecosystem approaches to management, harmonisation of observer schemes and a joint working group on FADs. A porbeagle risk assessment (southern hemisphere) was presented at WPEB in 2017. The IOTC Secretariat, the SC chair and the chair of WPEB all participated in the tRFMO joint meeting on EBFM (FAO, Rome) and the FAD Working Group (Madrid) in 2017.	Ongoing	Medium
PRIOTC02.22 (para. 211)	***Special requirements of developing States*** The PRIOTC02 **RECOMMENDED** that: a) the continuation and optimisation of the IOTC Meeting Participation Fund indefinitely as part of the IOTC Regular Budget, and that the MPF is used to support participation of all eligible Contracting Parties in order to create a more balanced attendance to both science and non-science meetings of the Commission.	*Commission*	**Ongoing:** In 2017, 61 MPF applications were accepted by the IOTC Secretariat – although a significant proportion of applicants were funded through external funding sources rather than the IOTC regular budget.	Ongoing	High
	b) the IOTC Secretariat in partnership with development agencies and organisations, should develop a five year regional fisheries capacity development program to ensure coordinated capacity building activities across the region.	*Secretariat & Commission*	**Pending:** The Strategic Plan will include the development plan for capacity building. A capacity-building workshop was held in 2017 on data-poor approaches to stock assessment.	Ongoing	Medium

APPENDIX XXXV
PROGRESS ON RECOMMENDATIONS FROM SC19

SC19 Report	SC recommendations	Update/Progress
SC19.07 Para. 21 SC19.08 Para. 22	***SC – National Reports from CPCs*** **NOTING** that the Commission, at its 15th Session, expressed concern regarding the limited submission of National Reports to the SC, and stressed the importance of providing the reports by all CPCs, the SC **RECOMMENDED** that the Commission note that in 2016, 23 reports were provided by CPCs (26 in 2015, 26 in 2014) (Table 2). The SC **RECOMMENDED** that the Compliance Committee and Commission note the lack of compliance by 9 Contracting Parties (Members) and 3 Cooperating Non-Contracting Parties (CNCPs), that did not submit a National Report to the Scientific Committee in 2016, noting that the Commission agreed that the submission of the annual reports to the Scientific Committee is mandatory.	**Update:** The Commission NOTED missing National Reports from 9 CPCs and 3 CNCPs and encouraged those countries to submit the National Report to SC in 2017.
SC19.09 Para. 29	***WPNT CPUE standardisation*** **ACKNOWLEDGING** the importance of indices of abundance for future stock assessments, the WPNT **RECOMMENDED** that the development of standardised CPUE series is explored, with priority given to fleets which account for the largest catches of neritic tuna and tuna-like species (e.g., I.R. Iran, Indonesia, India, Pakistan, and Sri Lanka).	**Update:** This item is currently still pending data availability and funding. The WPNT07 made a number of Recommendations for consideration by SC20: (IOTC-2017-WPNT07-R, para. 27) **NOTING** a number of long-standing data reporting or data quality issues that severely impact the assessment of neritic species, the WPNT **RECOMMENDED** that funds be made available to the IOTC Secretariat (either through the IOTC Regular Budget or from external sources) dedicated to capacity building activities, or data compliance and support missions, aimed at improving the availability of data for those countries identified as a priority for neritic species in terms of importance of catches. Specifically: iv. that the IOTC Secretariat conducts a Data Compliance and Support mission to I.R. Iran to assess the status of data collection and reporting of IOTC datasets, notably catch-and-effort, and the availability of data that could be used as a basis of a future standardized CPUE series gillnet fleets; v. when sufficient data is recovered, or made available, that the IOTC Secretariat allocates funds to assist with the development of a standardized CPUE series for gillnets, in collaboration with IOTC members, including organization of a joint-workshop or hiring of an international consultant; vi. that the IOTC Secretariat formally communicates to India requesting the submission of mandatory datasets according to the requirements of IOTC Resolution 15/02 and, if necessary, conducts a Data Compliance and Support mission to facilitate the reporting of data to the IOTC; vii. that the IOTC Secretariat continues to support the work of WWF-Pakistan and the Government of Pakistan in the evaluation and reporting of the crew-based observer program, and facilitate the reporting of length data and catch-and-effort collected by the observer log-books.

		(para. 140) The WPNT **AGREED** that a new item on data mining and collation should be added as a fundamental piece of work to be undertaken as a priority and **RECOMMENDED** that this work is supported by the IOTC Secretariat. The WPNT further **AGREED** that data collation has been identified as the main priority of the group and allocated this the highest priority ranking. (para. 141) **ACKNOWLEDGING** the importance of indices of abundance for future stock assessments, the WPNT **RECOMMENDED** that the development of standardised CPUE series is explored, with priority given to fleets which account for the largest catches of neritic tuna and tuna-like species (e.g., I.R. Iran, Indonesia, India, Pakistan, and Sri Lanka).
SC19.10 Para. 32 SC19.11 Para. 33	***WPNT Selection of Stock Status indicators*** The SC noted the importance of exploring alternative data poor stock assessment methods and **RECOMMENDED** that the Commission allocates funding for work to explore methods based on different data sources, such as catch curve estimation of mortality from length-frequency data. A range of data sources should be explored, including data from observer programmes, the sport fisheries project, and non-state actor (e.g. WWF) projects for suitability. The SC **RECALLED** the recommendation of the WPNT05 for the SC to request the Working Party on Methods evaluate a proposed alternative methodology for presenting management advice for data poor methods in 2016. The SC **REQUESTED** that the WPM evaluate the possibility of using different colours to distinguish between stocks which have not been assessed (e.g., white) and stocks which have been assessed but the status is considered to be uncertain (e.g., grey).	**Update:** Under Outcome 1 (Improved stock assessments of target fisheries and bycatch) of the 2017 EU grant to IOTC (GCP/INT/305/EC) a sub-project will be tendered in 2018 for 1.4: Review of data poor stock assessment methods for Indian Ocean tuna fisheries. This study will develop a manual of best practice methodologies for the types of data available for Indian Ocean species. **Update:** The WPM **AGREED** that work on the presentation of stock status advice for data limited stocks will need to be carried out inter-sessionally, and that this will require some level of preparation and planning. The WPM **REQUESTED** the Chairperson liaise with the Chairs of the species WPs (WPNT and WPB) in order to draft a study proposal on this issue and **RECOMMENDED** the SC allocate funding to this project (para.121, IOTC-2017-WPM08-R). This project has been included as item 2 in the WPM workplan.
SC19.12 Para. 41	***WPTmT Growth curve of albacore*** **NOTING** the general paucity of biological indicators available from the Indian Ocean, and particularly the lack of age-specific maturity as a primary source of uncertainty in the stock assessment of albacore tuna, the SC **RECOMMENDED** a study on the growth curve of albacore tuna in the Indian Ocean as a high priority in the **SC** Program of Work.	**Update:** Under Outcome 1 (Improved stock assessments of target fisheries and bycatch) of the 2017 EU grant to IOTC (GCP/INT/305/EC) a sub-project will be established for 1.5: Albacore growth curve analysis. An agreement has been reached with CSIRO to conduct the project in 2018. This research project is intended to conduct ageing of Indian Ocean albacore and the results of this work will be available in time to incorporate in the next albacore stock assessment scheduled for 2018.
SC19.13 Para. 46	***WPB Shortbilled spearfish*** The SC **RECOMMENDED** that on the next revisions of the IOTC Agreement, short billed spearfish be included as an IOTC species.	**Update:** Pending Recommendations passed to Commission but no actions taken. Should be addressed in the next revision of the IOTC Agreement.

SC19.14 Para. 48	***WPB Billfish species ID guides*** The SC **AGREED** on the importance of the hard, waterproof copies of the IOTC species identification guides for observers and port samplers, and **RECOMMENDED** that funds are allocated for further printing of the species ID guides for distribution to sports fishing clubs and recreational fisheries to improve the quality of data reported, and that funds also be continued for the translation of these into the priority languages identified by the SC.	**Update:** Under Outcome 2 (Improved data quality) of the 2017 EU grant to IOTC (GCP/INT/305/EC) a sub-project will be funded in 2018 for 2.6: Species ID cards translation and printing. Funds will be used to print hard copies of the IOTC species identification cards in priority languages identified by the SC.
SC19.15 Para. 51	***WPB Swordfish habitat and behavior*** The SC **RECOMMENDED** that, for subsequent WPB meetings, swordfish is treated as a single stock and that references related to swordfish for the southwest Indian Ocean are removed from the Executive Summary and from the summary of available data for all billfish species.	**Update:** The 2017 stock assessment of swordfish was carried out for a single stock in the Indian Ocean (IOTC-2017-WPB15-20 Rev_1) and the Executive Summary and Supporting Information have been revised accordingly.
SC19.16 Para. 55	***WPEB Identification guides for fishing gear*** The SC **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 SC **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.	**Update:** Pending The WPEB12 **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. **NOTING** the continued confusion in the terminology of various hook types being used in IOTC fisheries, (e.g. tuna hook vs. J-hook; definition of a circle hook), the WPEB **REITERATED** its previous **RECOMMENDATIONS** (2013, 2014 and 2016) and the **RECOMMENDATION** from SC19 (SC19.16; para. 55 of IOTC-2016-SC19-R) that the Commission allocate funds in the 2018 IOTC Budget to develop an identification guide for fishing hooks and pelagic fishing gears used in IOTC fisheries (para. 24, IOTC-2017-WPEB13-R).
SC19.17 Para. 56 SC19.18 Para. 57	***WPEB Regional observer scheme*** **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 SC **RECOMMENDED** all CPCs to submit observer data in an electronic format that can 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. **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” make	**Update:** Partial. Some CPCs Observer reports are submitted electronically but not all. The SC should reiterate its RECOMMENDATION. **Update:** Pending revision of Resolution 11/04

	no reference to the data collected not being used for compliance purposes, the SC reiterated its **RECOMMENDATIO**N that at the next revision of Resolution 11/04, it be clearly stated that the data collected shall only be used for scientific purposes.	
SC19.19 Para. 58	***WPEB B*****ycatch data exchange protocol (BDEP)** The SC **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.	**Update:** The ROS database development is now complete and the processing of inputting historical reported data has begun (a first data extraction of JPN observer data from 2014-2016 has been completed). This process will be time consuming given the number of inconsistencies in the reported datasets in terms of format, content, code lists etc, however, the sufficient resources are available and the work is ongoing through a consultancy project. On completion of this task, the Secretariat has agreed to collate all the relevant observer data from the ROS regional database into the BDEP format to enhance data exchange with other institutions. Testing of the export facilities for this is currently under way.
SC19.20 Para. 59	***WPEB Gillnet fisheries*** **NOTING** that gillnets are regularly being used with lengths in excess of 4,000 m (and up to 7,000 m) within and occasionally into the high seas, and that those used within the EEZ may sometimes drift onto the high seas in contravention of Resolution 12/12, the SC reiterated it's previous **RECOMMENDATION** 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	**Update:** In May 2017 the Commission adopted Resolution 17/07 *On the prohibition to use large-scale driftnets in the IOTC Area.* This Resolution bans the use of large scale drifting gillnets in coastal EEZs from 2022.
SC19.21 Para. 60	***WPEB Data collection opportunities*** The SC **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 SC **RECOMMENDED** that the collection of seabird bycatch mitigation photographs through the ROP is trialled as a pilot.	**Update:** In early 2017 CPCs involved in the ROP were formally contacted by the IOTC Secretariat to request permission to use the information provided by the compliance programme for the monitoring of seabirds. Permission was granted and BirdLife International are currently working on the information available to assess whether any meaningful data on mitigation measures can be obtained.

SC19.22 Para. 68	***ACAP best practice advice: update*** The SC **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.	**Update:** Pending revision of Resolution 12/06
SC19.23 Para. 69	The SC **RECOMMENDED** that when Resolution 12/06 is reviewed, the two hook-shielding devices recommended by ACAP as best practice mitigation measures be incorporated as 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 SC **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 SC 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 SC 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.	**Update:** As above
SC19.24 Para. 82	***WPEB NPOAs*** The SC **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. 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 16 of the 36 IOTC CPCs have an NPOA-Sharks (6 more in development), while only 7 CPCs have an NPOA-Seabirds (3 more in development). A single CPC has determined that an NPOA-Sharks is not needed, and 3 have similarly determined that an NPOA-Seabirds is not needed. Currently 10 CPCs have implemented the FAO guidelines to reduce marine turtle mortality in fishing operations, and two CPCs (European Union, France (OT)) have implemented a full NPOA.	**Update:** Presented to and Noted at the S21 Commission meeting. The SC should reiterate its RECOMMENDATION.
SC19.25 Para. 93	***WPTT Bigeye tuna CPUE summary discussion*** The SC **RECOMMENDED** that the multi-nation CPUE standardisation collaboration continue their efforts to improve the understanding of commercial CPUE as relative abundance indices, and expand future work to include other fleets, including the Seychelles longline fleet.	**Update: Ongoing** In 2017 a follow-up CPUE workshop was arranged to update and develop the collaborative longline CPUE for tropical and temperate tunas. The consultant worked closely with scientists from the three fleets to understand and resolve the inconsistencies between the fleets; five papers on the results of developments in the collaborative CPUE were presented at WPTT19 and WPM08. In addition, the CPUE for yellowfin and bigeye tuna was standardised for the Seychelles longline fleet and presented at WPTT19 (IOTC-2017-WPTT19-37).

SC19.26 Para. 95	***WPTT Stock Synthesis III (SS3) assessment of yellowfin tuna*** **NOTING** the discussions on the tagging mixing period during previous WPTT meetings, related to the assessment of yellowfin and other tropical tuna stocks, the SC **RECOMMENDED** that additional work to be conducted to elucidate the most appropriate approach to tag modelling in IOTC stock assessments.	**Update: Ongoing** Under Outcome 1 (Improved stock assessments of target fisheries and bycatch) of the 2017 EU grant to IOTC (GCP/INT/305/EC) a sub-project will be tendered in 2018 for 1.3: Tag modelling project (tropical tunas). The aim of the project is to develop a preliminary spatially explicit operating model of the tropical tuna population for potential use in evaluating assessment bias.
SC19.27 Para. 96	***WPTT Parameters for future analyses: Yellowfin tuna CPUE standardisation and stock assessments*** The SC **RECOMMENDED** that development of the next stock assessment of yellowfin tuna should include a detailed review of the existing data sources (conducted by the stock assessment consultant, in collaboration with the IOTC Secretariat and main longline and purse seine fleets), including: i. Size frequency data: Evaluation of the reliability of length composition from the longline fisheries (including recent and historical data), review of issues with the use of the (EU) purse seine length composition data prior to 1991, and the need for a thorough review of the size frequency data held by IOTC, in collaboration with the fleets involved, to improve the utilization of these data in tropical tuna stock assessments. ii. Collaborative longline CPUE: Further refinement of the procedures to standardize the composite longline logsheet data sets to develop the longline CPUE indices; iii. Tagging data: Comprehensive analysis of the tag release/recovery data set; iv. Alternative CPUE series: a review of the available data from the Indian tuna longline survey data.	**Update:** Ongoing Under Outcome 2 (Improved data quality) of the 2017 EU grant to IOTC (GCP/INT/305/EC) a sub-project will be funded in 2018 for 2.2: Review of longline and purse seine size frequency data. A consultant will be hired, with support from the IOTC Secretariat Data Section, to evaluate the reliability of length composition and evaluate the need for a thorough review of the size frequency data held by IOTC, in collaboration with the fleets involved, to improve the utilization of these data in tropical tuna stock assessments.
SC19.28 Para. 100	***WPM Revision of the WPM Program of work (2017–2021)*** The SC **RECOMMENDED** the proposed standardised methods for the presentation of MSE results (Appendix IX) are submitted to TCMP and S21 for discussion, revision and endorsement, as appropriate. Subsequently, this should be considered a living document that will benefit from revision based upon feedback received from the TCMP, which will first meet in 2017.	**Update:** This was presented to and ENDORSED by S21 Commission meeting as a living document. Furthermore, The WPM RECOMMENDED (WPM08.07) a revised version of the standardised methods for the presentation of MSE results to be discussed and revised at SC20 and to be presented at the TCMP02 and S22 Commission meeting.
SC19.29 Para. 101	***WPM Operational definition of TRPs and LRPs*** The SC noted the request for advice on the feasibility of reporting stock status in relation to limit reference points in addition to the target reference points currently used: "The Commission noted the progress towards development of harvest strategies for key stocks, including the adoption of limit and target reference points for a number of stocks, and **REQUESTED** that the SC provide advice to the 21st Session of the IOTC on the feasibility of reporting stock status in relation to the agreed limit reference points" (IOTC-2016-S20-R, para. 16). The SC noted that if stock status advice changes as soon as the target reference points are exceeded, it is likely for advice to change based purely on natural fluctuations in stock abundance or other expected sources of variability. The SC **RECOMMENDED** that the	**Update:** Ongoing Discussed at TCMP in 2017 and will be discussed further in 2018. Furthermore, the WPTT RECOMMENDED (WPTT19.05) that the Scientific Committee review the approach used to provide management advice, particularly in relation to how the outcomes from stock assessments are reported against target and limit reference points.

	operational definition of TRPs and LRPs is included for discussion at the Technical Committee on Management Procedures.	
SC19.30 Para. 102	***WPM Revision of the WPM Program of work (2017–2021)*** The SC noted that the next stock assessment of Indian Ocean swordfish is due to take place in 2017 and **RECOMMENDED** that the development of MSE of swordfish is considered as a high priority in the revised WPM Program of Work and that funding is allocated for this activity, to start the conditioning of an OM for this stock.	**Update:** Work started in 2017 and a report will be presented to the Scientific Committee in December 2017 (IOTC-2017-SC20-11).
SC19.31 Para. 109	***WPDCS Further analysis of length frequency data and likely impacts on the assessments*** The SC **RECOMMENDED** that a collaborative work on longline size frequency data gathering scientists from Taiwan,China, Japan, Seychelles and Rep. of Korea should be conducted in 2017 in conjunction with the joint CPUE workshop, to compare the different data sets available and extract information useful for the future stock assessments of yellowfin, bigeye and albacore tuna.	**Update: Completed.** Various papers presented to WPM and WPTT. IOTC-2017-WPTT19-31 – 36 IOTC-2017-WPM08-18 - 22
SC19.32 Para. 116	***WPDCS Capacity Building Activities: Data Collection and Processing in Coastal Countries, and Compliance with Minimum Requirements*** SC19.32 (para. 116) The SC **RECOMMENDED** that a capacity building workshop on R data extraction, manipulation and data visualisation takes place in 2017, **NOTING** that funding sources have to be sought and that Sri Lanka has expressed strong interest in this type of activity.	**Update:** Pending funding
SC19.33 Para. 120	***WPDCS General discussion on data issues*** The SC noted the issues with lack of data and poor quality data problems that were identified throughout the working party reports strongly **RECOMMENDED** that these issues are addressed through improved compliance with Resolutions 15/01 On the recording of catch and effort data by fishing vessels in the IOTC area of competence, and 15/02 Mandatory statistical reporting requirements for IOTC contracting parties and cooperating non-contracting parties.	**Update:** This was presented to Commission but not actions taken. The SC should strongly reiterate this RECOMMENDATION.
SC19.34 Para. 121	***WPDCS Data collection and capacity building*** The SC **AGREED** that, while external funding is helping the work of the Commission, funds allocated by the Commission to capacity building are still too low, considering the range of issues identified by the SC and its Working Parties, particularly in relation to the implementation of the Regional Observer Scheme and data collection and reporting for artisanal fisheries and **RECOMMENDED** that the Commission further increases the IOTC Capacity Building budget to fund these activities in the future.	**Update:** The majority of data-related capacity building activities were carried out using extra-budgetary funding in 2017. The 2018 Commission budget includes $85,000 for data and science-related capacity building activities.

SC19.35 Para. 123	***WPDCS Meeting participation fund*** The SC reiterated its **RECOMMENDATION** 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, and that the full Draft paper be submitted no later than 45 days before the start of the relevant meeting. The aim is to allow the Selection Panel to 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.	**Update:** Pending revision of the IOTC Rules of Procedures by a CPC.
SC19.36 Para. 124	***General - IOTC species identification guides: Tuna and tuna-like species*** The SC **RECOMMENDED** that the Commission allocates budget towards continuing the translation and printing of the IOTC species ID guides so that hard copies of the identification cards can 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.	**Update:** Under Outcome 2 (Improved data quality) of the 2017 EU grant to IOTC (GCP/INT/305/EC) a sub-project will be funded in 2018 for 2.6: Species ID cards translation and printing. Funds will be used to to print hard copies of the IOTC species identification cards in priority languages identified by the SC.
SC19.37 Para. 126	***General - IOTC Secretariat staffing*** **NOTING** the very heavy workload at the IOTC Secretariat and the ever increasing demands by the Commission and the Scientific Committee, and also the capacity to respond to requests for assistance by countries, the SC **RECOMMENDED** that the recommendation from the Performance Review PRIOTC02.07(g) is implemented, and that permanent staff of the IOTC Data and Science Section be increased by two (2) (1 x P4 and 1 x P3 level positions), supplemented by additional short-term consultants, to commence work by 1 January 2018 or earlier, and that funding for these new positions should come from both the IOTC regular budget and from external sources to reduce the financial burden on the IOTC membership.	**Update:**. A P1 Data Assistant position has been advertised and interviews are due to take place shortly.
SC19.38 Para. 127	***General – Collaborative Longline CPUE*** The SC **ACNOWLEDGED** the work of the WPTmT and WPTmT and especially improvements in the joint CPUE standardization work which is critical for reliably estimating the stocks. The SC noted that the joint CPUE has become a critical component for the assessments of temperate and tropical tuna species and the SC **RECOMMENDED** that this work continue under the current framework, but that plans should be developed to formalize the process within the IOTC in the near future.	**Update:**. Completed for yellowfin, bigeye and albacore tunas and planned to continue in the future and expanded to other species where funds are available.
SC19.40 Para. 160	***General - Implementation of the Regional Observer Scheme*** The SC noted the substantial resourcing that the proposed framework will require and **RECOMMENDED** that the Commission provide adequate resources to enable implementation of the project.	**Update**: Under Outcome 2 (Improved data quality) of the 2017 EU grant to IOTC (GCP/INT/305/EC) a sub-project will be tendered in 2018 for 2.3: Regional Observer Scheme - support for the implementation of the IOTC Regional Observer Scheme. This project aims to develop data collection protocols for the artisanal component of the ROS and assist countries through capacity building activities, directly through workshops held by the IOTC Secretariat staff and consultants and indirectly through the harmonisation of regional capacity building training courses.

SC19.41 Para. 168	***General - Progress on the Implementation of the Recommendations of the Second Performance Review Panel*** The SC **RECOMMENDED** that the Commission note the updates on progress regarding Resolution 16/03, as provided at Appendix XXXIII.	**Update**: Presented to the Commission and progress is reviewed on IOTC-2017-SC20-08
SC19.42 Para. 179	***General – Consultants*** **NOTING** the highly beneficial and relevant work done by IOTC stock assessment consultants in 2016 and in previous years, the SC **RECOMMENDED** that the engagement of consultants be continued for each coming year based on the Program of Work. Consultants will be hired to supplement the skill set available within the IOTC Secretariat and CPCs. The draft budget provided in Table 5, shall be incorporated into the overall IOTC Science budget for the consideration of the Commission.	**Update**: Completed with Consultants attending all Working Parties meetings in 2017. And planned for next year as well.
SC19.43 Para. 185	***General - Consideration of Resolution 15/09 On a fish aggregating devices (FADs) working group*** The SC further noted that the intention of this is to hold a dialogue meeting between Commissioners as well as scientists and **RECOMMENDED** that the Commission consider holding an internal IOTC meeting in early 2017 in advance of the global meeting.	**Update:** An internal IOTC working group on FADs was held prior to the joint tRFMO working group as recommended by the SC19. The one-day meeting was co-Chaired by the Chair of the Commission and the Chair of the Scientific Committee and the data received by the Secretariat were reviewed and discussed by the group. The IOTC remains the only tRFMO to have taken the practical step of implementing a limit on the number of active FADs that may be used.

APPENDIX XXXVIA
WORKING PARTY ON NERITIC TUNAS PROGRAM OF WORK (2018–2022)

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

Topic	**Sub-topic and project**	**Priority**	**Est. budget and/or potential source**	**Timing**				
				2018	**2019**	**2020**	**2021**	**2022**
1. Data mining and collation	Collate and characterise operational level data for the main neritic tuna fisheries in the Indian Ocean to investigate their suitability to be used for developing standardised CPUE indices.	High (1)	CPCs directly					
2. CPUE standardisation	Develop standardised CPUE series for the main fisheries for longtail, kawakawa, Indo-Pacific King mackerel and Spanish mackerel in the Indian Ocean, with the aim of developing CPUE series for stock assessment purposes.	High (2)	CPUE Workshop (TBD)					
	➢ Longtail tuna. Priority fleets: Iran (gillnet), Indonesia (line and gillnet), Malaysia (coastal purse seine), Pakistan, Oman, Thailand (coastal purse seine) and India (all gillnet).		CPCs directly					
	➢ Spanish mackerel. Priority fleets: Gillnet fisheries of Indonesia, India, Iran, Pakistan and Oman.		CPCs directly					
	➢ Kawakawa. Priority fleets: Indonesia (purse seine/ line), Malaysia (coastal purse seine), Thailand (coastal purse seine), India (gillnet), Iran (gillnet) and Pakistan (gillnet).		CPCs directly					
	➢ Indo-Pacific king mackerel. Priority fleets: Gillnet fisheries of India, Indonesia, Pakistan (gillnet/troll) and Iran.		CPCs directly					
3. Stock assessment / Stock indicators	Develop and compare multiple assessment approaches to determine stock status for longtail tuna, kawakawa and Spanish mackerel (SS3, ASPIC etc).	High (3)	IOTC Regular Budget					

	➢ The Weight-of-Evidence approach should be used to determine stock status, by building layers of partial evidence, such as CPUE indices combined with catch data, life-history parameters and yield-per recruit metrics, as well as the use of data poor assessment approaches. ➢ The following data should be collated and made available for collaborative analysis: 1) catch and effort by species and gear by landing site; 2) operational data: stratify this by vessel, month, and year for the development as an indicator of CPUE over time; and 3) operational data: collate other information on fishing techniques (i.e. area fished, gear specifics, depth, environmental condition (near shore, open ocean, etc.) and vessel size (length/horsepower).						
4. Biological information (parameters for stock assessment)	Age and growth research; Age-at-Maturity Quantitative biological studies are necessary for all neritic tunas throughout their range to determine key biological parameters including age-at-maturity and fecundity-at-age/length relationships, age-length keys, age and growth, which will be fed into future stock assessments.	High (4)					

5. Stock structure (connectivity)	Genetic research to determine the connectivity of neritic tunas throughout their distributions	High (5)	1.3 m Euro: European Union					
	➢ Determine the degree of shared stocks for all neritic tunas under the IOTC mandate in the Indian Ocean, so as to better equip the SC in providing management advice based on unit stocks delineated by geographic distribution and connectivity. ➢ Genetic research to determine the connectivity of neritic tunas throughout their distributions: Table 2b should be used as a starting point for research project development to delineate potential stock structure for neritic tunas in the Indian Ocean. ➢ The IOTC Secretariat to coordinate a review of the available literature on neritic tuna stock structure across the Indian Ocean to assess the data already available such as the location of spawning grounds to identify potential sub-stocks.		TBD					

APPENDIX XXXVIB
WORKING PARTY ON TEMPERATE TUNAS PROGRAM OF WORK (2018–2022)

Table 1. Priority topics for obtaining the information necessary to develop stock status indicators for albacore in the Indian Ocean (2017-2021).

Topic	Sub-topic and project	Priority	Est. budget and/or potential source	Timing				
				2017	**2018**	**2019**	**2020**	**2021**
1. Stock structure (connectivity and diversity)	1.1 Genetic research to determine the connectivity of albacore throughout its distribution and the effective population size.	High (4)	1.3 m Euro: European Union					
	1.1.1 Determine albacore stock structure, migratory range and movement rates in the Indian Ocean.		TBD					
	1.1.2 Determine the degree of shared stocks for albacore in the Indian Ocean with the southern Atlantic Ocean.		Ifremer					
	1.1.3 Population genetic analyses to decipher inter- and intraspecific evolutionary relationships, levels of gene flow (genetic exchange rate), genetic divergence, and effective population sizes.		TBD					
2. Biological information (parameters for stock assessment)	2.1 Age and growth research (collaborative research to estimate ages across research facilities; stratification of sampling across fishery and stock)	High (1)	TBD					
	2.1.1 China and other CPCs to provide further research reports on albacore biology, including through the use of fish otolith studies, either from data collected through observer programs or other research programs, at the next WPTmT meeting.		CPCs directly					
	2.1.2 Growth curve analysis: Uncertainty about the growth curve is a primary source of uncertainty in the stock assessment. Depending on the shape of the growth curve, it is likely that only limited information about total mortality can be obtained from catch-at-size data. As an additional information source, data on the age structure of the catch may be very informative about total mortality and may considerably reduce uncertainty in the assessment. Research needs to be undertaken to investigate the potential and the best approaches to be used. MSE process will look at improvement in precision of estimates given different		TBD					

		amounts of age structure data, depending on fishery, growth curve, and effective sample sizes.							
		2.2 Age-at-Maturity	High (3)						
		2.2.1 Quantitative biological studies are necessary for albacore throughout its range to determine key biological parameters including age-at-maturity and fecundity-at-age/length relationships, age-length keys, age and growth, which will be fed into future stock assessments.		CPCs directly					
3	Ecological information	3.1 Spawning time and locations	Medium (5)						
		3.1.1 Collect gonad samples from albacore to confirm the spawning time and location of the spawning area that are presently hypothesized for albacore.		CPCs directly					
4	CPUE standardisation	4.1 Develop standardized CPUE series for each albacore fishery for the Indian Ocean, with the aim of developing a single CPUE series for stock assessment purposes (either a combined or single fleet series approved by the WPTmT).	High (2)	CPUE Workshop (TBD)					
		4.1.1 Changes in species targeting is the most important issue to address in CPUE standardizations.		CPCs directly					
		4.1.2 Appropriate spatial structure needs to be considered carefully as fish density (and targeting practices) can be highly variable on a fine spatial scale, and it can be misleading to assume that large areas are homogenous when there are large shifts in the spatial distribution of effort.		CPCs directly					
		4.1.3 If there are many observations with positive effort and zero catch, it is worth considering models which explicitly model the processes that lead to the zero observations (e.g. negative binomial, zero-inflated or delta-lognormal models). Adding a small constant to the lognormal model may be fine if there are few zero's, but may not be appropriate for areas with many zero catches (e.g. north of 10oS). Sensitivity to the choice of constant should be tested.		CPCs directly					
		4.1.4 The appropriate inclusion of environmental variables in CPUE standardization is an ongoing research topic. Often these variables do not have as much explanatory power as, or may be confounded with, fixed spatial effects. This may indicate that model-derived		CPCs directly					

		environmental fields are not accurate enough at this time, or there may need to be careful consideration of the mechanisms of interaction to include the variable in the most informative way.								
		4.1.5 It is difficult to prescribe analyses in advance, and model building should be undertaken as an iterative process to investigate the processes in the fishery that affect the relationship between CPUE and abundance.		CPCs directly						
5	Target and Limit reference points	5.1 To advise the Commission, by end of 2016 at the latest on Target Reference Points (TRPs) and Limit Reference Points (LRPs).	High (WPM)							
		5.1.1 Assessment of the interim reference points as well as alternatives: Used when assessing the albacore stock status and when establishing the Kobe plot and Kobe matrices. Agreed to pass this task temporarily to WPM.								
6	Management measure options	6.1 To advise the Commission, by end of 2016 at the latest, on potential management measures having been examined through the Management Strategy Evaluation (MSE) process. Agreed to pass this task temporarily to WPM.	High (WPM)							

APPENDIX XXXVIC
WORKING PARTY ON BILLFISH PROGRAM OF WORK (2018–2022)

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

Topic	Sub-topic and project	Priority ranking	Est. budget and/or potential source	Timing				
				2018	**2019**	**2020**	**2021**	**2022**
1. Stock structure (connectivity and diversity)	1.1 Genetic research to determine the connectivity of billfish throughout their distribution (including in adjacent Pacific and Atlantic waters as appropriate) and the effective population size.	High (4)	1.3 m Euro: (European Union)					
	1.1.1 Next Generation Sequencing (NGS) to determine the degree of shared stocks for billfish 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.	High (4)						
	1.1.2 Nuclear markers (i.e. microsatellite) to determine the degree of shared stocks for billfish (highest priority species: blue, black, striped marlin and sailfish) in the Indian Ocean with the southern Atlantic Ocean and Pacific Ocean, as appropriate.	High (4)						
	1.1.3 Develop a close-kin mark recapture method (*Bravington et al.* 2016) on marlins to estimates population size and other important demographic parameters. This method includes the sampling of juveniles and adult fish and genetic parenting analyses to estimate the population size from mark-recapture models.	High (4)						
	1.2 Tagging research to determine connectivity, movement rates and mortality estimates of billfish.	High (4)	US$100,000					
	1.2.1 Tagging studies (PSAT)		(TBD)					
	2.1 Age and growth research	High (7)						

2. Biological and ecological information (incl. parameters for stock assessment)	2.1.1 CPCs to provide further research reports on billfish biology, namely age and growth studies including through the use of fish otolith or other hard parts, either from data collected through observer programs or other research programs.		(CPCs directly)					
	2.2 Age-at-Maturity	High (8)						
	2.2.1 Quantitative biological studies are necessary for billfish throughout its range to determine key biological parameters including age-at-maturity and fecundity-at-age/length relationships, age-length keys, age and growth, which will be fed into future stock assessments.		(CPCs directly)					
	2.3 Spawning time and locations	High (9)						
	2.3.1 Collect gonad samples from billfish to confirm the spawning time and location of the spawning area that are presently hypothesized for each billfish species.		(CPCs directly)					
3. Historical data review	3.1 Changes in fleet dynamics							
	3.1.1 Japan and Taiwan,China to undertake an historical review of their longline fleets and to document the changes in fleet dynamics. The historical review should include as much explanatory information as possible regarding changes in fishing areas, species targeting, gear changes and other fleet characteristics to assist the WPB understand the current fluctuations observed in the data.	High (6)	(CPCs directly)					
	3.2 Species identification							
	3.2.1 The quality of the data available at the IOTC Secretariat on marlins (by species) is likely to be compromised by species miss-identification. Thus, CPCs should review their historical data in order to identify, report and correct (if possible) potential identification problems that are detrimental to any analysis of the status of the stocks.	High (5)	(CPCs directly)					
4. Sports/recreational fisheries	4.1 Fishery trends							

		4.1.1 The catch and effort data for sports/recreational fisheries targeting marlins and sailfish in the Indian Ocean should be submitted to the IOTC Secretariat to assist in future assessments for these species. CPCs with active sports/recreational fisheries targeting marlins and sailfish should undertake a comprehensive analysis for provision to the WPB.	High (First phase to be finalized in 2017)	Consultant US$TBD					
5.	CPUE standardization	5.1 Develop and/or revise standardized CPUE series for each billfish species and major fisheries/fleets for the Indian Ocean.							
		5.1.1 Swordfish: Priority LL fleets: Taiwan,China, EU(Spain, Portugal, France), Japan, Indonesia	High (20)	(CPCs directly)					
		5.1.2 Striped marlin: Priority fleets: Japan, Taiwan,China	High (21)	(CPCs directly)					
		5.1.3 Black marlin: Priority fleets: Longline: Taiwan,China; Gillnet: I.R. Iran, Sri Lanka	High (13)	(CPCs directly)					
		5.1.4 Blue marlin: Priority fleets: Japan, Taiwan,China	High (14)	(CPCs directly)					
		5.1.5 I.P. Sailfish: Priority fleets: Priority gillnet fleets: I.R. Iran and Sri Lanka; Priority longline fleets: EU(Spain, Portugal, France), Japan, Indonesia;	High (12)	(CPCs directly)					
6.	Stock assessment / Stock indicators	6.1 Develop and compare multiple assessment approaches to determining stock status for swordfish (SS3, ASPIC, etc.).	High (15)	US$??					
		6.2 Stock assessment on billfish species in 2018 and 2019	High (2)	Consultant/ US$16,250					
		6.3 Workshops on techniques for assessment including CPUE estimations for billfish species in 2018 and 2019.	High (3)	Consultant US$11,750					
7	Target and Limit reference points	7.1 To advise the Commission, by end of 2016 at the latest on Target Reference Points (TRPs) and Limit Reference Points (LRPs).	High (16)						
		7.1.1 Assessment of the interim reference points as well as alternatives: Used when assessing the Swordfish stock status and when establishing the Kobe plot and Kobe matrices.		WPM					
8	Management measure options	8.1 To advise the Commission, by end of 2016 at the latest, on potential management measures having been examined through the Management Strategy Evaluation (MSE) process.	High (17)						

	8.1.1 These management measures will therefore have to ensure the achievement of the conservation and optimal utilization of stocks as laid down in article V of the Agreement for the establishment of the IOTC and more particularly to ensure that, in as short a period as possible and no later than 2020, (i) the fishing mortality rate does not exceed the fishing mortality rate allowing the stock to deliver MSY and (ii) the spawning biomass is maintained at or above its MSY level.	WPM					

APPENDIX XXXVID
WORKING PARTY ON ECOSYSTEMS AND BYCATCH PROGRAM OF WORK (2018–2022)

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				
						2018	2019	2020	2021	2022
	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	17	CSIRO/AZTI/IRD/RITF	Financed (1.3m Euro (EU + 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.									
	1.2 Connectivity, movements and habitat use	High	3							

	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).			AZTI, IRD, Others	Partially funded (153,000€ IOTC + 100.000€ EU/DCF)	BTH OCS	SMA, PTH			
	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).				Funded (50,000€ EU/DCF)	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) including:	High	1							
	2.1.1 Capacity building of fisheries observers (including the provision of ID guides, training, etc.)			WWF-Pakistan/ ACAP (seabirds)	US$20,000 (ID guides)					
	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			TBD						
	2.2 Implementation of the Pilot Project (Resolution 16/04) for the Regional Observer Scheme	High	4							
	2.2.1 Definition of minimum standards and development of a training package for the ROS to be reviewed and rolled out in voluntary CPCs (Sri Lanka, I.R.Iran, Tanzania)				Partially funded (EC)					
	2.2.2 Development of a Regional Observer database and population with historic observer data				Funded (NOAA and EC)					
	2.2.3 Development, piloting and implementation of an electronic reporting tool to facilitate data reporting				Funded (NOAA and EC)					
	2.2.4 Development and trial of Electronic Monitoring Systems for gillnet fleets				Partially funded (EC)					

	2.2.5 Port sampling protocols for artisanal fisheries				Funded (EC)					
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))	High	6		US$?? (TBD)					
	3.1.1 CPCs to provide further research reports on shark biology, namely age and growth studies including through the use of vertebrae or other means, either from data collected through observer programs or other research programs.			CPCs directly	US$?? (TBD)	OCS				
	3.2 Post-release mortality	High	16							
	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.			IRD/ NRIFSF	Partially funded (IOTC + EU/DCF)	OCS, BTH	SMA, PTH			
	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 seine fisheries			IRD/AZTI	Funded (EU/DCF)	OCS				
	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			IRD/AZTI	Funded (EU/DCF)					
	3.3 Reproduction research Priority species: blue shark (BSH), shortfin mako shark (SMA) and oceanic whitetip shark (OCS), and silky shark (FAL))	High	7	CPCs directly	US$??(TBF)	OCS				
	3.4 Ecological Risk Assessment (sharks & rays)	High	2		TBD					
4. Shark bycatch mitigation measures	4.1 Develop studies on shark mitigation measures (operational, technological aspects and best practices)	High	14							

	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)				US$?? (TBD)
	4.1.2 Gillnet selectivity, to assess the effect of mesh size, hanging ratio and net twine on sharks catches composition (i.e. species and size), and fishing yield (socio-economics)			WWF-Pakistan	US$?? (ABNJ funding to WWF)
	4.1.3 Develop guidelines and protocols for safe handling and release of sharks caught on longlines and gillnets fisheries				
	4.1.4 Biodegradable FADs testing and implementing biodegradable FADs in the IO Purse Seine fleet to reduce environmental footprint of the gear.			EU Consortium + ISSF	Funded
5. CPUE standardisation / Stock Assessment / Other indicators	5.1 Develop standardised CPUE series for each key shark species and fishery in the Indian Ocean	High	13		US$?? (TBD)
	5.1.1 Blue shark: Priority fleets: TWN,CHN LL, EU,Spain LL, Japan LL; Indonesia LL; EU,Portugal LL			CPCs directly	US$??
	5.1.2 Shortfin mako shark: Priority fleets: Longline and Gillnet fleets			CPCs directly	US$??
	5.1.3 Oceanic whitetip shark: Priority fleets: Longline fleets; purse seine fleets			CPCs directly	US$??
	5.1.4 Silky shark: Priority fleets: Purse seine fleets			CPCs directly	US$??
	5.2 Joint CPUE standardization across the main LL fleets, using detailed operational data	High	11	Consult.	30,000 €
	5.3 Stock assessment and other indicators	High	12		
	5.3.1 Develop and compare multiple assessment approaches to determining stock status for key shark species (see Table 2)			TBD	Part of: 600K Euro (European Union)

MARINE TURTLES											
6. Marine turtle bycatch mitigation measures	6.1 Review of bycatch mitigation measures	High	8								
	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:			CPCs directly	US$??						
	a) Develop recommendations on appropriate mitigation measures for gillnet, longline and purse seine fisheries in the IOTC area; [mostly completed for LL and PS]				(TBD)						
	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)]										

	6.1.2 Res. 12/04 (para. 11) Part II. The recommendations of the IOTC Working Party on Ecosystems and Bycatch shall be provided to the IOTC Scientific Committee for consideration at its annual session in 2012. In developing its recommendations, the IOTC Working Party on Ecosystems and Bycatch shall examine and take into account the information provided by CPCs in accordance with paragraph 10 of this measure, other research available on the effectiveness of various mitigation methods in the IOTC area, mitigation measures and guidelines adopted by other relevant organizations and, in particular, those of the Western and Central Pacific Fisheries Commission. The IOTC Working Party on Ecosystems and Bycatch will specifically consider the effects of circle hooks on target species catch rates, marine turtle mortalities and other bycatch species.			CPCs directly	US$?? (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.			CPCs directly	Nil						
	6.1.4 ERA (turtles, including LL, PS and GIL)				TBD						
	SEABIRDS										
7. Seabird bycatch mitigation measures	7.1 Review of bycatch mitigation measures	High	10								

	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.			Rep. of Korea, Japan, Birdlife Int.	US$?? (TBD)					
	7.1.2 ERA for sea-birds			ACAP, Birdlife						
CETACEANS										
8.Bycatch assessment and mitigation	8.1 Review and development of cetacean bycatch mitigation measures	High	9							
	8.1.1 Collate all data available on bycatch of key species interacting with all tuna fisheries in the IOTC area (tuna drift gillnets, longlines, purse seines)			Consultancy?	U.S.$??					
	8.1.2 Creation of identification cards for cetacean species in IOTC Area of Competence			IOTC	IOTC / U.S. MM Commission (15k)					
	8.1.3 Conduct an ecological risk assessment for cetaceans in the IOTC area			Consultancy?	?					
	8.1.4 Collaborate with other organisations on the assessment of marine mammal abundance and collect data on marine mammal bycatch interactions with gillnets.			FIU/WWF-Pakistan?	U.S.$? (IWC)					
	8.1.5 Testing mitigation methods for cetacean bycatch in tuna drift gillnet fisheries			WWF Pakistan	U.S. MM Commission? Others?					
DISCARDS										
9. Bycatch mitigation measures	9.1 Review proposal on retention of non-targeted species	High	5							

	9.1.1 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:	Consultant	US$?? (TBD)					
	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, 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.									
		ECOSYSTEMS									
10.	Ecosystems	10.1 Develop a plan for Ecosystem Based Fisheries Management (EBFM) approaches in the IOTC, in conjunction with the Common Oceans Tuna Project.	High	15	WPEB	US$?? (TBD)					
		10.1.1 Training workshop for CPCs on EBFM system and discussion on ecological components and the elements that are needed (ideally in 2018).									
		10.1.2 Workshop for CPCs on developing strategic plan for formalized implementation of EBFM (2019).									
		10.1.3 Implementation of EBFM plan according to approved strategies and executive measures by the IOTC commission during 2020.									
		10.1.4 Evaluation of implemented EBFM plan in IOTC area of competence by the secretariat and review its elements, components and making corrective measures in 2021.									

APPENDIX XXXVIE
WORKING PARTY ON TROPICAL TUNAS PROGRAM OF WORK (2018–2022)

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

Topic	**Sub-topic and project**	**Priority ranking**	**Lead**	**Est. budget (potential source)**	**TIMING**				
					2018	**2019**	**2020**	**2021**	**2022**
1. Stock structure (connectivity and diversity)	1.1 Genetic research to determine the connectivity of tropical tuna species throughout their distribution (including in adjacent Pacific Ocean waters as appropriate) and the effective population size.	High (on-going)	CSIRO/AZTI/IRD/RITF	1.3 m Euro: (European Union; 20% additional co-financing)					
	1.1.4 Next Generation Sequencing (NGS) to determine the degree of shared stocks for tropical tuna species in the Indian Ocean. Population genetic analyses to decipher inter- and intraspecific evolutionary relationships, levels of gene flow (genetic exchange rate), genetic divergence, and effective population sizes.								
	1.1.5 Nuclear markers (i.e. microsatellite) to determine the degree of shared stocks for tropical tuna species in the Indian Ocean with the Pacific Ocean, as appropriate.								
	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 tropical tuna species distribution, making use of conventional and electronic tagging (P-SAT).	Medium		US$?? (TBD)					
	1.2.2 Investigation into the degree of local or open population in main fishing areas (e.g,, the Maldives and Indonesia – archipelagic and open ocean) by using techniques such flux in FAD arrays or used of morphological features such as shape of otoliths.	Medium		Some work ongoing – MDV, IDN					

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	TIMING				
					2018	2019	2020	2021	2022
2. Biological and ecological information (incl. parameters for stock assessment)	2.1 Age and growth								
	2.1.1 Design and develop a plan for a biological sampling program to support research on tropical tuna biology. The plan would consider the need for the sampling program to provide representative coverage of the distribution of the different tropical tuna species within the Indian Ocean and make use of samples and data collected through observer programs, port sampling and/or other research programs. The plan would also consider the types of biological samples that could be collected (e.g. otoliths, spines, gonads, stomachs, muscle and liver tissue, fin clips etc), the sample sizes required for estimating biological parameters, and the logistics involved in collecting, transporting and processing biological samples. The specific biological parameters that could be estimated include, but are not limited to, estimates of growth, age at maturity, fecundity, sex ratio, spawning season, spawning fraction and stock structure.	High	CPCs directly	US$?? (TBD)					
	2.2 Age-at-Maturity								
	2.2.1 CPCs to provide further research reports on tropical tuna biology, namely age and growth studies including gonad maturity studies, or through use of fish otoliths, either from data collected through observer programs or other research programs.	High	CPCs directly	US$?? (TBD)					
3. Ecological information	3.1 Spawning periods and locations								
	3.1.1 Collect gonad samples from tropical tunas to confirm the spawning periods and location of the spawning area that are presently hypothesised for each tropical tuna species.	Medium		US$?? (TBD)					
4. Historical data review	4.1 Changes in fleet dynamics need to be documented by fleet								
	4.1.1 Provide an evaluation of fleet-specific fishery impacts on the stock of bigeye tuna, skipjack tuna and yellowfin tuna. Project	Medium	Consultant	US$30K					

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	TIMING 2018	2019	2020	2021	2022
	potential impact of realizing fleet development plans on the status of tropical tunas based upon most recent stock assessments.								
5. CPUE standardisation	5.1 Develop standardised CPUE series for each tropical tuna fleet/fishery for the Indian Ocean								
	5.1.1 Further development and validation of the collaborative longline CPUE indices using the data from multiple fleets and to provide joint CPUE series for longline fleets where possible	High (on-going)	SC and consultants	US$40K (IOTC)					
	5.1.2 That standardised CPUE index for juvenile yellowfin tuna and bigeye tuna caught by the EU purse seiner fleets, be estimated and submitted to the WPTT before the next round of stock assessments of tropical tunas.		CPCs directly	US$?? (TBD)					
	5.1.3 Development of minimum criteria (e.g. 10% using a simple random stratified sample) for logbook coverage to use data in standardisation processes; and 2) identifying vessels through exploratory analysis that were misreporting, and excluding them from the dataset in the standardisation analysis.		CPCs directly	US$?? (TBD)					
	5.1.4 Vessel identity information for the Japanese fleets for the period prior to 1979 should be obtained either from the original logbooks or from some other source, to the greatest extent possible to allow estimation of catchability change during this period and to permit cluster analysis using vessel level data.		Japan	US$?? (TBD)					
	Bigeye tuna: High priority fleets	High	CPCs directly	US$?? (TBD)					
	Skipjack tuna: High priority fleets	High	CPCs directly	US$?? (TBD)					
	Yellowfin tuna: High priority fleets	High	CPCs directly	US$?? (TBD)					

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	TIMING				
					2018	2019	2020	2021	2022
	5.2 That methods be developed for standardising purse seine catch species composition using operational data, so as to provide alternative indices of relative abundance (see Terms of Reference, Appendix IXb below).	High	Consultant and CPCs directly	US$?? (TBD)					
	5.3 Investigate the potential to use the Indian longline survey as a fishery-independent index of abundance for tropical tunas.	High	Consultant And CPCs directly	US$30K (TBD)					
	5.4 Further investigate and use of gillnet CPUE series from Sri Lankan gillnet fishery	High	Consultant And CPCs directly	US$ (TBD)					
6. Stock assessment / stock indicators	6.1 Develop and compare multiple assessment approaches to determine stock status for tropical tunas 6.2 Scoping of ageing studies of tropical tunas to provide information on population age structure (based on species and age composition of sampled catches) 6.3 Develop a high resolution age structured operating model that can be used to test the spatial assumptions including potential effects of limited tags mixing on stock assessment outcomes (see Terms of Reference, Appendix IXa below). 6.4 Stock assessment priorities – detailed review of the existing data sources, including: i. *Size frequency data: Evaluation of the reliability of length composition from the longline fisheries (including recent and historical data), review of anomalies in the (EU) PS length composition data, and the need for a thorough review of the size frequency data held by IOTC, in collaboration with the fleets*	Medium Medium	Consultant and CPCs directly Consultant and CPCs directly						

Topic	Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	TIMING 2018	2019	2020	2021	2022
	involved, to improve the utilization of these data in tropical tuna stock assessments. ii. *Tagging data: Further analysis of the tag release/recovery data set.* iii. *Alternative CPUE series: a review of the available data from the Indian tuna longline survey data.*								
7. Fishery independent monitoring	7.1 Develop fishery independent estimates of stock abundance to validate the abundance estimates of CPUE series. All of the tropical tuna stock assessments are highly dependent on relative abundance estimates derived from commercial fishery catch rates, and these could be substantially biased despite efforts to standardise for operational variability (e.g. spatio-temporal variability in operations, improved efficiency from new technology, changes in species targeting). Accordingly, the IOTC should continue to explore fisheries independent monitoring options which may be viable through new technologies. There are various options, among which some are already under test. Not all of these options are rated with the same priority, and those being currently under development need to be promoted, as proposed below: i. Acoustic FAD monitoring, with the objective of deriving abundance indices based on the biomass estimates provided by echo-sounder buoys attached to FADs ii. Longline-based surveys (expanding on the Indian model) or “sentinel surveys” in which a small number of commercial sets follow a standardised scientific protocol iii. Aerial surveys, potentially using remotely operated or autonomous drones iv. Studies (research) on flux of tuna around anchored FAD arrays to understand standing stock and independent estimates of the stock abundance.	 High High Medium Medium	Consultant and CPCs directly	US$?? (TBD) US$60K US$?? (TBD)					

Topic		Sub-topic and project	Priority ranking	Lead	Est. budget (potential source)	TIMING 2018	2019	2020	2021	2022
		v. Genetics-based tagging techniques using recaptured individuals or identification of close-related pairs. Use of Close Kin Mark Recapture (CKMR) methods to study fishery independent methods of generating spawner abundance estimates based on genotyping individuals to a level that can identify close relatives (e.g. parent-offspring or half-siblings). The method avoids many of the problems of conventional tagging, e.g. live handling is not required (only catch needs to be sampled), tag shedding, tag-induced mortality and recovery reporting rates are irrelevant. It has been cost-effective in a successful application to southern bluefin tuna, but it remains unknown how the cost scales with population size. It would be valuable to conduct a scoping exercise to evaluate the applicability to the tropical tuna species	Medium							
8	Target and Limit reference points	8.1 To advise the Commission, on Target Reference Points (TRPs) and Limit Reference Points (LRPs). 8.1.1 Used when assessing tropical tuna stock status and when establishing the Kobe plot and Kobe matrices	High	CPC's directly	US$?? (TBD)					

APPENDIX XXXVIF
WORKING PARTY ON DATA COLLECTION AND STATISTICS PROGRAM OF WORK (2018–2022)

Table 1. Priority topics for obtaining the information necessary to deliver the necessary advice to the Commission.

Topic	Sub-topic and project	Priority ranking	Est. budget (potential source)	Timing				
				2018	**2019**	**2020**	**2021**	**2022**
1. Artisanal fisheries data collection	1.1 Assist the implementation of data collection and sampling activities of coastal fisheries in countries/fisheries insufficiently sampled in the past; priority to be given to the following fisheries: • Coastal fisheries of Indonesia • Coastal fisheries of Pakistan • Coastal fisheries of Sri Lanka • Coastal fisheries of Kenya • Coastal fisheries of I.R. Iran • Coastal fisheries of Somalia	1	US$??? (TBD)					
8. Assistance to CPCs for the fulfillment of Resolution 17/01 mandate	2.1 Provide support to identified CPCs to increase their level of monitoring and reporting in accordance with paragraph 8 of Resolution 17/01	**FUNDED**	US$ 60K (EU cofund.)					
3. Review Size Data Longline Fisheries	3.1 Assistance to historical review of length frequency data for longline fisheries, in particular longliners from Taiwan,China and Japan	**FUNDED**	US$ 48K (EU cofund.)					
4. Compliance with IOTC Data Requirements	4.1 Data support missions 4.1.1 Identification of indicators to assess performance of IOTC CPCs against IOTC Data Requirements; evaluation of performance of IOTC CPCs with those Requirements; development of plans of action to address the issues identified, including timeframe of implementation and follow-up activities required. Priority to be given to the following fisheries: • Pakistan • Indonesia	**FUNDED**	US$ 5-10K each (EU cofund.)					

		• Sri Lanka • India • Yemen							
5.	IOTC Data access	5.1 Develop software libraries (in the most widely adopted languages for statistical analysis, e.g. R, Python etc.) to simplify access to the new IOTC Remote data services by scientists	3	US$ 5K (Consultant, TBD)					
		5.2 Identify and add descriptive metadata to main IOTC data sets	3	US$ 30K (Consultant, IOC / IRD ?)					
		5.3 Deliver *R* capacity building support (workshops, training courses) for the manipulation of IOTC data by national scientists	4	US$??? (TBD)					
6.	ROS – Support for the implementation of the IOTC Regional Observer Scheme	6.1 ROS tools							
		6.1.1 Support the adoption of the ROS e-Reporting and ROS national database tools by countries not having any existing observer data collection and management system in place	2	US$??? (TBD)					
		6.2 ROS Regional Database							
		6.2.1 Incorporate all historical observer data currently available in other proprietary data formats (e.g. ObServe database dumps, ICCAT ST09 and other custom observer forms)	2	US$ 20K (Consultant, TBD)					
		6.2.2 Add import / export capabilities from proprietary data collection systems to the ROS Observer Data Model format	2	US$ 35K (Consultant, TBD)					
		6.2.2 Implement dissemination best-practices for all data collected by the ROS Regional Database	2	US$ 20K (TBD - Consultant)					
		6.3 ROS Electronic Monitoring Systems							

	6.3.1 Implement pilot EMS system on gillnet / coastal longline vessels for fleets insufficiently covered by on-board observers	**FUNDED**	US$ 150 k (CPCs, EU co-funded)					

APPENDIX XXXVIG
WORKING PARTY ON METHODS PROGRAM OF WORK (2018–2022)

Table 1. Priority topics for obtaining the information necessary to deliver the necessary advice to the Commission. Resolution 15/10 elements have been incorporated as required by the Commission.

Topic	Sub-topic and project	Research Priority	Funding Priority	Lead	Est. budget (potential source)	Timing				
						2018	2019	2020	2021	2022
1. Management Strategy Evaluation	1.1 Albacore	High	5	EU (JRC)	Funded (EC JRC)					
	1.1.1 Revision of Operating Models based on WPM and SC feedback, including possible robustness tests									
	1.1.2 Implementation of initial set of simulation runs and results									
	1.1.3 Revision of Management Procedures and Indicators after presentation of initial set to TCMP and Commission									
	1.1.4 External peer review (2018 or date TBD)				US$15,000					
	1.1.5 Evaluation of new set of Management Procedures (if required)									
	1.2 Skipjack tuna	High	2	Maldives						
	1.2.1 Review of model implementation and participation in MSE process				$?? (TBD)					
	1.3 Bigeye tuna	High	4							
	1.3.1 Update OM & present preliminary MP results to TCMP, WPTT/WPM review of new OM			Australia (CSIRO)	$75,000 (ABNJ/CSIRO)					
	1.3.2 External peer review (2018 or date TBC)				US$15,000					
	1.3.3 Present revised MP results to TCMP with target adoption date of 2019				$30,000 (Jan - Jun 2018)					

	1.3.4 Additional iterations if required				(TBD)
	1.4 Yellowfin tuna	High	3		
	1.4.1 Update OM & present preliminary MP results to TCMP, WPTT/WPM review of new OM			Australia (CSIRO)	Funded to Dec 2018 (ABNJ/CSIRO)
	1.4.2 External peer review (2018 or date TBD)				US$15,000
	1.4.3 Present revised MP results to TCMP with target adoption date of 2018; iteratively update development if required)				US$30,000 (Jan-Jun 2018)
	1.4.4 additional iterations if required				(TBD)
	1.5 Swordfish	High	1	TBD	$?? (TBD)
	1.5.1 Initial OM				
	1.5.2 Conditioning and OM set up				
	1.5.3 Generic MP tests				
	1.5.4 Final Model with MPs				
	1.5.5 External peer review				US$15,000
2. Presentation of stock status advice for data limited stocks	2.1 Explore potential methods of presenting stock status advice to managers from a range of data limited scenarios, e.g. through the development of a 'Tier' approach for providing stock status advice, based on the type of indictors used to determine stock status (e.g. CPUE series, stock assessment model)	Medium	7	Consult.	US$10,000 (TBD)
3. Multiple stock status derived from different model structures	3.1 Develop specific guidance for the most appropriate models to be used or how to synthesize the results when multiple stock assessment models are presented. (*see IOTC-2016-WPTT18-R, para.91*)	Medium	6		$?? (TBD)

Appendix XXXVII
Schedule of stock assessments for IOTC species and species of interest from 2018–2022, and for other Working Party priorities

Working Party on Neritic Tunas					
Species	**2018**	**2019**	**2020**	**2021**	**2022**
Bullet tuna	CPUE workshop	Biological parameters	Data-poor assessment	Workshop on priority topic in PoW	Workshop on priority topic in PoW
Frigate tuna	CPUE workshop	Biological parameters	Data-poor assessment	Workshop on priority topic in PoW	Workshop on priority topic in PoW
Indo-Pacific king mackerel	CPUE workshop	Biological parameters	Data-poor assessment	Workshop on priority topic in PoW	Workshop on priority topic in PoW
Kawakawa	CPUE workshop	Biological parameters	**Assessment***	Workshop on priority topic in PoW	Workshop on priority topic in PoW
Longtail tuna	CPUE workshop	Biological parameters	**Assessment***	Workshop on priority topic in PoW	Workshop on priority topic in PoW
Narrow-barred Spanish mackerel	CPUE workshop	Biological parameters	**Assessment***	Workshop on priority topic in PoW	Workshop on priority topic in PoW
Working Party on Billfish					
Species	**2018**	**2019**	**2020**	**2021**	**2022**
Black marlin	**Full assessment**		**Full assessment**		**Full assessment**
Blue marlin		**Full assessment**			**Full assessment**
Striped marlin	**Full assessment**			**Full assessment**	
Swordfish		Indicators	**Full assessment**		
Indo-Pacific sailfish		**Full assessment***		**Full assessment***	
Working Party on Tropical Tunas					
Species	**2018**	**2019**	**2020**	**2021**	**2022**
Bigeye tuna	Indicators	**Full assessment**	Indicators	Indicators	**Full assessment**
Skipjack tuna	Indicators	Indicators	**Full assessment**	Indicators	Indicators
Yellowfin tuna	**Full assessment**	Indicators	Indicators	**Full assessment**	Indicators
Working Party on Ecosystems and Bycatch					
Species	**2018**	**2019**	**2020**	**2021**	**2022**
Blue shark	Revisit ERA		Indicators	**Full assessment***	Indicators
Oceanic whitetip shark	Revisit ERA	Indicators	**Full assessment***	Revisit ERA	Indicators
Scalloped hammerhead shark	Revisit ERA		–	Revisit ERA	Indicators

Shortfin mako shark	Revisit ERA	Indicators–	**Full assessment***	Revisit ERA	–
Silky shark	Indicators; Revisit ERA	**Full assessment***	**–**	Indicators; Revisit ERA	**Full assessment***
Bigeye thresher shark	Revisit ERA	**–**	**–**	Revisit ERA	–
Pelagic thresher shark	Revisit ERA	**–**	**–**	Revisit ERA	–
Porbeagle shark	–	**–**	**–**	–	–
Marine turtles	Revisit ERA	**–**	**Review of mitigation measures in Res. 12/04**	Revisit ERA	–
Seabirds	–	**ERA; Review of mitigation measures in Res.**	**–**	-	Review of mitigation measures in Res. 12/06
Marine Mammals	Indicators; Results from Common Oceans Gillnets project	**Report from the IWC**	**–**	ERA	–
Ecosystem Based Fisheries Management (EBFM) approaches	Preliminary report cards	**–**	**–**	–	–

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

Working Party on Temperate Tunas					
Species	**2017**	**2018**	**2019**	**2020**	**2021**
Albacore	–	–	Data preparatory meeting **and Stock assessment**	–	Data preparatory meeting

APPENDIX XXXVIII
SCHEDULE OF IOTC SCIENCE MEETINGS IN 2018 AND 2019

	2018			2019		
Meeting	**No.**	**Date**	**Location**	**No.**	**Date**	**Location**
Working Party on **NeriticTunas**	8th	4 – 7 June	Kenya/Mozambique	9th	TBD	TBD
Working Party on **Temperate Tunas**		-	-	Data Prep 7th	January 2019 July 2019	Malaysia Shimizu (Japan)
Working Party on **Billfish**	16th	4-8 September (5d)	South Africa	17th	9 -13 September (5d)	La Réunion (TBC)
Working Party on **Ecosystems and Bycatch**	14th	10-14 September (5d)	South Africa	15th	3 - 7 September (5d)	La Réunion (TBC)
Working Party on **Methods**	9th	25-27 October (3d)	TBD	10th	Third week in October (3d) (with WPTT)	TBD
Working Party on **Tropical Tunas**	20th	29 Oct – 3 November (6d)	TBD	21st	Third week in October (6d)	TBD
Working Party on **Data Collection and Statistics**	14th	29 November – 1 December (3d)	Seychelles	15th	November (3d)	Seychelles
Scientific Committee	21st	3 – 7 December	Seychelles	22nd	November (5d)	Seychelles

APPENDIX XXXIX
CONSOLIDATED SET OF RECOMMENDATIONS OF THE 20TH SESSION OF THE SCIENTIFIC COMMITTEE (30 NOVEMBER–4 DECEMBER 2017) TO THE COMMISSION

STATUS OF TUNA AND TUNA-LIKE RESOURCES IN THE INDIAN OCEAN AND ASSOCIATED SPECIES

Tuna – Highly migratory species

SC20.01 (para. 176) The SC **RECOMMENDED** that the Commission note the management advice developed for each tropical and temperate tuna species as provided in the Executive Summary for each species, and the combined Kobe plot for the four species assigned a stock status in 2017 (Fig. 4):

- Albacore (*Thunnus alalunga*) – Appendix VIII
- Bigeye tuna (*Thunnus obesus*) – Appendix IX
- Skipjack tuna (*Katsuwonus pelamis*) – Appendix X
- Yellowfin tuna (*Thunnus albacares*) – Appendix XI

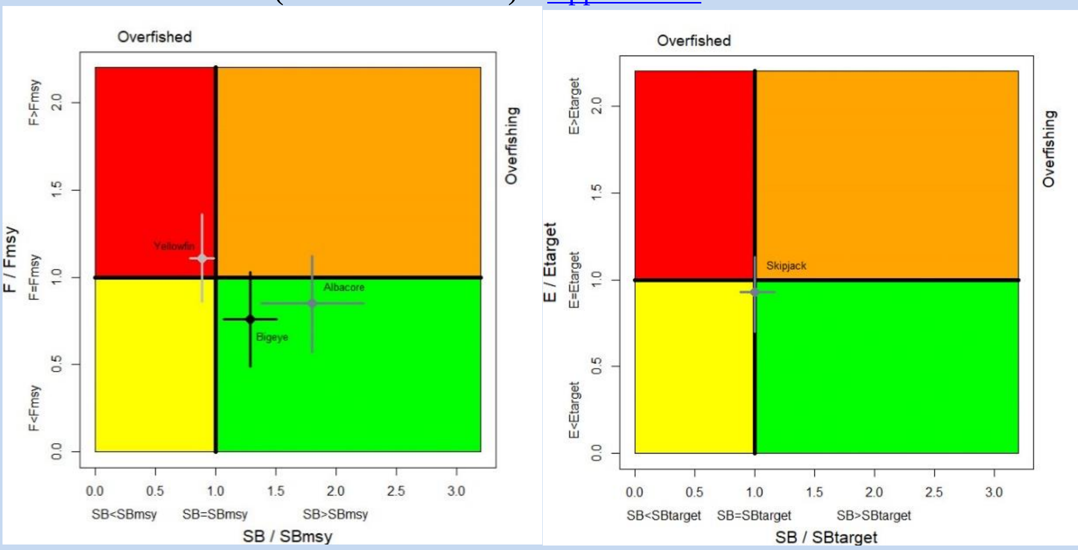

Fig. 4. (Left) Combined Kobe plot for bigeye tuna (black: 2015), yellowfin tuna (grey: 2015), and albacore tuna (dark grey: 2014) showing the estimates of current spawning stock size (SB) and current fishing mortality (F) in relation to SBtarget and Ftarget. (Right) Kobe plot for skipjack tuna (2016) showing the estimates of the current spawning stock status (SB) and exploitation rate in relation to SBtarget and Etarget. Numbers in brackets indicate the last year of data available at the time of the assessment. Cross bars illustrate the range of uncertainty from the model runs with 80% CI.

Billfish

SC20.02 (para. 179) The SC **RECOMMENDED** that the Commission note the management advice developed for each billfish species under the IOTC mandate, as provided in the Executive Summary for each species, and the combined Kobe plot for the five species assigned a stock status in 2017 (Fig. 6):

- Swordfish (*Xiphias gladius*) – Appendix XII
- Black marlin (*Makaira indica*) – Appendix XIII
- Blue marlin (*Makaira nigricans*) – Appendix XIV
- Striped marlin (*Tetrapturus audax*) – Appendix XV
- Indo-Pacific sailfish (*Istiophorus platypterus*) – Appendix XVI

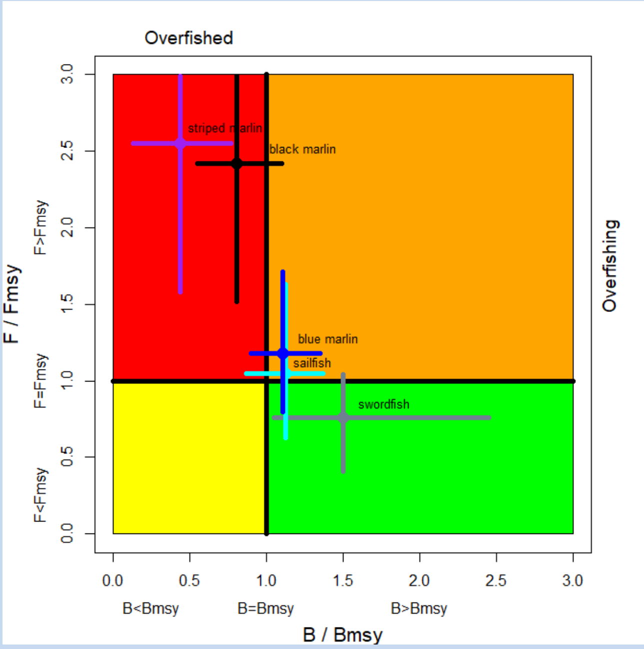

Fig. 6. Combined Kobe plot for swordfish (grey: 2015), indo-pacific sailfish (cyan: 2014), black marlin (black: 2015), blue marlin (blue: 2015) and striped marlin (purple: 2015) showing the estimates of stock size (SB or B, species assessment dependent) and fishing mortality (F) in relation to MSY-based reference points. Numbers in brackets indicate the last year of data available at the time of the assessment. Cross bars illustrate the range of uncertainty from the model runs.

Tuna and seerfish – Neritic species

SC20.03 (para. 178) The SC **RECOMMENDED** that the Commission note the management advice developed for each neritic tuna (and mackerel) species under the IOTC mandate, as provided in the Executive Summary for each species, and the combined Kobe plot for the three species assigned a stock status in 2017 (Fig. 5):

- Bullet tuna (*Auxis rochei*) – Appendix XVII
- Frigate tuna (*Auxis thazard*) – Appendix XVIII
- Kawakawa (*Euthynnus affinis*) – Appendix XIX
- Longtail tuna (*Thunnus tonggol*) – Appendix XX
- Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix XXI
- Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix XXII

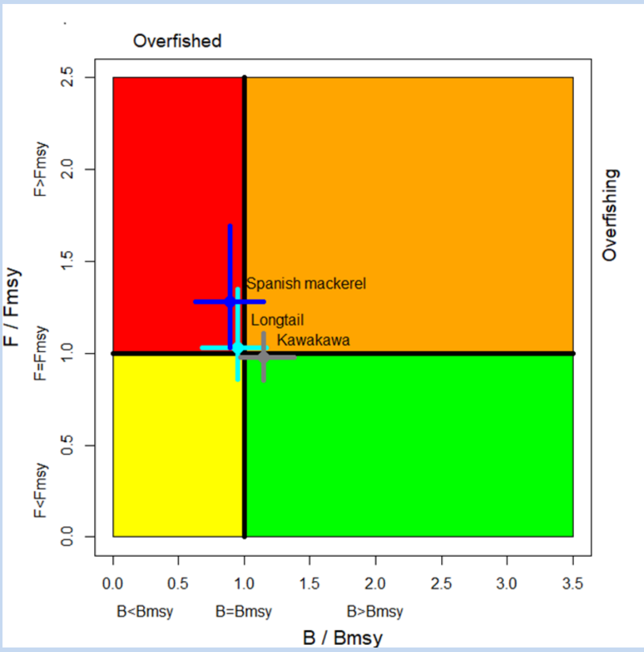

Fig. 5. Combined Kobe plot for longtail tuna (cyan: 2016), narrow-barred Spanish mackerel (dark blue: 2016), and kawakawa (white: 2015) showing the estimates of stock size (B) and current fishing mortality (F) in relation to MSY-based reference points.

Numbers in brackets indicate the last year of data available at the time of the assessment. Cross bars illustrate the range of uncertainty from the model runs.

Sharks

SC20.04 (para. 180) The SC **RECOMMENDED** that the Commission note the management advice developed for a subset of shark species commonly caught in IOTC fisheries for tuna and tuna-like species:

- Blue shark (*Prionace glauca*) – Appendix XXIII
- Oceanic whitetip shark (*Carcharhinus longimanus*) – Appendix XXIV
- Scalloped hammerhead shark (*Sphyrna lewini*) – Appendix XXV
- Shortfin mako shark (*Isurus oxyrinchus*) – Appendix XXVI
- Silky shark (*Carcharhinus falciformis*) – Appendix XXVII
- Bigeye thresher shark (*Alopias superciliosus*) – Appendix XXVIII
- Pelagic thresher shark (*Alopias pelagicus*) – Appendix XXIX

Marine turtles

SC20.05 (para. 181) The SC **RECOMMENDED** that the Commission note the management advice developed for marine turtles, as provided in the Executive Summary encompassing all six species found in the Indian Ocean:

- Marine turtles – Appendix XXX

Seabirds

SC20.06 (para. 182) The SC **RECOMMENDED** that the Commission note the management advice developed for seabirds, as provided in the Executive Summary encompassing all species commonly interacting with IOTC fisheries for tuna and tuna-like species:

- Seabirds – Appendix XXXI

Cetaceans

SC20.07 (para. 183) The SC **RECOMMENDED** that the Commission note the management advice developed for cetaceans, as provided in the newly developed Executive Summary encompassing all species commonly interacting with IOTC fisheries for tuna and tuna-like species:

- Cetaceans – Appendix XXXII

GENERAL RECOMMENDATIONS TO THE COMMISSION

PREVIOUS DECISIONS OF THE COMMISSION

SC20.08 (para. 13) The SC **RECOMMENDED** that Resolution 15/02 *Mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)* be reviewed to include the mandatory reporting of zero catches for all species under the mandate of IOTC, in order to support the implementation of IOTC Resolution 16/06 *On measures applicable in case of non fulfilment of reporting obligations in the IOTC*.

NATIONAL REPORTS FROM CPCS

SC20.09 (para. 24) Noting that the Commission, at its 15th Session, expressed concern regarding the limited submission of National Reports to the SC, and stressed the importance of providing the reports by all CPCs, the SC **RECOMMENDED** that the Commission note that in 2017, 22 reports were provided by CPCs (23 in 2016, 26 in 2015, 26 in 2014) (Table 2).

SC20.10 (para. 25) The SC **RECOMMENDED** that the Compliance Committee and Commission note the lack of compliance by 10 Contracting Parties (Members) and 2 Cooperating Non-Contracting Parties (CNCPs) that did not submit a National Report to the Scientific Committee in 2017, noting that the Commission agreed that the submission of the annual reports to the Scientific Committee is mandatory.

REPORT OF THE 7TH SESSION OF THE WORKING PARTY ON NERITIC TUNAS (WPNT07)

DATA QUALITY ISSUES

SC20.11 (para. 32) The SC noted that compliance with data reporting obligations is particularly low for neritic tuna species, despite the importance of scientific data for stock assessment, and **REQUESTED** CPCs do their best to collect data and comply with data reporting requirements adopted by the IOTC. The SC further **RECOMMENDED** that mechanisms are developed by the Commission to improve current scientific advice by encouraging CPCs to comply with their data recording and reporting requirements.

SC20.12 (para. 33) Noting a number of long-standing data reporting or data quality issues that severely impact the assessment of neritic species, the SC **RECOMMENDED** that funds be made available to the IOTC Secretariat (either through the IOTC Regular Budget or from external sources) dedicated to capacity building activities, or data compliance and support missions, aimed at improving the availability of data for those countries identified as a priority for neritic species in terms of importance of catches. Specifically:

viii. when sufficient data is recovered, or made available, that the IOTC Secretariat allocates funds to assist with the development of a standardized CPUE series for gillnets, in collaboration with IOTC members, including organization of a joint-workshop or hiring of an international consultant;

ix. that the IOTC Secretariat formally communicates to India requesting the submission of mandatory datasets according to the requirements of IOTC Resolution 15/02 and, if necessary, conducts a Data Compliance and Support mission to facilitate the reporting of data to the IOTC;

x. that the IOTC Secretariat continues to support the work of WWF-Pakistan and the Government of Pakistan in the evaluation and reporting of the crew-based observer program, and facilitate the reporting of length data and catch-and-effort collected by the observer log-books

SC20.13 (para. 34) The SC **AGREED** that a new item on data mining and collation of historical and current catch data for these species should be added as a fundamental piece of work to be undertaken as a priority and **RECOMMENDED** that this work is supported by the IOTC Secretariat.

CPUE standardisation

SC20.14 (para. 35) Acknowledging the importance of indices of abundance for future stock assessments, the SC **RECOMMENDED** that the development of standardised CPUE series is explored, based on the guidelines developed by the SC in 2015 (*Guidelines for the presentation of CPUE standardisations and stock assessment models*[48]), with priority given to fleets which account for the largest catches of neritic tuna and tuna-like species (e.g., I.R. Iran, Indonesia, India, Pakistan, and Sri Lanka).

Working party attendance and the MPF

SC20.15 (para. 42) The SC **RECOMMENDED** that the Commission note the following:

1) The participation of developing coastal state scientists to the WPNT has been consistently high following the adoption and implementation of the IOTC Meeting Participation Fund adopted by the Commission in 2010 (Resolution 10/05 On the establishment of a Meeting Participation Fund for developing IOTC Members and Non-Contracting Cooperating Parties), now incorporated into the IOTC Rules of Procedure (2014), as well as though the hosting of the WPNT in developing coastal State Contracting Parties (Members) of the Commission (Table 8).

2) The continued success of the WPNT, at least in the short term, appears heavily reliant on the provision of support via the MPF which was established primarily for the purposes of supporting scientists to attend and contribute to the work of the Scientific Committee and its Working Parties.

3) The MPF should be utilised so as to ensure that all developing Contracting Parties of the Commission are able to attend the WPNT meeting, as neritic tunas are very important resources for many of the coastal countries of the Indian Ocean.

REPORT OF THE 15[TH] SESSION OF THE WORKING PARTY ON BILLFISH (WPB15)

SC20.16 (para. 44) The SC recalled its previous **RECOMMENDATION** that on the next revision of the IOTC Agreement, the shortbill spearfish (*Tetrapturus angustirostris*) be included as an IOTC species.

Billfish species identification

SC20.17 (para. 49) The SC **AGREED** on the importance of the hard, waterproof copies of the billfish IOTC species identification guides for observers and port samplers, and again **RECOMMENDED** that funds are allocated for further printing of the species ID guides for distribution to sports fishing clubs and recreational fisheries to improve the quality of data reported, and that additional funds be provided for the translation of these into the priority languages identified by the SC.

Swordfish stock assessment and MSE

SC20.18 (para. 55) The SC noted that the next step of the swordfish MSE is to finalize the OM and present the results to the TCMP02 within the current resource constraints (e.g., staff time and travelling). Noting that the Commission considers the development of an MSE for swordfish to be a high priority activity, the SC **RECOMMENDED** that this is reflected in the 2019 budget of the Commission.

Resolution 15/05 conservation measures for billfish

SC20.19 (para. 58) The SC noted that catches for Black Marlin, Blue Marlin, and Striped Marlin have increased in 2016 (and 2015) from the average level of 2009-2014 as observed in Appendix VIa. The catch in 2016 for Blue marlin was 3,510 t higher (27 % larger) than the average 2009-2014, 4,286 t larger (32 %) for Black marlin and 1,398 (36 %) for Striped marlin. Considering the status of these stocks the SC urgently **RECOMMENDED** that measures are agreed to recover the status of the stock of the three marlin species covered by Resolution 15/05 as per the management advice given in the Executive Summaries.

REPORT OF THE 13[TH] SESSION OF THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH (WPEB13)

Evaluation of the mitigation measures contained in Resolution 13/06 for Oceanic whitetip shark

SC20.20 (para. 61) The SC noted the ongoing compliance issue for those CPCs reporting nominal catch of oceanic whitetip sharks and **RECOMMENDED** that the Compliance Committee investigate these reported catches further and report the findings to the Commission.

Longline hook identification guide

SC20.21 (para. 62) 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 SC reiterated its previous **RECOMMENDATION** (SC19.16; para. 55 of IOTC-2016-SC19-R) that the Commission allocate funds in the 2018 IOTC Budget to develop an identification guide for fishing hooks and pelagic fishing gears used in IOTC fisheries

CPUE Collaborative study of shark CPUE from multiple Indian Ocean longline fleets

SC20.22 (para. 63) Noting the conflicting patterns in blue shark CPUE derived from different Indian Ocean longline fleets and considering the success of using joint analysis of operational catch and effort data to resolve such conflicts in other Working Parties, the SC **RECOMMENDED** initiating work on joint analysis of operational catch and effort data from multiple fleets, to further develop methods and to provide indices of abundance for sharks of interest to the IOTC. A consultant should be considered to conduct such work for a budget of around EUR45, 000.

Review of mitigation measures in Resolution 12/04

SC20.23 (para. 67) Noting the findings of the Pacific workshop regarding the effectiveness of large circle hooks, finfish bait and the removal of the first and/or second hooks next to the floats for mitigating sea turtle

[48] http://iotc.org/documents/guidelines-presentation-cpue-standardisations-and-stock-assessment-models-1

interactions and mortalities in Pacific longline fisheries, the SC **AGREED** that further consideration of these mitigation techniques for Indian Ocean fisheries is warranted. Such a study should attempt to develop findings regarding the consequences of various mitigation techniques, primarily with regard to impacts on target and non-turtle bycatch species catch rates, to the extent possible based on data availability and quality. The SC therefore **RECOMMENDED** that the potential for a similar workshop to be held in the Indian Ocean is explored with potential funding from the Commission and/or from the Common Oceans ABNJ Tuna Project. The SC noted this is included in the WPEB workplan and **REQUESTED** the WPEB Chairperson work with the Secretariat to pursue this idea further with potential participants and funding sources.

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

SC20.24 (para. 69) The SC **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 in 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.

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

SC20.25 (para. 70) The SC noted the need for training and capacity building as the first step to moving forward with developing goals and strategies for the implementation of EBFM and therefore **RECOMMENDED** that a workshop is held to explain the key elements of EBFM so that a plan for implementation of EBFM in the IOTC Area of Competence can be developed by 2019.

REPORT OF THE 19TH SESSION OF THE WORKING PARTY ON TROPICAL TUNAS (WPTT19)

Review of new information on the status of bigeye tuna: Nominal and standardised CPUE indices

SC20.26 (para. 78) The SC acknowledged the efficiency value of making the operational logbook data available to appropriate analysts outside of the responsible CPCs, and **RECOMMENDED** that high level arrangements for sharing and confidentiality should be pursued. Noting the confidentiality issues with some of the datasets, the SC **REQUESTED** that the IOTC Secretariat and main stakeholders explore options to facilitate future data sharing agreements which, once in place, may not necessitate face-to-face meetings and could instead include remote processes

SC20.27 (para. 79) The SC **RECOMMENDED** that the joint longline CPUE standardization for tropical tunas should continue, and that further development work should be assigned a high priority. Acknowledging that the law of diminishing returns will affect similar future analyses, the SC suggested that immediate priorities should focus on the following areas:

- develop joint CPUE indices for other IOTC species (i.e., billfish and sharks);
- explore possibilities for including CPUE data provided by other IOTC CPCs (particularly coastal fisheries);
- identify a unified approach for species targeting using simulation testing (for example, the value of cluster analysis is clear in the temperate regions, but less so in tropical regions);
- recover vessel identification details from historical data;
- further develop the work on time-area interactions. Include a detailed examination of catch rates and related data in the piracy area, comparing pre-piracy and post-piracy effects. Potentially also consider the effects of localised depletion and renewal processes on catch rates.
- conduct further analyses to explore 1977 discontinuity (other oceans);
- develop an Indian Ocean CPUE reference manual for practitioners to use
- explore other density probability functions to improve model fit.

Skipjack stock assessment

SC20.28 (para. 88) The SC noted that catches of skipjack in recent years are close to the recommended annual catch limit from the HCR, and **RECOMMENDED** that the Commission encourage CPCs to closely monitor catches of skipjack tuna to ensure that the integrity of the catch limit is maintained.

REPORT OF THE 6TH SESSION OF THE WORKING PARTY ON TEMPERATE TUNAS (WPTMT6)

Review of data available at the IOTC Secretariat for temperate tuna species

SC20.29 (para. 91) The SC **RECOMMENDED** that funding be allocated for the further development of the combined joint CPUE series which incorporates the standardized indices of abundance for Japan, Republic of Korea, and Taiwan,China, and that an update is provided at the next WPTmT meeting prior to the next stock assessment of albacore.

New information on biology, ecology, fisheries and environmental data relating to temperate tunas

SC20.30 (para. 92) Noting the general paucity of biological indicators available from the Indian Ocean, and particularly the lack of age-specific maturity as a primary source of uncertainty in the stock assessment of albacore tuna, the SC recalled its previous **RECOMMENDATION** that a study on the growth curve of albacore tuna in the Indian Ocean be given a high priority in the SC Program of Work and that the study is completed prior to the next meeting of the WPTmT scheduled for 2019.

REPORT OF THE 8TH SESSION OF THE WORKING PARTY ON METHOD (WPM08)

Update on the status of the joint CPUE indices (yellowfin tuna, bigeye tuna & albacore)

SC20.31 (para. 100) The SC recognized the importance of normalizing these procedures and approaches into the various Working Party stock assessments making use of longline catch rate indices, **ENDORSED s**uch joint analyses and **RECOMMENDED** these continue into the future as a normal course of business. It was noted that additional time for more detailed analysis is still needed and SC **REQUESTED** that methods to increase analysis time, such as the use of secure, cloud-based data exchange and increased use of electronic communication between analysts be investigated.

SC20.32 (para. 101) The SC congratulated the WPM for the investigation of catchability/selectivity changes and spatial size patterns of bigeye and yellowfin tuna in the early years of the Japanese longline fishery and **AGREED** that this work is important in terms of improving understanding of the trends in CPUE. Noting that various issues have been identified that could be explored further, the SC **RECOMMENDED** that this work is continued.

Priorities for future development of the joint CPUE indices

SC20.33 (para. 102) The SC noted that a substantial amount of work has already been completed for the tropical tunas and that it may be more worthwhile to focus on some other species for which this approach would be useful. The SC therefore **RECOMMENDED** that a similar joint analysis approach is explored for key IOTC billfish and shark species.

Presentation of stock status advice for data limited stocks

SC20.34 (para. 106) The SC **AGREED** that work on the presentation of stock status advice for data limited stocks will need to be carried out inter-sessionally, and that this will require some level of preparation and planning. The SC **REQUESTED** the WPM Chairperson liaise with the Chairs of the species WPs (WPNT and WPB) in order to draft a study proposal on this issue and **RECOMMENDED** the Commission allocates funding to this project.

REPORT OF THE 13TH SESSION OF THE WORKING PARTY ON DATA COLLECTION AND STATISTICS (WPDCS13)

ROS E-reporting and E-monitoring projects

SC20.35 (para. 112) The SC **RECOMMENDED** that a data exchange be implemented between existing software formats used for the collection of observer data by CPCs (e.g., ObServe), and the IOTC Regional Observer Database, to facilitate the transfer of historical observer data to the IOTC database for future dissemination and analysis.

SC20.36 (para. 115) Resolution 11/04 On a Regional Observer Scheme requests the submission of a report after each trip but the SC **RECOMMENDED** that on the next revision of the Resolution, this should be amended to request the submission of data in an electronic format suitable for automated data extraction (including historic data) with a given deadline so that information from multiple trips can be provided.

General discussion on data issues

SC20.37 (para. 118) Acknowledging the substantial gaps in reporting of mandatory IOTC datasets by many CPCs to the IOTC Secretariat, which increases the uncertainty of stock assessments and management advice based on these data, the SC strongly **RECOMMENDED** the Commission strengthen the penalty mechanisms adopted in *Resolution 16/06 On measures applicable in case of non-fulfilment of reporting obligations in the IOTC* to improve compliance by CPCs in terms of the submission of basic fishery data in accordance with Resolution 15/01 and 15/02.

SC20.38 (para. 119) The SC noted the issues with the lack of data and problems of poor data quality that were identified throughout the Working Party reports and strongly **RECOMMENDED** that these issues are addressed through improved compliance with Resolutions 15/01 *On the recording of catch and effort data by fishing vessels in the IOTC area of competence*, and 15/02 *Mandatory statistical reporting requirements for IOTC contracting parties and cooperating non-contracting parties*.

SUMMARY DISCUSSION OF MATTERS COMMON TO WORKING PARTIES (CAPACITY BUILDING ACTIVITIES – STOCK ASSESSMENT COURSE; CONNECTING SCIENCE AND MANAGEMENT, ETC.)

Data collection and capacity building

SC20.39 (para. 122) The SC **AGREED** that, while external funding is helping the work of the Commission, funds allocated by the Commission to capacity building are still too low, considering the range of issues identified by the SC and its Working Parties, particularly in relation to the implementation of the Regional Observer Scheme and data collection and reporting for artisanal fisheries and **RECOMMENDED** that the Commission further increases the IOTC Capacity Building budget to fund these activities in the future.

Invited Expert(s) at the WP meetings

SC20.40 (para. 124) Given the importance of external peer review for working party meetings, the SC **RECOMMENDED** that the Commission continues to allocate sufficient budget for an invited expert to be regularly invited to all scientific WP meetings.

Meeting participation fund

SC20.41 (para. 126) The SC reiterated its **RECOMMENDATION** 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, and that the full Draft paper be submitted no later than 45 days before the start of the relevant meeting. The aim is to allow the Selection Panel to 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.

IOTC species identification guides: Tuna and tuna-like species

SC20.42 (para. 127) The SC reiterated its **RECOMMENDATION** that the Commission allocates budget towards continuing the translation and printing of the IOTC species ID guides so that hard copies of the identification cards can 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.

IOTC Secretariat staffing

SC20.43 (para. 128) Noting the very heavy workload at the IOTC Secretariat and the ever increasing demands by the Commission and the Scientific Committee, and also the capacity to respond to requests for assistance by countries, the SC **RECOMMENDED** that the recommendation from the Performance Review PRIOTC02.07(g) is implemented, and that permanent staff of the IOTC Data and Science Section be increased by two (2) (1 x P4 and 1 x P3 level positions), supplemented by additional short-term consultants, to commence work by late-2018 or earlier, and that funding for these new positions should come from both the IOTC regular budget and from external sources to reduce the financial burden on the IOTC membership.

Chairpersons and Vice-Chairpersons of the SC and its subsidiary bodies

SC20.44 (para. 132) SC **RECOMMENDED** that the Commission note and endorse the Chairpersons and Vice-Chairpersons for the SC and its subsidiary bodies for the coming years, as provided in Appendix VII.

Outcomes of the IOTC and joint t-RFMO FAD Working Group

SC20.45 (para. 150) Noting that Resolution 17/08 provides a start date for the implementation of non-entangling FADs, but no end date, the SC **RECOMMENDED** that this Resolution is revised to include a date by which non-entangling FADs should be fully implemented.

"*To reduce the entanglement of sharks, marine turtles or any other species, the design and deployment of FADs shall be based on the principles set out in Annex III, which will be applied gradually from 2014*" (Resolution 17/08, para. 13).

Biodegradable FAD (BIOFAD) project

SC20.46 (para. 163) The SC noted the challenges in conducting studies on biodegradable FADs (for example the limit on the number of active FADs per purse seine vessel in the Indian Ocean that may hinder the deployment of BIOFADs following experimental sampling designs, and also engagement with the fleet to deploy BIOFADs that may not be successful for fishing). Thus, the SC **RECOMMENDED** the Commission consider special allocations for experimental FADs deployed for the collection of scientific data for vessels willing to participate in biodegradable FAD testing under protocols reviewed and endorsed by the Scientific Committee.

Implementation of the Regional Observer Scheme

SC20.47 (para. 197) The SC therefore **RECOMMENDED** that the EMS standards presented for purse seine fisheries (IOTC-2016-SC19-15) are adopted and **REQUESTED** that draft standards are similarly proposed for the longline fleets by CPCs currently trialling and implementing EMS on these vessels and that draft standards are also developed for gillnet fleets through the ROS Pilot Project.

Progress on the Implementation of the Recommendations of the Performance Review Panel

SC20.48 (para. 201) The SC **RECOMMENDED** that the Commission note the updates on progress regarding Resolution 16/03, as provided at Appendix XXXIII.

Program of work and schedule of Working Party and Scientific Committee meetings

Consultants

SC20.49 (para. 212) Noting the highly beneficial and relevant work done by IOTC stock assessment consultants in 2016 and in previous years, the SC **RECOMMENDED** that the engagement of consultants be continued for each coming year based on the Program of Work. Consultants will be hired to supplement the skill set available within the IOTC Secretariat and CPCs.

Other Business

Template for Invited Experts

SC20.50 (para. 237) Noting the recommendation of the IOTC Performance Review (PRIOTC02.02d), the SC **AGREED** that a comprehensive, formal external peer review is sometimes important for important or contentious assessments. Thus, the SC **RECOMMENDED** that a process is established and that the Commission allocates funding for external peer review of stock assessments to take place periodically, based on priorities identified by the SC, and **REQUESTED** that the Secretariat develop ToRs for these, with input from the SC Chair and Vice-Chair, and potentially based on a framework similar to that established for the Center for Independent Experts.

Review of the Draft, and Adoption of the Report of the 18th Session of the Scientific Committee

SC20.51 (para. 239) The SC **RECOMMENDED** that the Commission consider the consolidated set of recommendations arising from SC20, provided at Appendix XXXVII.