Report of the 23rd Session of the IOTC Scientific Committee

Held by video-conference, 7 – 11 December 2020

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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
EM/EMS	Electronic Monitoring/Electronic Monitoring System
ERA	Ecological Risk Assessment
EU	European Union
F	Fishing mortality; F_{2010} is the fishing mortality estimated in the year 2010
FAD	Fish Aggregation device
FAO	Food and Agriculture Organization of the United Nations
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 Applicable
NGO	Non-Governmental Organization
NPOA	National Plan of Action
OFCF	Overseas Fishery Cooperation Foundation of Japan
OM	Operating Model
OT	Overseas 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
SB	Spawning Biomass
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 23rd Session of the Indian Ocean Tuna Commission (IOTC) Scientific Committee (SC) was held Online, from 7 – 11 December 2020. A total of 141 delegates and other participants attended the Session (43 in 2019), comprised of 112 delegates (34 in 2019) from 20 Contracting Parties, and 0 delegates from Cooperating Non-Contracting Parties (0 in 2019), and 29 participants from 13 observer organisations (including the invited experts). The meeting was chaired by the Chairperson, Dr Toshihide Kitakado (Japan). The list of participants is provided at Appendix 1.

The following are the recommendations from the 23rd Session of the Scientific Committee, which are provided in Appendix 38.

Tuna – Highly migratory species

SC23.01 (para. 130) 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 2020 (Fig. 1):

- Albacore (*Thunnus alalunga*) – Appendix 8
- Bigeye tuna (*Thunnus obesus*) – Appendix 9
- Skipjack tuna (*Katsuwonus pelamis*) – Appendix 10
- Yellowfin tuna (*Thunnus albacares*) – Appendix 11

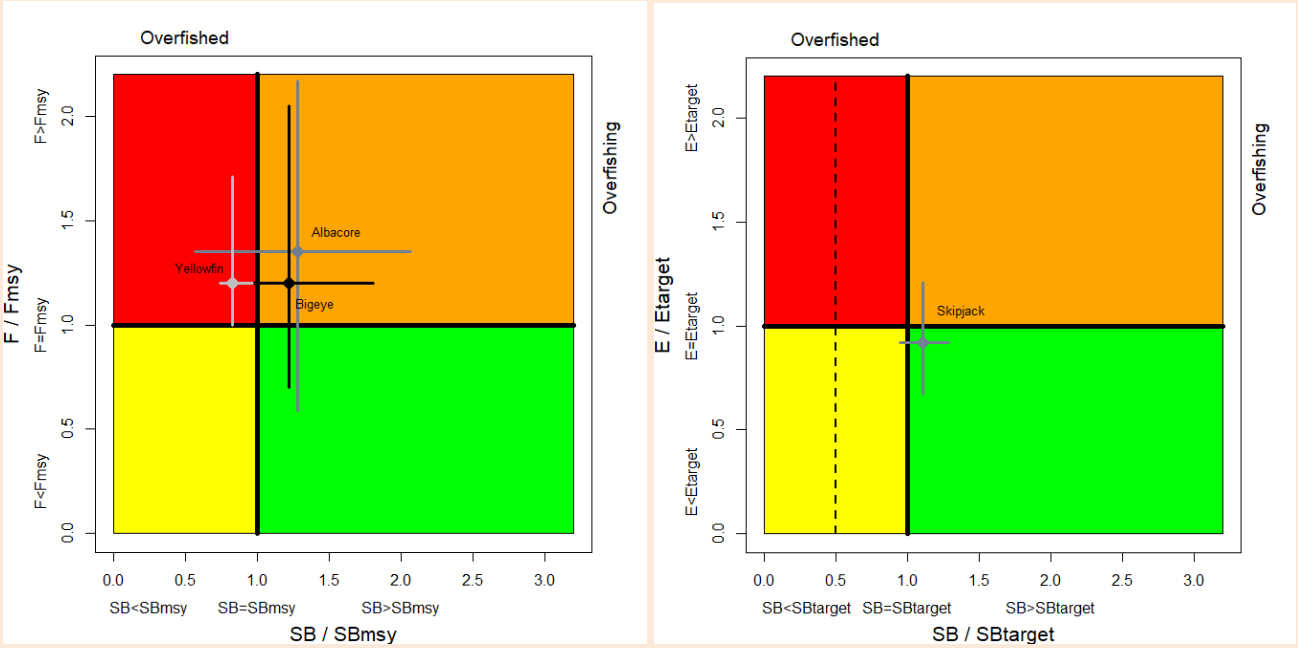

Fig. 1. (Left) Combined Kobe plot for bigeye tuna (black: status in 2018, based on the assessment conducted in 2019), yellowfin tuna (light grey: 2017, with assessment conducted in 2018) and albacore (dark grey: 2017 with assessment conducted in 2019) showing the estimates of current spawning spawning biomass (SB) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality. (Right) Kobe plot for skipjack tuna (assessment conducted in 2020) showing the estimates of the current stock status (The dashed line indicates the limit reference point at 20%SB0 while SBtarget=0,4 SB0). Cross bars illustrate the range of uncertainty from the model runs with an 80% CI (95% CI for albacore).

Billfish

SC23.02 (para. 133) 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 2020 (Fig. 3):

- Swordfish (*Xiphias gladius*) – Appendix 12
- Black marlin (*Makaira indica*) – Appendix 13
- Blue marlin (*Makaira nigricans*) – Appendix 14
- Striped marlin (*Tetrapturus audax*) – Appendix 15
- Indo-Pacific sailfish (*Istiophorus platypterus*) – Appendix 16

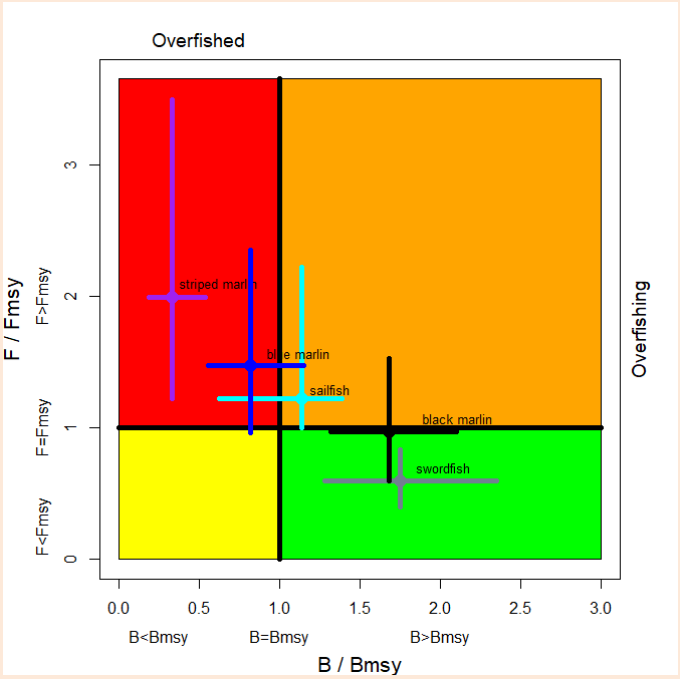

Fig. 3. Combined Kobe plot for swordfish (2018 with assessment conducted in 2020, grey), Indo-Pacific sailfish (2017 with assessment conducted in 2019, cyan), black marlin (2017 with assessment conducted in 2018, black), blue marlin (2017 with assessment conducted in 2019, blue) and striped marlin (2017 with assessment conducted in 2018, purple) showing the estimates of current stock size (SB or B, species assessment dependent) and current fishing mortality (F) in relation to optimal biomass and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs.

Tuna and seerfish – Neritic species

SC23.03 (para. 132) 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 2020 (Fig. 2):

- Bullet tuna (*Auxis rochei*) – Appendix 17
- Frigate tuna (*Auxis thazard*) – Appendix 18
- Kawakawa (*Euthynnus affinis*) – Appendix 19
- Longtail tuna (*Thunnus tonggol*) – Appendix 20
- Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix 21
- Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix 22

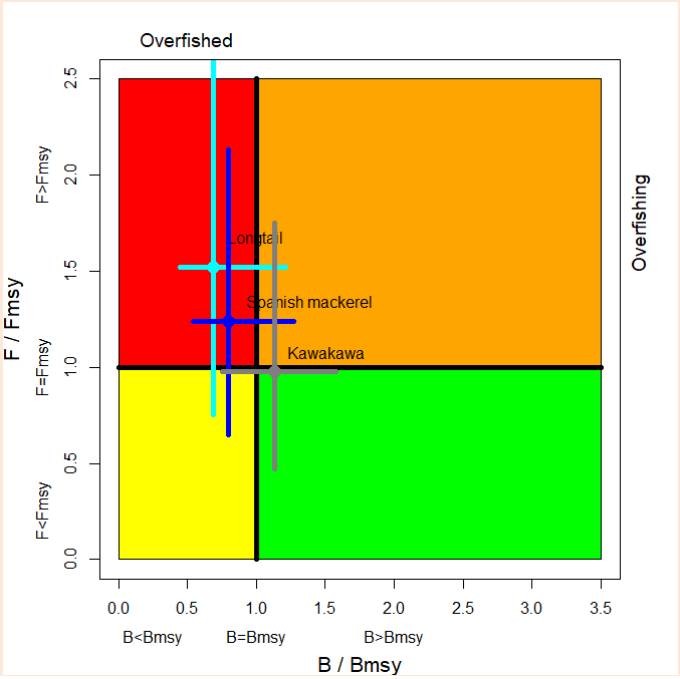

Fig. 2. Combined Kobe plot for longtail tuna, narrow-barred Spanish mackerel and kawakawa, showing the estimates of stock size (B) and current fishing mortality (F) in 2018 (assessment conducted in 2020) in relation to optimal spawning stock size and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs.

Sharks

SC23.04 (para. 134) 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 23
- Oceanic whitetip shark (*Carcharhinus longimanus*) – Appendix 24
- Scalloped hammerhead shark (*Sphyrna lewini*) – Appendix 25
- Shortfin mako shark (*Isurus oxyrinchus*) – Appendix 26
- Silky shark (*Carcharhinus falciformis*) – Appendix 27
- Bigeye thresher shark (*Alopias superciliosus*) – Appendix 28
- Pelagic thresher shark (*Alopias pelagicus*) – Appendix 29

Marine turtles

SC23.05 (para. 135) 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 30

Seabirds

SC23.06 (para. 136) 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 31

Marine Mammals

SC23.07 (para. 137) 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 32

GENERAL RECOMMENDATIONS TO THE COMMISSION

NATIONAL REPORTS FROM CPCS

SC23.08 (para. 31) **NOTING** that the Commission, at its 15th Session (in 2011), 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 2020, 25 reports were provided by CPCs (23 in 2019, 26 in 2018, 23 in 2017, 23 in 2016, 26 in 2015) (Table 2).

SC23.09 (para. 32) The SC **RECOMMENDED** that the Compliance Committee and Commission note the lack of compliance by 6 Contracting Parties (Members) and 2 Cooperating Non-Contracting Party (CNCPs) that did not submit a National Report to the Scientific Committee in 2020, noting that the Commission agreed that the submission of the annual reports to the Scientific Committee is mandatory

REPORT OF THE 15TH SESSION OF THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH (WPEB15)

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

SC23.10 (para. 59) 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 5, recalling that the IPOA-Seabirds and IPOA-Sharks were adopted by the FAO in 1999 and 2000, respectively, and recommended the development of NPOAs.

REPORT OF THE 2ND SESSION OF THE WORKING PARTY ON TROPICAL TUNAS (WPTT22)

Skipjack tuna Stock Assessment

SC23.11 (para. 78) The SC **NOTED** that the reference points for skipjack tuna are defined with respect to unfished spawning biomass only in resolution 16/02; nonetheless the notation is in terms of B (total exploitable biomass) instead of SB (spawning biomass). Although the resolution also specified Etarg (annual equilibrium exploitation rate associated with the unfished target spawning biomass), it was intended as a control parameter for the harvest control rule, rather than as an explicit target. Meanwhile Resolution 16/02 did not define a limit exploitation rate (Elim). The SC further **NOTED** that resolution 15/10 had specified a default depletion-based target and limit fishing mortality rate but it was discussed whether these are appropriate for skipjack tuna (the default values are defined only when MSY-based reference points can not be estimated robustly according to 15/10). As such the SC **RECOMMENDED** that the skipjack MSE project to revisit these reference points, including to investigate the plausibility of establishing a limit reference point for fishing mortality (or exploitation rate).) and to evaluate the .differences on the catch forecasts by using total biomass instead of spawning biomass in the HCR.

REPORT OF THE 16TH SESSION OF THE WORKING PARTY ON DATA COLLECTION AND STATISTICS (WPDCS16)

SC23.12 (para. 107) Furthermore, the SC **RECOMMENDED** the Commission to consider how to best take into account the confidentiality aspects inherent to such a dataset (e.g. through updates to Res. 12/02) while at the same time ensuring proper attribution of its ownership (Refer to paras. 104 and 106 for qualifying details on this Recommendation)

SC23.13 (para. 109) **ACKNOWLEDGING** a potential lack of clarity in the current definition of "For reporting (Optional)" data elements in the context of the ROS minimum standard data fields, the SC **RECOMMENDED** that the Commission require CPCs to report such fields to the IOTC Secretariat (as part of their regular ROS data submissions) when these are available to the national observer programmes.

SC23.14 (para. 111) For this reason, the SC **RECOMMENDED** that an ad-hoc, intersessional Working Group on the development of EM Programme Standard be constituted and physical or virtual workshops (depending on the circumstances) be held to further progress with the definition of EMS minimum standards.

SUMMARY DISCUSSION OF MATTERS COMMON TO WORKING PARTIES (CAPACITY BUILDING ACTIVITIES – STOCK ASSESSMENT COURSE; CONNECTING SCIENCE AND MANAGEMENT, ETC.)

Invited Expert(s) at the WP meetings

SC23.15 (para. 114) Given the importance of external independent review for working party meetings, the SC **RECOMMENDED** the Commission continues to allocate sufficient budget for invited scientific experts to be regularly invited to scientific working party meetings.

Meeting participation fund

SC23.16 (para. 116) 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

SC23.17 (para. 117) 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 at port, need to have hard copies.

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

SC23.18 (para. 118) 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 7.

PROGRAM OF WORK AND SCHEDULE OF WORKING PARTY AND SCIENTIFIC COMMITTEE MEETINGS

Consultants

SC23.19 (para. 163) Noting the highly beneficial and relevant work done by IOTC stock assessment consultants 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.

REVIEW OF THE DRAFT, AND ADOPTION OF THE REPORT OF THE 23RD SESSION OF THE SCIENTIFIC COMMITTEE

SC23.20 (para. 168) The SC **RECOMMENDED** that the Commission consider the consolidated set of recommendations arising from SC23, provided at Appendix 38.

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		2016	2017	2018	2019	2020	Advice to the Commission
Albacore *Thunnus alalunga*	Catch 2019: Average catch 2015–2019: MSY (1000 t) (95% CI): F_{MSY} (95% CI): SB_{MSY} (1000 t) (95% CI): F_{2017}/F_{MSY} (95% CI): SB_{2017}/SB_{MSY} (95% CI): SB_{2017}/SB_{1950} (95% CI):	39,876 t 38,365 t 35.7 (27.3–44.4) 0.21 (0.195-0.237) 23.2 (17.6–29.2) 1.346 (0.588–2.171) 1.281 (0.574–2.071) 0.262 (-)						A new stock assessment was carried out for albacore in 2019 to update the assessment undertaken in 2016. Although considerable uncertainty remains in the SS3 assessment conducted in 2019, particularly due to the conflicts in key data inputs, a precautionary approach to the management of albacore tuna should be applied. The K2SM indicates that catch reductions are required in order to prevent the biomass from declining to below MSY levels in the short term, due to the low recent recruitment levels. Although there is considerable uncertainty in the projections, current catches are exceeding the estimated MSY level (35,700 t). The stock status in relation to the Commission's BMSY and FMSY target reference points indicates that the stock is **not overfished** but is **subject to overfishing** Click here for full stock status summary: Appendix 8
Bigeye tuna *Thunnus obesus*	Catch in 2019: Average catch 2015–2019: MSY (1000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2018}/F_{MSY} (80% CI): SB_{2018}/SB_{MSY} (80% CI): SB_{2018}/SB_0 (80% CI):	73,165 t[1] 88,303 t[1] 87 (75 – 108) 0.24 (0.18 – 0.36) 503 (370 – 748) 1.20 (0.70 – 2.05) 1.22 (0.82 – 1.81) 0.31 (0.21 – 0.34)	**84%**			**38%**		In 2019 a new stock assessment was carried out for bigeye tuna in the IOTC area of competence to update the stock status undertaken in 2016. The stock status determination changed qualitatively in 2019 to **not overfished** but **subject to overfishing**. If catches remain at 2018 levels there is a risk of breaching MSY reference points with 58.9% and 60.8% probability in 2021 and 2028. Maintaining catches of at least 10% below 2018 levels will likely reduce the probabilities of breaching reference levels to 49.1% in 2028. Continued monitoring and improvement in data collection, reporting and analyses is required to reduce the uncertainty in assessments. Click here for full stock status summary: Appendix 9
Skipjack tuna *Katsuwonus pelamis*	Catch in 2019: Average catch 2015-2019 (MT): $C_{40\%SB0}$ (MT) (80% CI): C_{2019} / $C_{40\%SB0}$ (80% CI): $E_{40\%SB0}$ (80% CI):	547,248 t 506,555 t[1] 535,964 (461,995–674,536) 1.02 (0.81–1.18) 0.59 (0.53–0.66)	**47%**				**60%**	A new stock assessment was carried out for skipjack tuna in 2020 using Stock Synthesis with data up to 2019. On the weight-of-evidence available in 2020, the skipjack tuna stock is determined to be: (i) above the adopted biomass target reference point; (ii) **not overfished** ($SB_{2019}>SB_{40\%SB0}$); (iii) with fishing mortality below the adopted target fishing mortality, and; (iv)

[1] Considering the alternative purse seine log-associated catch composition for the EU fleet in 2018 as per IOTC-2019-WPTT21-R[E]

	E_{2019} / $E_{40\%SB0}$ (80% CI): SB_0 (MT) (80% CI): SB_{2019} (MT) (80% CI): $SB_{40\%SB0}$ (MT) (80% CI): $SB_{20\%SB0}$ (MT) (80% CI): SB_{2019} / SB0 (80% CI): SB_{2019} / $SB_{40\%SB0}$ (80% CI): SB_{2019} / SB_{MSY} (80% CI): MSY (MT) (80% CI): E_{2019} / E_{MSY} (80% CI):	0.92 (0.67-1.21) 1,992,089 (1,691,710–2,547,087) 870,461 (660,411–1,253,181) 794,310 (672,825–1,019,056) 397,155 (336,412–509,528) 0.45 (0.38-0.5) 1.11 (0.95-1.29) 1.99 (1.47-2.63) 601,088 (500,131–767,012) 0.48 (0.35-0.81)						**not subject to overfishing** (E_{2019}<$E_{40\%SB0}$). The catch limit calculated applying the HCR specified in Resolution 16/02 is 513,572t for the period 2021 -2023. The SC noted that this catch limit is higher than for the previous period notwithstanding regular overshooting of the previous established catch limit. This is attributed to the new stock assessment which estimates a higher productivity of the stock and a higher stock level relative to the target reference point, possibly due to skipjack life history characteristics and favourable environmental conditions. Thus, it is likely that the recent catches that have exceeded the limits established for the period 2018-2020 have been sustained by favourable environmental conditions. Therefore, the Commission needs to ensure that catches of skipjack tuna during this period (2021 – 2023) do not exceed the agreed limit. Click here for full stock status summary: Appendix 10
Yellowfin tuna *Thunnus albacares*	Catch 2019: Average catch 2015–2019: MSY (1000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2017}/F_{MSY} (80% CI): SB_{2017}/SB_{MSY} (80% CI): SB_{2017}/SB_0 (80% CI):	427,240 t[2] 424,103 t[2] 403 (339–436) 0.15 (0.13–0.17) 1069 (789–1387) 1.20 (1.00–1.71) 0.83 (0.74–0.97) 0.30 (0.27 – 0.33)	**68%**		**94%**			No new stock assessment was carried out for yellowfin tuna in 2020, thus, stock status is determined on the basis of the 2018 assessment and other information presented in 2020. On the weight-of-evidence available in 2018 and 2019, the yellowfin tuna stock is determined to remain **overfished** and **subject to overfishing.** The decline in stock status to below MSY reference level is not well understood due to various uncertainties. As a precautionary measure, the Commission should ensure that CPCs take all necessary action to achieve the catch reductions in their fleets, as per Res 19/01, to reduce overfishing. It is recommended that catches be reduced to a level at least below the CMSY estimate (403, 000 MT) from the 2018 assessment until new information based on the 2021 stock assessment and its associated projections are carried out. It is reminded that F_{2017} was 20% above the target reference point. In the 2018 Scientific Committee a Workplan was developed to address the issues identified in the assessment review, aimed at increasing the Committee's ability to provide more concrete and robust advice by the 2019 meeting of the Scientific Committee. The workplan started in January 2019 which aimed at addressing the issues identified by the WPTT and the external reviewer in 2018. The draft workplan is attached as Appendix 38 of the 2018 Scientific Committee Report (IOTC-2018-SC21-R). The Commission should ensure that this workplan is budgeted appropriately. Despite the progress made to reduce the uncertainties

[2] Considering the alternative purse seine log-associated catches for the EU fleet in 2018 as per IOTC-2019-WPTT21-R

								inherent to this assessment, the WPTT agreed that no new K2SM could be provided in 2019 and 2020. The Commission has an interim plan for the rebuilding the yellowfin stock, with catch limitations based on 2014/2015 levels (Resolution 19/01, which superseded 17/01 and 18/01). Some of the fisheries subject to catch reductions had fully achieved a decrease in catches in 2019 in accordance with the levels of reductions specified in the Resolution; however, these reductions were offset by increases in the catches from CPCs exempt and some CPCs subject to limitations on their catches of yellowfin tuna (see Appendix 33). Thus, the total catches of yellowfin in 2019 increased by around 5.22% from 2014levels. The Commission should ensure that any revision of the management measure can effectively achieve any prescribed catch reduction to ensure the effectiveness of the management measure. Click here for full stock status summary: Appendix 11

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 also important for localised small-scale and artisanal fisheries or as targets in sports and recreational fisheries.

Stock	Indicators		2016	2017	2018	2019	2020	Advice to the Scientific Committee
Swordfish *Xiphias gladius*	Catch 2019: Average catch 2015-2019: MSY (1,000 t) (80% CI): F_{MSY} (80% CI): SB_{MSY} (1,000 t) (80% CI): F_{2018}/F_{MSY} (80% CI): SB_{2018}/SB_{MSY} (80% CI): SB_{2018}/SB_{1950} (80% CI):	32,671 t 31,712 t 33 (27–40) 0.23 (0.15–0.31) 59 (41–77) 0.60 (0.40–0.83) 1.75 (1.28–2.35) 0.42 (0.36–0.47)					**98%**	A new assessment was undertaken in 2020 using stock synthesis with fisheries data up to 2018. On the weight-of-evidence available in 2020, the stock is determined to be **not overfished** and **not subject to overfishing**. The most recent catches (32,671 MT in 2019) are at approximately the MSY level (33,000 MT). Under the current levels of catches, the spawning biomass is projected to remain relatively stable, with a high probability of maintaining at or above the SBMSY for the longer term. Nevertheless, the Commission should consider limiting the catches so as not to exceed the 2018 catch level (30,847 t) to ensure that the probability of exceeding the SBMSY target reference points in the long term remains minimal (2%). Projections indicate that an increase of 40% or more from 2018 catch levels will likely result in the biomass dropping below the SBMSY level for the longer term (>75% probability). Taking into account the updated information regarding swordfish stock structure (IOTC-2020-WPB18-09), as well as the differential CPUE and biomass trends between regions, the WPB should continue to discuss the swordfish stock assessment model specifications and consider the feasibility of including a multi-stock assessment in 2023. Recognising that there is recurring evidence for

								localised depletion in the southern regions (particularly the South West) the WPB expresses concern and suggests this should continue to be monitored. Click here for full stock status summary: Appendix 12
Black marlin *Makaira indica*	Catch 2019: Average catch 2015–2019: MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): F_{2017}/F_{MSY} (80% CI): B_{2017}/B_{MSY} (80% CI): B_{2017}/B_0 (80% CI):	17,415 t 18,599 t 12.93 (9.44-18.20) 0.18 (0.11-0.30) 72.66 (45.52-119.47) 0.96 (0.77-1.12) 1.68 (1.32-2.10) 0.62 (0.49-0.78)						No new stock assessment for black marlin was carried out in 2020 thus, the stock status is determined on the basis of the 2018 assessment based on JABBA and other indicators presented in 2019. The Kobe plot from the JABBA model indicated that the stock is **not subject to overfishing** and is currently **not overfished**, however these status estimates are subject to a high degree of uncertainty. Current catches (>17,400 MT in 2019) (Fig. 1) are higher than MSY estimate (12,930 MT), which is highly uncertainty. The catch limit as stipulated in Resolution 18/05 (9,932 MT) have also been exceeded. The Commission should provide mechanisms to ensure that catch limits are not exceeded by all concerned fisheries. Projections were not carried out due to the poor predictive capabilities identified in the assessment diagnostics. Click here for full stock status summary: Appendix 13
Blue marlin *Makaira nigricans*	Catch 2019: Average catch 2015-2019: MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): H_{2017}/H_{MSY} (80% CI): B_{2017}/B_{MSY} (80% CI): B_{2017}/B_0 (80% CI):	8,316 t 8,958 t 9.98 (8.18 –11.86) 0.21 (0.13 – 0.35) 47 (29.9 – 75.3) 1.47 (0.96 – 2.35) 0.82 (0.56 – 1.15) 0.41 (0.28 – 0.57)				**87%**		Stock status based on the Bayesian State-Space Surplus Production model JABBA suggests that there is an 87% probability that the Indian Ocean blue marlin stock in 2017 is in the red zone of the Kobe plot, indicating the stock is **overfished** and **subject to overfishing**. The current catches of blue marlin (average of 8,958 MT in the last 5 years, 2015-2019) are lower than MSY (9,984 MT). The assessment conducted in 2017 indicated that the stock was overfished and subject to overfishing. In order to achieve the Commission objectives of being in the green zone of the Kobe Plot by 2027 (F2027 < FMSY and B2027 > BMSY) with at least a 60% chance, the catches of blue marlin would have to be reduced by 35% compared to the average of the last 3 years, to a maximum value of approximately 7,800 MT well below the currect catch limit established by Resolution 18/05 (11,930 MT). Click here for full stock status summary: Appendix 14
Striped marlin *Tetrapturus audax*	Catch 2019: Average catch 2015-2019: MSY (1,000 t) (JABBA):	2,860 t 3,455 t 4.73 (4.27–5.18)[3]			**99%**			No new stock assessment for striped marlin was carried out in 2020, thus, the stock status is determined on the basis of the 2018 assessment and other indicators presented in 2019. On the weight-of-evidence

[3] JABBA estimates are the range of central values shown in Fig. 2 of Appendix 15

	F_{MSY} (JABBA): B_{MSY} (1,000 t) (JABBA): F_{2017}/F_{MSY} (JABBA): B_{2017}/B_{MSY} (JABBA): SB_{2017}/SB_{MSY} (SS3): B_{2017}/K(JABBA): SB_{2017}/SB_{1950} (SS3):	0.26 (0.20–0.34) 17.94 (14.21–23.13) 1.99 (1.21–3.62) 0.33 (0.18–0.54) 0.373 0.12 (0.07–0.20) 0.13 (0.09–0.14)						available in 2019, the stock status of striped marlin is determined to be **overfished** and **subject to overfishing**. Current or increasing catches have a very high risk of further decline in the stock status. Current catches of 2,860 t (2019) are lower than MSY (4,730 MT) and of the cach limit stipulated by Resolution 18/05 (3,260 MT) but the stock has been overfished for more than two decades and is now in a highly depleted state. If the Commission wishes to recover the stock to the green quadrant of the Kobe plot with a probability ranging from 60% to 90% by 2026, it needs to provide mechanisms to ensure the maximum annual catches remain between 1,500 MT – 2,200 MT. Click here for full stock status summary: Appendix 15
Indo-Pacific Sailfish *Istiophorus platypterus*	Catch 2019: Average catch 2015-2019: MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): F_{2017}/F_{MSY} (80% CI): B_{2017}/B_{MSY} (80% CI): B_{2017}/B_0 (80% CI):	29,872 t 30,306 t 23.9 (16.1 – 35.4) 0.19 (0.14 - 0.24) 129 (81–206) 1.22 (1 – 2.22) 1.14 (0.63 – 1.39) 0.57 (0.31 – 0.70)						No new stock assessment for Indo-Pacific sailfish was carried out in 2020, thus, the stock status is determined on the basis of the 2019 assessment using the C-MSY model. The data poor stock assessment techniques indicated that F was above FMSY (F/FMSY=1.22) and B is above BMSY (B/BMSY=1.14). However, both assessment models rely on catch data only, and the catch series is highly uncertain. In addition, 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 also a cause for concern. On the weight-of-evidence available in 2019, the stock status cannot be assessed and is determined to be **uncertain**. The catch limits as stipulated in Resolution 18/05 (25,000 MT) have been exceeded. The Commission should provide mechanisms to ensure that catch limits are not exceeded by all concerned fisheries. 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. Click here for full stock status summary: Appendix 16

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	2016	2017	2018	2019	2020	Advice to the Commission

Bullet tuna *Auxis rochei*	Catch 2019: Average catch 2015–2019: MSY (1,000 t) F_{MSY} : B_{MSY} (1,000 t): $F_{current}/F_{MSY}$: $B_{current}/B_{MSY}$: $B_{current}/B_0$:	22,245 t 18,878 t unknown unknown unknown unknown unknown unknown						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. Stock status in relation to the Commission's BMSY and FMSY reference points remains **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 FMSY and BMSY 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). 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 Click here for a full stock status summary: Appendix 17
Frigate tuna *Auxis thazard*	Catch 2019: Average catch 2015–2019: MSY (1,000 t) F_{MSY} : B_{MSY} (1,000 t): $F_{current}/F_{MSY}$: $B_{current}/B_{MSY}$: $B_{current}/B_0$:	84,738 t 93,846 t unknown unknown unknown unknown unknown unknown						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. Stock status in relation to the Commission's B_{MSY} and F_{MSY} reference points remains **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 FMSY and BMSY 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 bullet 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. Click here for a full stock status summary: Appendix 18
Kawakawa *Euthynnus affinis*	Catch 2019: Average catch 2015-2019: MSY (80% CI) F_{MSY} (80% CI) B_{MSY} (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	128,042 t 148,084 t 148,825 (124,114 – 222,505) t 0.44 (0.21–0.82) 355,670 (192,080 – 764,530) t 0.98 (0.85–1.11) 1.13 (0.75–1.58)					**50%**	A new assessment was carried out in 2020 using the Optimised Catch-Only Method (OCOM). Based on the weight-of-evidence available, the kawakawa stock for the Indian Ocean is classified as **not overfished** and **not subject to overfishing.** However, the assessment models rely on catch data, which is considered to be highly uncertain. The catch in 2018 (173,367 MT) was above the then estimated MSY (152,000MT). The available gillnet CPUE of kawakawa showed a somewhat increasing trend although the reliability of the index as abundance indices remains unknown. Despite the substantial uncertainties, the stock is probably very close to being fished at MSY levels and that higher catches may not be sustained in the longer term. A precautionary approach to management is recommended. Click here for a full stock status summary: Appendix 19
Longtail tuna *Thunnus tonggol*	Catch 2019: Average catch 2015–2019: MSY (80% CI) F_{MSY} (80% CI) B_{MSY} (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	107,088 t 133,872 t 128,750 (99,902 – 151,357) 0.32 (0.15 – 0.66) 395,460 (129,240 – 751,316) 1.52 (0.751 – 2.87) 0.69 (0.45 – 1.21)		**67%**			**76%**	A new assessment was carried out in 2020 using the Optimised Catch-Only Method (OCOM). Based on the weight-of-evidence currently available, the stock is considered to be both **overfished** and **subject to overfishing**. The catch in 2018 (136,906 MT) was just below the estimated MSY (140,000 MT) but the exploitation rate has been increasing over the last few years, as a result of the declining abundance. Despite the substantial uncertainties, this suggests that the stock is very close to being fished at MSY levels and that higher catches may not be sustained. A precautionary approach to management is recommended. Click here for a full stock status summary: Appendix 20
Indo-Pacific king mackerel	Catch 2018: Average catch 2014-2018:	42,488 t 44,833 t						No new stock assessment for Indo-Pacific king mackerel was carried out in 2019, thus, the stock status is determined on the basis of the

Scomberomorus guttatus	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						2016 assessment when a preliminary assessment was undertaken using catch-only methods techniques (Catch-MSY and OCOM). Given that no new assessment was undertaken in 2020, the WPNT considered that stock status in relation to the Commission's BMSY and FMSY target reference points remains **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 FMSY and BMSY 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 between 2009 and 2011 estimated at the time of the assessment (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. 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 here for a full stock status summary: Appendix 21
Narrow-barred Spanish mackerel *Scomberomorus commerson*	Catch 2019: Average catch 2015-2019: MSY (80% CI): F_{MSY} (80% CI): B_{MSY} (80% CI): $F_{current}/F_{MSY}$ (80% CI): $B_{current}/B_{MSY}$ (80% CI):	152,574 t 170,298 t 157,760 (132,140–187,190) 0.49 (0.25–0.87) 323,500 (196,260–592,530) 1.24 (0.65–2.13) 0.80 (0.54–1.27)		**89%**			**73%**	A new assessment was carried out in 2020 using the Optimised Catch-Only Method (OCOM). Based on the weight-of-evidence available, the stock appears to be **overfished** and **subject to overfishing.** The catch in 2019 was just below the estimated MSY and the available Gillnet CPUE show a somewhat increasing trend in recent years although the reliability of the Index as abundance indices remains unknown. Despite the substantial uncertainties, the stock is probably very close to being fished at MSY levels and that higher catches may not be sustained. Click here for a full stock status summary: Appendix 22

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		2016	2017	2018	2019	2020	Advice to the Commission
Blue shark *Prionace glauca*	Reported catch 2019: Estimated catch 2015: Not elsewhere included (nei) sharks 2019: Average reported catch 2015–19: Average estimated catch 2011–15: Ave. (nei) sharks 2015–19: 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) :	22,719 t 54,735 t 35,964 t 26,187 t 54,993 t 39,478 t 33.0 (29.5 - 36.6) 0.30 (0.30 - 0.31) 39.7 (35.5 - 45.4) 0.86 (0.67 - 1.09) 1.54 (1.37 - 1.72) 0.52 (0.46 - 0.56)		**72.6%**				No new stock assessment for blue sharks was carried out in 2020, thus, the stock status is determined on the basis of the 2017 assessment. On the weight-of-evidence available in 2017, the stock status is determined to be **not overfished** and **not subject to overfishing**. Even though the blue shark in 2017 is assessed to be not overfished nor subject to overfishing, current catches are likely to result in decreasing biomass and making the stock become overfished and subject to overfishing in the near future. If the Commission wishes to maintain stocks above MSY reference levels ($B>B_{MSY}$ and $F<F_{MSY}$) with at least a 50% probability over the next 10 years, then a reduction of 20% in catches is advised. The stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics, by ensuring CPCs comply with their recording and reporting requirement on sharks, so as to better inform scientific advice in the future. Click below for a full stock status summary: Blue sharks – Appendix 23
Oceanic whitetip shark *Carcharhinus longimanus*	Reported catch 2019: Not elsewhere included (nei) sharks: Average reported catch 2015–2019: Ave. (nei) sharks 2015–19:	32 t 35,964 t 169 t 39,478 t						There is a paucity of information available for these species and this situation is not expected to improve in the short to medium term. There is no quantitative stock assessment and limited basic fishery indicators currently available. Therefore the stock status is highly uncertain. The available evidence indicates considerable risk to the stock status at current effort levels. The primary source of data that drive the assessment (total catches) is highly uncertain and should be investigated further as a priority. Click below for a full stock status summary: Oceanic whitetip sharks – Appendix 24
Scalloped hammerhead shark *Sphyrna lewini*	Reported catch 2019: Not elsewhere included (nei) sharks: Average reported catch 2015–2019: Ave. (nei) sharks 2015–19:	51 t 21,899 t 67 t 38,190 t						

Shortfin mako *Isurus oxyrinchus*	Reported catch 2019: Not elsewhere included (nei) sharks: Average reported catch 2015–2019: Ave. (nei) sharks 2015–19:	1,087 t 37,773t 1,789 t 47,367 t						Scalloped hammerhead sharks – Appendix 25 Shortfin mako sharks – Appendix 26 Silky sharks– Appendix 27 Bigeye thresher sharks– Appendix 28 Pelagic thresher sharks– Appendix 29
Silky shark *Carcharhinus falciformis*	Reported catch 2019: Not elsewhere included (nei) sharks: Average reported catch 2015–2019: Ave. (nei) sharks 2015–19:	2,094 t 20,717 t 2,241 t 36,248 t						
Bigeye thresher shark *Alopias superciliosus*	Reported catch 2019: Not elsewhere included (nei) sharks: Average reported catch 2015–2019: Ave. (nei) sharks 2015–19:	0 t 24,043 t <1 t 40,006 t						
Pelagic thresher shark *Alopias pelagicus*	Reported catch 2019: Not elsewhere included (nei) sharks: Average reported catch 2015–2019: Ave. (nei) sharks 2015–19:	209 t 24,043 t 335 t 40,006t						

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

1. OPENING OF THE SESSION

1. The 23rd Session of the Indian Ocean Tuna Commission (IOTC) Scientific Committee (SC) was held Online, from 7 – 11 December 2020. A total of 141 delegates and other participants attended the Session (43 in 2019), comprised of 112 delegates (34 in 2019) from 20 Contracting Parties, and 0 delegates from Cooperating Non-Contracting Parties (0 in 2019), and 29 participants from 13 observer organisations (including the invited experts). The meeting was chaired by the Chairperson, Dr Toshihide Kitakado (Japan). The list of participants is provided at Appendix 1.

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

2. The SC **ADOPTED** the Agenda provided at Appendix 2. The documents presented to the SC are listed in Appendix 3.

3. The SC **NOTED** the statements from Mauritius, France (OT) and UK("BIOT") (Appendix 4a).

3. ADMISSION OF OBSERVERS

4. The SC admitted the following observers, in accordance with Rule XIV of the IOTC Rules of Procedure (2014):

3.1 Non-governmental and Inter-governmental Organisations (NGOs)

- Agreement on the Conservation of Albatrosses and Petrels (ACAP)
- Blue Marine Foundation
- Global Tuna Alliance (GTA)
- Indian Ocean Commission (IOC)
- International Pole-and-line Foundation (IPNLF)
- International Seafood Sustainability Foundation (ISSF)
- Marine Stewardship Council (MSC)
- PEW Charitable Trusts
- Shark Project
- Sustainable Fisheries Partnership (SFP)
- Sustainable Indian Ocean Tuna Initiative (SIOTI)
- World Wide Fund for Nature (WWF)
- Invited Experts

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

4.1 Outcomes of the 24th Session of the Commission

5. The SC **NOTED** paper IOTC–2020–SC23–03 which outlined the decisions and requests made by the Commission at its 24th Session, held in November 2020, that related to the IOTC science processes. The SC **NOTED** that 0 new CMMs were adopted in 2020 by the Commission

6. The SC **NOTED** that the current *Compendium of Active Conservation and Management Measures for the Indian Ocean Tuna Commission* may be downloaded from the IOTC website at the following link:
   - English: http://iotc.org/cmms
   - French: http://iotc.org/fr/mcgs

7. Noting that the 24th session of the Commission also made a number of general comments and requests on the recommendations made by the Scientific Committee in 2019, the SC **AGREED** that any advice to the Commission would be provided in the relevant sections of this report.

8. The SC **NOTED** the concern expressed by the Commission regarding the current status of IOTC stocks, with many being assessed to be overfished or subject to overfishing.

9. The SC **NOTED** that the Commission "REITERATED the urgency for the Scientific Committee to produce an assessment of the yellowfin tuna stock as a priority in 2021"

10. The SC further **NOTED** that "In accordance with Article VI.5 of the IOTC Agreement, the Commission AGREED to hold a Special Session (SS4) by video-conference from 8 to 12 March 2021 (Appendix 10). This meeting will be held for 4 hours per day and focus on the sustainability of the yellowfin tuna fishery and addressing deficiencies relating to the harvest control rule for skipjack tuna, in particular paragraph 11 of Resolution 16/02."

4.2 Previous decisions of the Commission

11. The SC **NOTED** paper IOTC–2020–SC23–04 which outlined a number of Commission decisions, in the form of previous Resolutions that require a response from the SC in 2020 and **AGREED** to develop advice to the Commission in response to each request during the current Session.

5. SCIENCE RELATED ACTIVITIES OF THE IOTC SECRETARIAT IN 2020

5.1 Report of the Secretariat – Activities in support of the IOTC science process in 2020

12. The SC **NOTED** paper IOTC–2020–SC23–05 which provided an overview of the work undertaken by the IOTC Secretariat in 2020, and congratulated the IOTC Secretariat for its contributions to the science processes in 2020. These contributions included support to the Working Parties and Scientific Committee meetings; facilitation of the IOTC Meeting Participation Fund; assisting in improvements made in the quality of the data sets being collected and submitted to the IOTC Secretariat; capacity building activities; support for the development of the Regional Observer Scheme,; recruitment and management of consultants; and facilitation of the attendance of the invited scientific experts that support IOTC technical meetings.

13. The SC **NOTED** the recent addition of two scientific staff at the Secretariat and welcomed them. The SC **RECALLED** that in 2019 the SC recommended that the Commission confirm the reinstatement of the position of a P4 officer for the IOTC Data and Science Section at its next meeting. However, the SC were **INFORMED** that the Commission has decided to defer the position.

14. The SC **CONGRATULATED** the Secretariat for the successful organization and completion of the different Working Party meetings in 2020 using Online meeting tools despite the technical challenges posed (internet connection, time zones and duration).

15. The SC **NOTED** although all meetings had been successful held virtually in 2020, they were shortened to facilitate the virtual platform. The SC **AGREED** that in the future virtual meetings may still be conducted for certain meetings (such as Data preparatory meetings) in order to reduce the expenses travel imposes on CPCs as well as the IOTC MPF, but for those meetings requiring closer collaborations in person, physical meetings will be continued as required.

16. The SC **REQUESTED** that the Secretariat provide the support received from member contributions to the scientific activities described within the body text of the document in addition to what is broadly provided in Appendix III.

17. The SC **NOTED** that there may be some discrepancies between the numbers of active vessels reported in the NR and the Active Vessels List (AVL) available for download from the IOTC website and **ENCOURAGED** all CPCs to carefully check and ensure consistency between both data sources reporting to IOTC any identified discrepancy.

18. The SC **NOTED** that the IOTC-OFCF project had signed a new letter of Understanding for a 6th phase starting in 2020. The SC **EXPRESSED** its appreciation of the long-term valuable contribution of the project to improve statistics in the developing countries over the last 19 years.

19. The SC **NOTED** paper IOTC-2020-SC23-11 on the Synthesis of population structure of IOTC species from the PSTBS-IO project and recommended priorities for future work, including the following abstract provided by the authors:

> "*In 2017, CSIRO in collaboration with AZTI Tecnalia (Spain), IRD (France) and CFR (Indonesia) commenced a 3-year collaborative project on population structure of tuna, billfish and sharks of the Indian Ocean funded by the European Union and the consortium partners (PSTBS-IO). The project aimed to describe the population structure and connectivity of priority tuna and tuna-like species within the Indian Ocean, as well as blue and scalloped hammerhead sharks. Genetic analysis of new and archived tissue samples was the primary method, complimented by microchemical analysis of otoliths. The project also aimed to extend collaborative research networks among partners and contribute to technical capacity building in participating coastal states*." – see document for full abstract

20. The SC **THANKED** the authors for the presentation and **CONGRATULATED** the consortium on this novel and important work that will feed into the IOTC scientific processes.

21. The SC **NOTED** that for several species of neritic tunas (Longtail Tuna and Narrow-Barred Spanish Mackerel), there appears to be a clear separation of stocks with little mixing between them. The SC further **NOTED** that this should be considered in the future management of these species.

22. The SC **NOTED** that for several species, insufficient samples or stratification of sampling was possible during the duration of the project, hindering the ability to provide clear conclusions on stock structure for these species. The SC **ENCOURAGED** CPCs to liaise with the project coordinators in order to continue the provision of samples for analysis.

6. NATIONAL REPORTS FROM CPCS

6.1 National Reporting to the Scientific Committee: overview

23. The SC **NOTED** that 25 National Reports were submitted to the IOTC Secretariat in 2020 by CPs (0 by Cooperating Non-Contracting Parties and 1 report by the invited experts, Taiwan,China). The abstracts of CPC reports are provided at Appendix 4b.

24. The SC **RECALLED** 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.

25. The SC **RECALLED** 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 2020, of the 25 National Reports submitted, 8 were submitted after the deadline. The SC **NOTED** that the National Report does not replace the need for submission of data according to the IOTC Mandatory Data Requirements listed in the relevant IOTC Resolution (currently Resolution 15/02 *On mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)*].

26. 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. The SC **NOTED** that 1 National Report was submitted using older reporting templates that do not include the latest requirements stipulated by the active CMMs. The Secretariat informed the SC that the latest template is published on the IOTC webpage (https://iotc.org/science) every year, following the entry into force of the new CMMs adopted by the Commission.

27. The SC **NOTED** that the availability for download of the revised National Report templates from the IOTC Website was announced through the IOTC Mailing List in August 2020, and **SUGGESTED** that in the future this is further complemented by an official circular informing CPCs of the availability of updated National Report templates.

28. The SC **NOTED** that current National Report templates include tables whose structure and purpose appear to overlap with similar requirements that CPCs have to fulfil to provide statistical data through official reporting channels, and **ACKNOWLEDGED** that this is overlap is necessary to ensure that summary information on important aspects of the fisheries (e.g., interaction with bycatch species such as marine turtles) which is not regularly provided by CPCs, becomes available to the SC.

29. Also, the SC **RECALLED** that the National Reports contain different subsections that specifically cover all important reporting components from the various IOTC Resolutions and **CONFIRMED** that the format of National Reports is timely updated by the IOTC Secretariat to ensure full accordance with the Resolutions' requirements.

30. 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.

31. **NOTING** that the Commission, at its 15th Session (in 2011), 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 2020, 25 reports were provided by CPCs (23 in 2019, 26 in 2018, 23 in 2017, 23 in 2016, 26 in 2015) (Table 2).

32. The SC **RECOMMENDED** that the Compliance Committee and Commission note the lack of compliance by 6 Contracting Parties (Members) and 2 Cooperating Non-Contracting Party (CNCPs) that did not submit a National Report to the Scientific Committee in 2020, noting that the Commission agreed that the submission of the annual reports to the Scientific Committee is mandatory.

33. The SC **RECALLED** that an agenda item specifically dealing with discussions on the effect of piracy in the Indian Ocean has been removed from the SC agenda since 2018 in agreement with the former SC chair. This decision was made as the information was not changing from year to year as all indications lead to the conclusion that there was no real impact of piracy on IOTC fishing activities in recent years.

Table 2. CPC submission of National Reports to the SC from 2010 to 2020.

CPC	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Contracting Parties (Members)											
Australia											19 Nov
Bangladesh	n.a.	n.a.	n.a.	n.a.	n.a.						24 Nov
China											23 Nov
Comoros											1 Dec
Eritrea											
European Union											22 Nov
France (OT)											10 Nov
India											20 Nov
Indonesia											20 Nov
Iran, Islamic Rep. of											29 Nov
Japan											20 Nov
Kenya											1 Dec
Korea, Republic of											22 Nov
Madagascar											23 Nov
Malaysia											22 Nov
Maldives, Rep. of											22 Nov
Mauritius											22 Nov
Mozambique	n.a.										
Oman, Sultanate of											20 Nov
Pakistan											23 Nov
Philippines											22 Nov
Seychelles, Rep. of											20 Nov
Sierra Leone											
Somalia	n.a.	n.a.	n.a.	n.a.							30 Nov
Sri Lanka											19 Nov
South Africa, Rep. of											19 Nov
Sudan											
Tanzania, United Republic of											
Thailand											20 Nov
United Kingdom ("BIOT")											22 Nov
Yemen	n.a.	n.a.									
Cooperating Non-Contracting Parties											
Liberia	n.a.	n.a.	n.a.	n.a.	n.a.						
Senegal											

Green = submitted. Red = not submitted. Orange = Submitted using an outdated template n.a. = not applicable (not a CPC in that year). Green hash = submitted as part of EU report. For 2020, the date of submission of the report is included in the table (**Note**: the deadline for submission was the 22nd of November 2020).

6.2 Contracting Parties (Members)

34. The SC **NOTED** that, with the exception of the EU and France(OT), the executive summaries, figure and table captions of the Annual Reports were not available in both English and French as the translators had been fully occupied translating the other SC documents, Executive summaries, Working Party reports as well as the documents from the recently completed Commission meeting (which was exceptionally held in November 2020). The SC **ACKNOWLEDGED** that the Secretariat is exploring ways to ensure that these preliminary translation tasks could be performed more efficiently in future years.

35. The SC **REITERATED** its request from 2018 for CPCs to assist the Secretariat by providing translations of their executive summaries and figures and tables in both French and English are translated as well.

36. **NOTING** the 25 National Reports submitted to the IOTC Secretariat in 2020 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.

37. The SC **NOTED** that scientific and statistical information such as discard levels, observer coverage, fleet statistics etc., which are of particular relevance for several IOTC Resolutions (e.g. 15/02, 16/04, 17/05 etc.), is often only reported by CPCs in their national reports but not made available to the IOTC Secretariat in due time in accordance with the reporting requirements prescribed in the resolutions. For this reason, the SC **REQUESTED** all CPCs to ensure that the information presented in the respective national reports and the official submissions available to the IOTC are in agreement.

38. Due to the time constraints imposed by the shortened meeting format, National Reports were not discussed during the meeting.

6.3 Cooperating Non-Contracting Parties (CNCPs)

39. The SC **NOTED** that no National Report was submitted to the IOTC Secretariat in 2019 by Cooperating Non-Contracting Parties (CNCPs).

6.4 Invited Experts

40. The SC **NOTED** the report 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 document IOTC-2020-SC23-INF02 and is available upon request.

7. REPORTS OF THE 2020 IOTC WORKING PARTY MEETINGS

7.1 Report of the 10th Session of the Working Party on Neritic Tunas (WPNT10)

41. The SC **NOTED** the report of the 10th Session of the Working Party on Neritic Tunas (IOTC–2020–WPNT10–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 43 participants (cf. 18 in 2019). No MPF funding was provided as the meeting was held online (cf. 6 in 2019).

42. The SC **NOTED** the importance of these neritic tuna species in the structure and functioning of the marine ecosystems as well as exploited stocks for several fisheries, particularly to developing coastal nations in the Indian Ocean. The SC **EXPRESSED** its concern that assessments can still not be carried out for several species due to the quality of data available.

43. The SC **NOTED** that catch limits for species that have not been assessed (Bullet and Frigate tunas and Indo-Pacific King Mackerel) are based on reference years corresponding to peak catches for species that have been assessed (Longtail tuna, Narrow-barred Spanish Mackerel and Kawakawa). These reference years may no longer be applicable and therefore alternate means of providing catch advice should be investigated such as empirical harvest control rules.

44. The SC **NOTED** that in the absence of any more detailed information, the SC should consider proposing MSY as a guidance on the catch limits for these species where it is available.

7.2 Report of the 18th Session of the Working Party on Billfish (WPB18)

45. The SC **NOTED** the report of the 18th Session of the Working Party on Billfish (IOTC–2020–WPB18–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 55 participants (cf. 25 in 2019). No MPF funding was provided as the meeting was held online (cf. 9 in 2019).

7.2.1 Swordfish stock assessment

46. The SC **NOTED** the need to better evaluate the influence of low-quality catch data on billfish stock assessments and to develop CPUE time series for billfish species caught in large gillnet fisheries, as recently initiated for some neritic species in collaboration with I.R. Iran.

47. The SC **NOTED** that the assessment of stock status performed for swordfish in 2020, with fisheries data up to 2018, indicates that the stock is not overfished (SB_{2018}/SB_{MSY}=1.75) and not subject to overfishing (F_{2018}/F_{MSY}=0.6).

48. The SC **NOTED** that the good status of the stock may be surprising taking into account the fact that swordfish is targeted by many longline fisheries and that the status of the other billfish species under IOTC mandate are bad or uncertain in the case of black marlin.

49. The SC **NOTED** that the Taiwanese CPUE index was excluded from the assessment due to uncertainty in the data and for consistency reasons with previous assessments.

50. The SC **NOTED** the conflicting signal trends in swordfish CPUE between areas, with an apparent major depletion in the South West and increasing trend in the North East Indian Ocean.

51. The SC **ACKNOWLEDGED** the need for more accurate information on swordfish population structure to better define the stock units (e.g. two distinct stocks vs. metapopulation with seasonal mixing) to be assessed in 2023.

52. The SC **NOTED** that the preliminary results of genomic-based approaches applied to swordfish suggest a certain level of differentiation between the Northern and Southern parts of the Indian Ocean, and **ENCOURAGED** the continuation of the work with complementary approaches such as microchemistry and tagging experiments.

53. The SC **ACKNOWLEDGED** the interest of reducing the catch level intervals included in the Kobe II Strategy Matrix (K2SM) (2019-2028) around the MSY (i.e. close to the current catch levels) from 20% to 10% in order to better describe and assess the changes in spawning stock biomass (SB) and fishing mortality (F) expected under different catch scenarios.

7.2.2 Revision of catch levels of Marlins under Resolution 18/05

54. The SC **RECALLED** that Resolution 18/05 On management measures for the conservation of billfish, striped marlin, black marlin, blue marlin and Indo-Pacific sailfish encourages CPCs to "…ensure that the overall catches, of the Indian Ocean Striped Marlin, Black Marlin, Blue Marlin and Indo Pacific Sailfish in any given year do not exceed either the MSY level or, in its absence, the lower limit of the MSY range of central values as estimated by the Scientific Committee…". Moreover, Resolution 18/05 also requires the SC to "…annually review the information provided and assess the effectiveness of the fisheries management measures reported by CPCs on striped marlin, black marlin, blue marlin and Indo-Pacific sailfish and, as appropriate, provide advice to the Commission". The SC further **NOTED** that the MSY for several of these species was updated after the Resolution came into force based on the updated stock assessments for these species.

55. The SC **NOTED** that current catches for Black Marlin and Indo-Pacific Sailfish have exceeded the MSY as well as the catch limits set by Resolution 18/05, and that current catch trends for the two species show no signs of decline in line with meeting the catch limits by 2020. As such, the SC urgently reiterates its **RECOMMENDATION** that measures are agreed to reduce current catches to the limits set for the two species covered by Resolution 18/05 as per the management advice given in the Executive Summaries.

56. The SC further **NOTED** the major uncertainties associated with the catches of gillnet fisheries, which target in particular black marlin and Indo-Pacific sailfish, and **RECALLED** the need for all concerned CPCs to ensure that the catch, effort and size data for these fisheries are systematically reported to the Secretariat in accordance with Resolution 15/02.

7.3 Report of the 16th Session of the Working Party on Ecosystems and Bycatch (WPEB16)

57. The SC **NOTED** the report of the 16th Session of the Working Party on Ecosystems and Bycatch (IOTC–2020–WPEB16–R), including the consolidated list of recommendations provided as an appendix to the report. The

meeting was attended by 108 participants (cf. 41 in 2019). No MPF funding was provided as the meeting was held online (cf. 13 in 2019).

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

58. The SC **NOTED** paper IOTC–2020–SC23–06 which provided the SC with the opportunity to 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.

59. 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 5, recalling that the IPOA-Seabirds and IPOA-Sharks were adopted by the FAO in 1999 and 2000, respectively, and recommended the development of NPOAs.

60. The SC **RECALLED** the request from WPEB15 in 2019 for the Secretariat to provide links in the NPOA portal on the IOTC website (http://iotc.org/science/status-of-national-plans-of-action-and-fao-guidelines) to the actual plan documents. The SC **NOTED** that work is being done to collect these documents from CPCs and thanked those who had already submitted them.

61. The SC **REQUESTED** that CPCs submit their NPOA to Secretariat for upload onto the NPOA portal.

62. The SC **NOTED** small revisions to the previous update on NPOAs in 2019 including the revision of a NPOA sharks by Thailand for the period 2020-24 and a revision to the South African NPOA seabirds..

63. The SC **NOTED** a statement from Thailand on their National Plan of Action (NPOA) for sharks which has been submitted to the Secretariat and that Thailand do not yet have NPOA for seabirds and turtles and questioned whether these must be developed when no interactions are thought to occur with these species. The SC **CLARIFIED** that the requirements for NPOAs should be discussed during WPEB when there is more time to discuss these issues on a case by case basis.

7.3.2 Shortfin mako shark stock assessment

64. The SC **NOTED** that in 2020, a stock assessment was completed for shortfin mako using a JABBA model but that it was not possible to provide scientific advice based on this assessment due to a number of reasons including: issues with model misspecification; the low credibility of nominal catch data; the selection of biological parameters used in the model; and the inability of the aggregated biomass dynamic model to reconcile the significant time delay (around 8 years) between fishing and the effect on future recruitment.

65. The SC **NOTED** that one of the four CPUE series which were made available for the assessment was found to be significantly different to the others and so this series provided by Japan was not included in the model. The SC **CLARIFIED** that this CPUE series is thought to differ from the other CPUE series submitted due to spatial differences in the catches and **NOTED** that there is no standardised CPUE which covers the entire Indian Ocean. The SC **NOTED** that it is difficult to understand the quality of different CPUE series' and that further work on this is required in order to better understand their quality level.

66. The SC **NOTED** the intent of the WPEB to liaise with the International Whaling Commission (IWC) on matters relating to cetacean bycatch in the Indian Ocean including the introduction of a sub-Working Group which will be dedicated to discussing cetaceans to better understand the levels of bycatch in the Indian Ocean, potential mitigation measures and methods for overcoming data deficiencies.

7.3.4 Other Matters

67. The SC **NOTED** a request from Japan for the omission of data for Japan prior to 1992 in assessments as these are not data officially submitted by Japan. The SC further **NOTED** that Japan is currently working to estimate catches at a species level for these years and will submit these to the Secretariat when available. The SC **REQUESTED** Japan to prioritise data for blue shark and silky shark to be used in assessments next year.

7.4 Report of the 22nd Session of the Working Party on Tropical Tunas (WPTT22)

68. The SC **NOTED** the report of the 22nd Session of the Working Party on Tropical Tunas (IOTC–2020–WPTT22(AS)–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was

attended by 111 participants (cf. 68 in 2019). No MPF funding was provided as the meeting was held online (cf. 13 in 2019).

7.4.1 Skipjack tuna stock assessment

69. The SC **NOTED** that the 2020 skipjack tuna assessment (using Stock Synthesis) concluded that the stock is not overfished and is not subject to overfishing. The SC further **NOTED** that the estimated stock status is more optimistic compared to the previous assessment, despite that the catches have increased in the last three years (the catches in 2018 exceeded the catch limit by as much as 30%).

70. The SC **DISCUSSED** the possible reasons for the improved stock status, e.g. favourable environment conditions which may have resulted in increased recruitment and productivity, as reflected in the recent CPUE trends. The SC **AGREED** that it is important to explore and understand the underlying ecological and environmental drivers that underpin the stock trend to ensure that the recent overshooting of TAC did not undermine the sustainability of the stock.

71. The SC also **NOTED** that the 2020 skipjack tuna stock assessment captured structural uncertainty through a grid of 24 models covering alternative assumptions on spatial structure, tag data weighting, steepness, and technological effort creep. Statistical uncertainty from individual models was incorporated into the estimates of stock status. The SC further **NOTED** that several uncertainty axes included in the grid differed to what was considered in the previous assessment, following detailed revisions of the data and model structure.

72. The SC **NOTED** paper IOTC–2020–SC23–INF04 which provided a review by the invited scientific expert to WPTT22 of the 2020 skipjack tuna stock assessments, including the following abstract provided by the author:

> "*The assessment author should be commended on the work put into this assessment. Despite the need for a video meeting and the possible necessity to abbreviate some aspects of the assessment process, the author and team covered a great amount of breadth and detail. The work and presentations were very complete and identified some of the major uncertainties in the assessment model and data. The overall process of the assessment was seemingly very transparent and comments from the attendees were welcomed and addressed. The assessment document itself was complete and extensive. While I cannot make the determination, I assume that the assessment addressed every comment or issue brought up at the data preparatory meeting*".

73. The SC **NOTED** that the report by the invited expert provides guidance on how future assessments for skipjack might be improved. The SC **REQUESTED** the Secretariat to work with the Chair of the WPTT and the relevant assessment modellers to consider the salient points raised in the expert review for use in the next assessment.

74. The SC **NOTED** that there were considerable deliberations on the technology effort creep that might have accrued over time in the Purse Seine fleet, and how they should be incorporated into the assessment. The SC **NOTED** that the 1.25% annual effort creep assumption included in the model grid was based on a study that evaluates the difference in catchability trends between Purse Seine and Longline CPUE using the yellowfin and bigeye assessment models, which suggested an effort creep about 1.25– 4% annually since 1990. The SC also **NOTED** disagreement between WPTT scientists as to whether a scenario of 0% effort creep should have been part of the assessment grid.

75. The SC **AGREED** that the technological effort creep represents a key source of uncertainty although in case of skipjack tuna it is influential, but not a main driver of the assessment results. The SC **NOTED** similar debate is likely to occur for other species if the PS CPUE is going to be applied, and therefore urge the scientists to undertake additional analysis to fully understand the extent of the effort creep to the PS fleet and to resolve the issue quickly.

76. The SC **NOTED** that for skipjack tuna target and limit reference points for unfished spawning biomass level have been agreed, in accordance with the HCR (16/02), which differ considerably to the MSY based reference points defined in Resolution 15/10. The SC further **NOTED** that when the skipjack tuna stock is maintained to fluctuate around its target, there is still a very large probability for the stock to be classified as being overfished, despite that the biomass is well above BMSY.

77. The SC discussed the plausibility of the provision of both depletion based as well as MSY based stock status plots for skipjack tuna. The SC **NOTED** the ad hoc reference point working group is mandated to review the definition of overfished and overfishing stock status, and possible revisions of the Kobe plots, and therefore provides a better forum on how to best present the stock status for skipjack.

78. The SC **NOTED** that the reference points for skipjack tuna are defined with respect to unfished spawning biomass only in resolution 16/02; nonetheless the notation is in terms of B (total exploitable biomass) instead of SB (spawning biomass). Although the resolution also specified Etarg (annual equilibrium exploitation rate associated with the unfished target spawning biomass), it was intended as a control parameter for the harvest control rule, rather than as an explicit target. Meanwhile Resolution 16/02 did not define a limit exploitation rate (Elim). The SC further **NOTED** that resolution 15/10 had specified a default depletion-based target and limit fishing mortality rate but it was discussed whether these are appropriate for skipjack tuna (the default values are defined only when MSY-based reference points can not be estimated robustly according to 15/10). As such the SC **RECOMMENDED** that the skipjack MSE project to revisit these reference points, including to investigate the plausibility of establishing a limit reference point for fishing mortality (or exploitation rate).) and to evaluate the .differences on the catch forecasts by using total biomass instead of spawning biomass in the HCR.

79. The SC **RECALLED** that the first iteration of the skipjack HCR was implemented in 2017 and an annual Catch Limit was established for 2018-2020. The SC **ENDORSED** the 2020 skipjack tuna assessment results for updating the catch limit for the period 2021-2023 using the Harvesting Control Rule stipulated by the Resolution 16/02.

7.4.2 Yellowfin tuna assessment update

80. The SC **RECALLED** that the yellowfin stock assessment conducted in 2018 concluded that the stock is overfished and is subject to overfishing. The SC further **RECALLED** that the assessment was not used to provide management advice due to the insufficient uncertainty considered, as well as the poor predictive capability of the model. Consequently, a yellowfin workplan was initiated to reduce the uncertainty and improve the predictive capability of the model.

81. The SC **NOTED** that the yellowfin modelling team has made considerable progress in addressing the array of tasks under the workplan, which were scrutinized in more details during the WPTT, including: the investigation of alternative (annual) temporal structure; the development of an objective procedure towards the selection of models based on diagnostics scores; a close examination of the issues in the projections.

82. The SC **NOTED** there is a structure issue in the projection which is related to how the regional recruitment distribution is propagated through the projection period. The SS3 software has assumed the long-term average values for the regional recruitment distribution parameters in the projection, which differed considerably to the recent values in case of yellowfin tuna. Consequently, this would have imposed a constraint on available biomass in regions with large catches and led to biomass collapse for some of the more pessimistic modes, resulting in biased estimates of K2SM probabilities.

83. The SC **NOTED** that the yellowfin modelling team is working collaboratively with the SS3 developer to resolve this issue by allowing for more flexible options in configuring time-varying parameters for the projections. The SC **AGREED** that until a solution is provided, the estimated K2SM probabilities should be not used for providing management advice for yellowfin tuna in order to avoid confusions.

84. The SC commended the yellowfin modelling team for their efforts and excellent contributions to identify the issues in the yellowfin assessment model. The SC **NOTED** that the work will continue in 2021 to provide a model that is sufficiently improved to justify its use for providing new management advice on catch limit. The SC NOTED that the work is expected to be complete in time for the WPTT meeting in 2021 and any progress made intersessionally will be reported to the special session of the Commission scheduled in March 2021.

7.4.3 Status of Yellowfin catches

85. The SC **NOTED** Para. 24 of Resolution 19/01 states that "The IOTC Secretariat, under advice of the Scientific Committee, shall prepare and circulate a table of allocated catch limits disaggregated as per the conditions set out in paragraphs 5 – 10 for preceding year, in December of the current year." As such, the table of allocated catch limits was presented to the SC and is contained in Appendix 33.

86. The SC **NOTED** that the intention of Res 19/01 is to reduce catch levels to allow the yellowfin tuna stock to rebuild. The SC NOTED, however that according to Appendix 33, catches have actually increased by 5.22% since 2014. The SC further **NOTED** that increases in catches by CPCs not bound by Res 19/01 have offset the reductions in catches by CPCs bound by the Resolution. This has led to the overall increase in catches from 2014 – 2019.

7.4.4 Other Matters

87. The SC **NOTED** the WPTT Program of work, with high priorities being given to stock assessment model data review, fishery-independent monitoring including acoustic FAD monitoring, and MSE, CPUE standardisations, Biological sampling, Historical data review, and Target and limit reference points review.

7.5 Report of the 11th Session of the Working Party on Methods (WPM11)

88. The SC noted the report of the 11th Session of the Working Party on Methods (IOTC–2020–WPM11–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 55 participants (cf. 37 in 2019). No MPF funding was provided as the meeting was held online (cf. 7 in 2019).

89. The SC **NOTED** the progress made in Management Strategy Evaluation exercises for IOTC species in 2020. The SC **NOTED** that unfortunately the TCMP meeting in 2020 had been cancelled due to the Covid-19 pandemic and therefore no discussions on the progress had been undertaken in that forum.

90. The SC **NOTED** that the 9th workshop on MSE of IOTC WPM Scientists had also been cancelled, delaying the technical progress on MSE in 2020. The SC **NOTED** that the expert MSE workshops are very constructive and effective in discussing technical matters and the outcomes of the meetings are reflected in the MSE development. As such the SC **STRESSED** the importance of this meeting taking place in 2021.

7.5.1 Management Strategy Evaluation Progress

91. The SC **NOTED** that in 2020 the Commission stated that:

> *The Commission **SUPPORTED** the ongoing Management Strategy Evaluation work and **NOTED** the revised workplan endorsed by the Scientific Committee in Appendix 6 of the 2019 Scientific Committee Report. The Commission particularly **NOTED** the importance of the work to specify the skipjack tuna harvest control rule as a full Management Procedure (MP) as well as the need to finalise the MP development for yellowfin tuna to provide sound management advice for this species.*

92. The SC **NOTED** that this schedule of work is once again included as Appendix 6 to this report to clarify the revised MSE schedule.

7.5.2 Albacore MSE

93. The SC **NOTED** that the project was initiated in 2020 to further develop the ALB MSE. Work has started on updating the simulation platform to the new model structure including a proposal for a new OM grid. The SC **NOTED** the WPM has endorsed a new set of reference OM grid to capture the range of uncertainty identified.

7.5.3 Skipjack tuna MSE

94. The SC **NOTED** an MSE expert has been contracted in 2020 to undertake review of the skipjack tuna harvest control rule with a view to review and potentially revise the HCR as required by Res 16/02. The work conducted so far included (1) developing an Operating Model based on Stock Synthesis III; (2) developing a simple stock assessment model that can be fitted to simulated data from the skipjack stock assessment grid, and (3) Simulation test model-based Management Procedures. The aim of the review is to develop a full skipjack MP.

7.5.4 Yellowfin tuna MSE

95. The SC **NOTED** the attempt to conduct a full assessment of the yellowfin tuna has not been achieved this year and the current yellowfin OM is based on the 2018 yellowfin assessment. The SC further **NOTED** that YFT OM development explored a range of modelling issues including retrospective pattern, high F, and revised treatment of recruitment and CPUE auto-correlation.

7.5.5 Bigeye tuna MSE

96. The SC **NOTED** that bigeye tuna OMs were updated from the 2019 stock assessment, and a Pella-Tomlinson Random Effects surplus production model that includes process and observation errors was developed as a candidate for the MP.

7.5.6 Swordfish MSE

97. The SC **NOTED** that limited progress had been made on the Swordfish MSE. The modeller working on the MSE was currently not available. As such, very little progress had been made since the 2019 SC meeting. The work is expected to resume in late 2020, early 2021.

7.5.7 Stock status guide and other business

98. The SC were made aware that:

*The Commission **NOTED** the ongoing work of the Ad Hoc Reference Point Working Group and REQUESTED that the outcomes of this group are presented to the TCMP for its consideration in 2021.*

99. The SC **NOTED** the discussions on whether, for any given species with a harvest strategy, the OM requires reconditioning when there is an updated assessment. The SC **AGREED** that there is a need for deciding on when to stop the reconditioning of the OMs with new assessments. The SC **NOTED** that although there has been some general practice in assisting the decision (e.g. the new assessment biomass estimates fall outside the range of the OM) a more generic set of criteria and guidance is required. Such guidance will help expedite the progress of the MSE process towards focusing on the testing of candidate MPs. The SC further **NOTED** the issue is also related to determining when and whether any exceptional circumstances has occurred.

7.6 Report of the 16th Session of the Working Party on Data Collection and Statistics (WPDCS16)

100. The SC **NOTED** the report of the 16th Session of the Working Party on Data Collection and Statistics (IOTC–2020–WPDCS16–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 76 participants (cf. 41 in 2019) No MPF funding was provided as the meeting was held online (cf. 9 in 2019).

101. The SC **CONGRATULATED** both Sri Lanka and Somalia for the positive updates in terms of the implementation of their national statistical systems. Furthermore the SC also **NOTED** how CPCs reacted to new challenges (such as reduction in onboard observers and sampling coverage) caused by the insurgence of the Covid pandemic in 2020.

102. The SC **NOTED** that Electronic Monitoring Systems can be one viable and effective means to collect fishery independent information, including when external circumstances prevent human observers from being deployed onboard, while at the same time **ACKNOWLEDGING** that data collection through EMS alone cannot fully conform to Res. 11/04 *On a Regional Observer Scheme* requirements.

103. **NOTING** that the quality of data available for artisanal fisheries in the Indian Ocean still needs to be greatly improved, the SC reiterated its **REQUEST** that the WPDCS continue assisting CPCs in improving the implementation of data collection and sampling activities for artisanal, coastal and small-scale fisheries, and **SUGGESTED** that when re-estimation of original data provided by CPCs are made by the Secretariat, these are revised frequently in close collaboration with national scientists.

104. **RECALLING** that Res. 15/02 requires CPCs to provide documents covering sampling and raising procedures by species and type of fishery, the SC **REQUESTED** the IOTC Secretariat develops, in close collaboration with CPCs, electronic templates to drive the documentation of such sampling procedures for all gears and fleets, focusing on time-area catches and size data, to be revised and discussed at the next session of the WPDCS.

105. Also, the SC **NOTED** the discussions ongoing at the WPDCS about the requirement (still from Res. 15/02) to sample at least 1 fish / MT, and also on the fact that sampling lengths from live bycatch species (such as sharks) prior to their release, is discouraged by some CPCs for crew safety reasons and that this has to be taken into account when assessing the level of compliance of such CPCs.

106. **NOTING** the scientific importance of the information provided through the daily buoy position dataset (as this was initially required by Res. 19/02), the SC **ACKNOWLEDGED** that confidentiality aspects restrict its usage to the analysis of compliance aspects only (see para. 24 of Res. 19/02), therefore preventing its use for scientific purposes.

107. Furthermore, the SC **RECOMMENDED** the Commission to consider how to best take into account the confidentiality aspects inherent to such a dataset (e.g. through updates to Res. 12/02) while at the same time ensuring proper attribution of its ownership.

108. The SC **ACKNOWLEDGED** that this information is the result of combined efforts from several stakeholders (that including the industry, national organizations and also the IOTC Secretariat) and that when deciding how to give access to this data, the original providers should be pre-emptively consulted before the information is released. Also, the SC **CONSIDERED** the possibility that access priority to this data be given to scientists affiliated with the source institutions / stakeholders, in order to recognize their work.

109. **ACKNOWLEDGING** a potential lack of clarity in the current definition of "*For reporting (Optional)*" data elements in the context of the ROS minimum standard data fields, the SC **RECOMMENDED** that the Commission require CPCs to report such fields to the IOTC Secretariat (as part of their regular ROS data submissions) when these are available to the national observer programmes.

110. The SC **NOTED** the steps forward in the definition of Electronic Monitoring Programme Standards presented at the WPDCS and **ACKNOWLEDGED** that these require additional contributions and development for their successful implementation at regional level.

111. For this reason, the SC **RECOMMENDED** that an *ad-hoc*, intersessional Working Group on the development of EM Programme Standard be constituted and physical or virtual workshops (depending on the circumstances) be held to further progress with the definition of EMS minimum standards.

112. The SC **NOTED** that further information on these matters will be provided during the agenda item on EMS Minimum Programme Standards, and therefore deferred all discussions to later (in particular those related to the newly constituted *ad-hoc* Working Group and procedures for participation).

7.7 Summary discussion of matters common to Working Parties (capacity building activities; connecting science and management, etc.)

7.7.1 Data collection and capacity building

113. The SC **NOTED** that the ability to determine the 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.

7.7.2 Invited Expert(s) at the WP meetings

114. Given the importance of external independent review for working party meetings, the SC **RECOMMENDED** the Commission continues to allocate sufficient budget for invited scientific experts to be regularly invited to scientific working party meetings.

7.7.3 Meeting participation fund

115. The SC **NOTED** that in 2020, no MPF funding was provided as all meetings were held online.

116. 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.

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

117. The SC reiterated its **RECOMMENDATION** that the Commission allocate 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 at port need to have hard copies.

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

118. 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 7.

7.7.6 Development of management advice and plausibility criteria of stock assessment models

119. 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 IOTC working parties.

120. 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 possibility of exceptional circumstances e.g. large increase in catches, or revisions to data, between assessment years.

121. 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.

122. The SC **NOTED** that to date IOTC scientists have employed a wide range of models in stock assessments, and overtime has acquired considerable experience in model validation and selection. The SC **AGREED** that it is useful to develop a set of generic criteria for model plausibility, utilising best practice in evaluating model convergence and data fits, retrospective patten and forecast bias, and predictive skills, as well as other potential aspects of model diagnostics. The SC **NOTED** that establishing such guidance and criteria can help ensure that the stock assessments are transparent and comprehensive and allow stakeholders to have a good grasp of the scientific process. Stock specific plausibility criteria can also be considered to evaluate if assessment results are consistent with prior knowledge about the exploitation history and population biology.

123. The SC also **SUGGESTED** that it is important to conduct continuity runs during stock assessment to ensure that the impact of data and structural changes to the stock assessment model is adequately understood and well documented. Such exercises help establish when and whether a new benchmark assessment is required in light of new information.

124. The SC **ACKNOWLEDGED** the importance of considering both the input (effort) control as well as the output (catch) control to develop management advice, also through MSE testing, to rebuild certain stocks

7.7.7 Presentation of stock assessment results

125. The SC **AGREED** that the work conducted to review and improve the standardised presentation of stock status is very important to better convey management information. The SC **SUGGESTED** that the revision should aim to adequately capture all risk elements associated with the determination of stock status in relation to the target and limit reference points. Several CPCs noted that, when reference points are reviewed in the near future, it is necessary to understand the biological and/or ecological meanings(definitions) of the coefficients of the current limit reference points used for the 5 species. For example, in the case of yellowfin tuna, coefficients of 0.4 and 1,4 are used for BLim and FLim respectively (BLim = 0.4 BMSY and FLim = 1.4 FMSY). The scientific rationale for these coefficients is unclear and should be justified or modified in the future..

126. The SC **SUPPORTED** ongoing work to improve the presentation of stock assessment results both through discussions at the Working Party meetings and through the ad hoc Reference Point WG.

7.7.8 Environmental Considerations

127. The SC **NOTED** that the ongoing work regarding Ecosystem Report cards was not discussed in 2020 due to the time constraints imposed by the virtual meetings, however the SC **SUPPORTED** the ongoing work to develop these Report Cards

128. The SC **NOTED** that the Secretariat continues to collaborate with CPC scientists in a scoping study to create a platform for climate indicator information to be provided through the IOTC Website

8. STATUS OF TUNA AND TUNA-LIKE RESOURCES IN THE INDIAN OCEAN

8.1 Tuna – Highly migratory species

129. The SC **STRESSED** that yellowfin tuna is overfished and subject to overfishing and that bigeye tuna, though not overfished, is subject to overfishing.

130. 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 2020 (Fig. 1):

- Albacore (*Thunnus alalunga*) – Appendix 8
- Bigeye tuna (*Thunnus obesus*) – Appendix 9
- Skipjack tuna (*Katsuwonus pelamis*) – Appendix 10
- Yellowfin tuna (*Thunnus albacares*) – Appendix 11

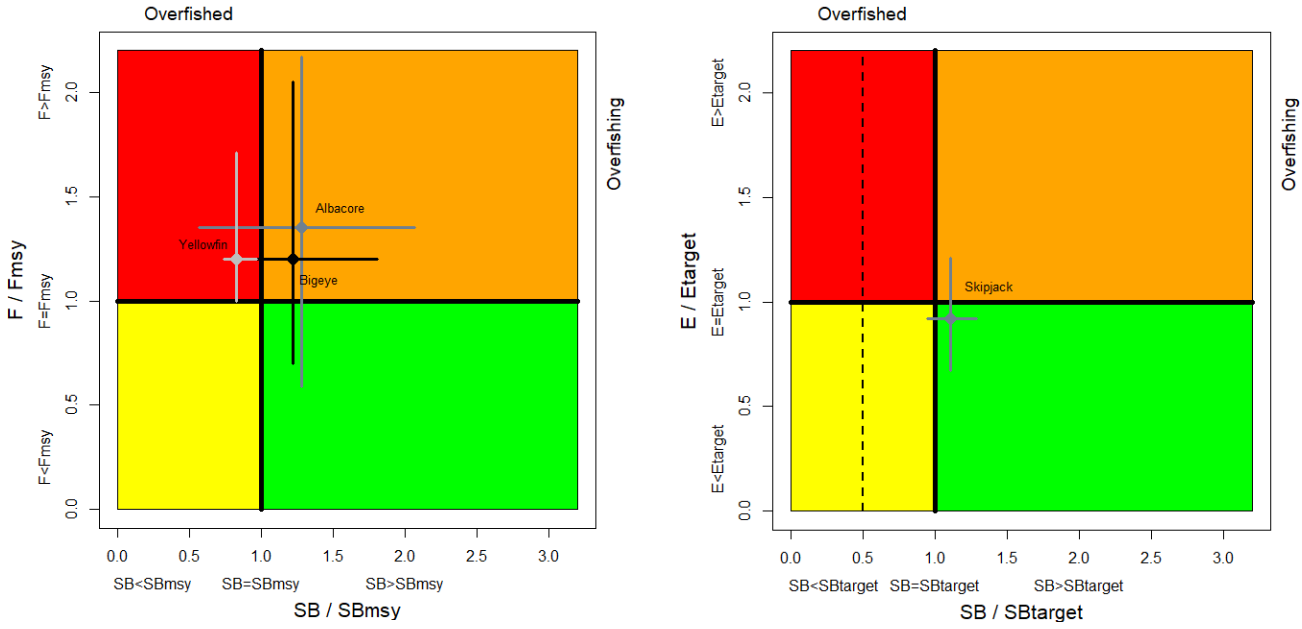

Fig. 1. (Left) Combined Kobe plot for bigeye tuna (black: status in 2018, based on the assessment conducted in 2019), and yellowfin tuna (light grey: 2017, with assessment conducted in 2018) and albacore (dark grey: 2017 with assessment conducted in 2019) showing the estimates of current spawning biomass (SB) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality. (Right) Kobe plot for skipjack tuna (assessment conducted in 2020) showing the estimates of the current stock status (The dashed line indicates the limit reference point at 20%SB0 while SBtarget=0.4 SB0). Cross bars illustrate the range of uncertainty from the model runs with an 80% CI (95% CI for albacore).

131. The SC **NOTED** paper IOTC–2020–SC23–ES05 which provided an overview of the biology, stock status and management of southern bluefin tuna (*Thunnus maccoyii*), and thanked CCSBT for its provision.

8.2 Tuna and mackerel – neritic species

132. 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 2020 (Fig. 2):

- Bullet tuna (*Auxis rochei*) – Appendix 17
- Frigate tuna (*Auxis thazard*) – Appendix 18
- Kawakawa (*Euthynnus affinis*) – Appendix 19
- Longtail tuna (*Thunnus tonggol*) – Appendix 20
- Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix 21
- Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix 22

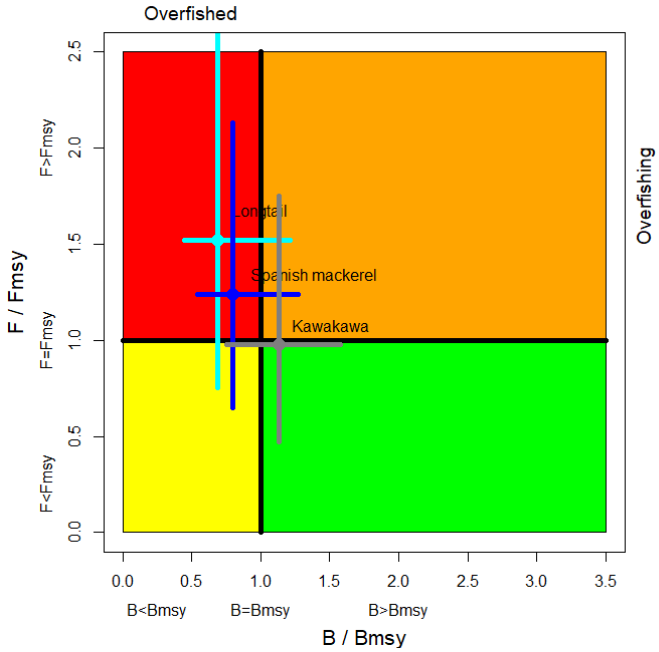

Fig. 2. Combined Kobe plot for longtail tuna, narrow-barred Spanish mackerel and kawakawa, showing the estimates of stock size (B) and current fishing mortality (F) in 2018 (assessment conducted in 2020) in relation to optimal biomass and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs.

8.3 Billfish

133. 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 2020 (Fig. 3):

- Swordfish (*Xiphias gladius*) – Appendix 12
- Black marlin (*Makaira indica*) – Appendix 13
- Blue marlin (*Makaira nigricans*) – Appendix 14
- Striped marlin (*Tetrapturus audax*) – Appendix 15
- Indo-Pacific sailfish (*Istiophorus platypterus*) – Appendix 16

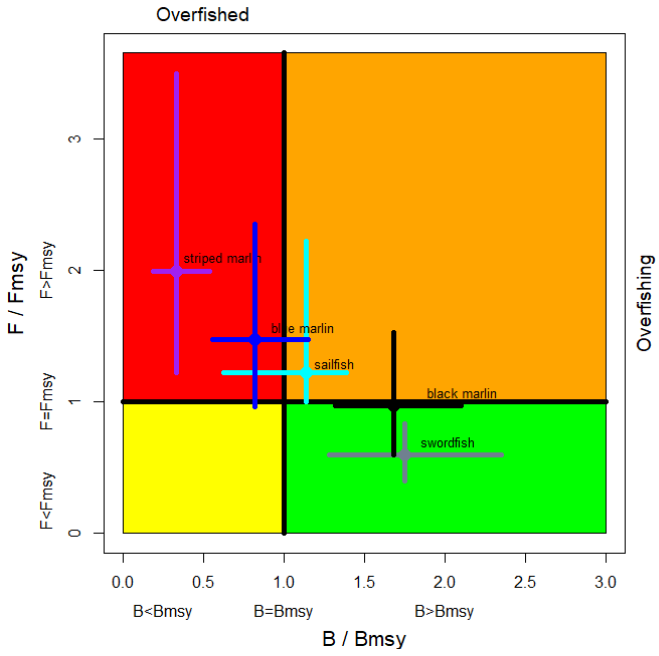

Fig. 3. Combined Kobe plot for swordfish (2018 with assessment conducted in 2020, grey), Indo-Pacific sailfish (2017 with assessment conducted in 2019, cyan), black marlin (2017 with assessment conducted in 2018, black), blue marlin

(2017 with assessment conducted in 2019, blue) and striped marlin (2017 with assessment conducted in 2018, purple) showing the estimates of current stock size (SB or B, species assessment dependent) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs.

9. STATUS OF SHARKS, MARINE TURTLES, SEABIRDS AND MARINE MAMMALS IN THE INDIAN OCEAN

9.1 Sharks

134. 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 23
    - Oceanic whitetip shark (*Carcharhinus longimanus*) – Appendix 24
    - Scalloped hammerhead shark (*Sphyrna lewini*) – Appendix 25
    - Shortfin mako shark (*Isurus oxyrinchus*) – Appendix 26
    - Silky shark (*Carcharhinus falciformis*) – Appendix 27
    - Bigeye thresher shark (*Alopias superciliosus*) – Appendix 28
    - Pelagic thresher shark (*Alopias pelagicus*) – Appendix 29

9.2 Marine turtles

135. The SC **RECOMMENDED** that the Commission note the management advice developed for marine turtles, as provided in the Executive Summary which encompasses all six species found in the Indian Ocean:
    - Marine turtles – Appendix 30

9.3 Seabirds

136. The SC **RECOMMENDED** that the Commission note the management advice developed for seabirds, as provided in the Executive Summary which encompasses all species commonly interacting with IOTC fisheries for tuna and tuna-like species:
    - Seabirds – Appendix 31

9.4 Marine mammals

137. The SC **RECOMMENDED** that the Commission note the management advice developed for cetaceans, as provided in the newly developed Executive Summary which encompasses all species commonly interacting with IOTC fisheries for tuna and tuna-like species:
    - Cetaceans – Appendix 32.

10. IMPLEMENTATION OF THE REGIONAL OBSERVER SCHEME

138. The SC **NOTED** paper IOTC–2020–SC23–07 which provided 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) including the coverage estimated for both the longline and purse seine large scale fisheries from concerned CPCs, and how these compare to the expected minimum coverage level.

139. The SC **ENCOURAGED** CPCs to validate the information provided in appendices A, B and C of paper IOTC-2020-SC23-07, and confirm that it correctly reflects the status of implementation of the ROS at the national level, and to liaise with the IOTC Secretariat should any discrepancy be identified.

140. The SC **NOTED** that Japan intends to liaise with the Secretariat intersessionally to ensure that information relating to Japan and South Africa are correct to avoid misunderstandings relating to the joint venture agreement in place between the CPCs.

141. The SC **NOTED** a clarification of the definition of dry observers **NOTING** that these are observers based on land who analyse the footage received from Electronic Monitoring Systems (EMS) and that therefore they are not required to be accredited in the same way that onboard observers are.

142. The SC **NOTED** that while many data are now submitted electronically to the Secretariat, still many are not reported in formats such as PDFs from which data cannot easily be extracted so not all submitted data are

included in the Regional Observer Scheme (ROS) database. The SC **CLARIFIED** that data held in the database are only those which are officially submitted in trip reports rather than those included within National Reports but that the Secretariat uses the National Reports to cross verify information received in trip reports. The SC **SUGGESTED** that the process of submitting data and accrediting observers should be formalised **NOTING** that currently the methods for doing this are inconsistent.

143. The SC **NOTED** that the ROS is very important for the collection of independent scientific data and expressed **CONCERN** that the level of coverage remains low at 2.15% and that there is no coverage of the artisanal fleet which comprise a large proportion of catches taken in the Indian Ocean.

144. The SC **CLARIFIED** that currently the level of observer coverage is estimated for longline fleets by comparing the observed number of hooks with the total reported number of hooks and for purse seine fleets fishing days are used to estimate the level of coverage.

145. The SC **NOTED** comments from Kenya that the pilot project is progressing well and has been very helpful in training observers to a high level.

146. The SC **NOTED** paper IOTC-2020-SC23-12 on minimum standards for designing and implementing Electronic Monitoring systems in Indian Ocean tuna fisheries, including the following abstract provided by the authors:

> "*In addition to catch and effort fishery-dependent information collected through logbooks and/or port-sampling of commercial vessels, observer data is key to compile, complement and verify fishery activity information. Electronic monitoring (EM) using cameras and other sensors is a proven technology that has been widely used for various purposes on fishing vessels, primarily in industrial fleets. EM systems include equipment that tracks a vessel's position and activity, together with cameras that record key aspects of the fishing operations. EM has been used extensively for this purpose to obtain reliable information on catches and their composition, as well as to monitor and collect data on bycatches of protected species (ETP)*." – See document for full abstract

147. The SC **NOTED** that EMS is a very promising tool for enhancing observer coverage and can complement data collected by onboard observers, noting there are still certain types of information which cannot yet be collected using EMS.

148. The SC **NOTED** the plan decided by the WPDCS to establish an ad-hoc working group to continue discussions around developing the EMS standards further. The SC **NOTED** that several CPCs expressed interest in joining this group including Australia, China, the European Union, Japan, Maldives, Seychelles and Somalia. The SC **NOTED** that the formalities for this group have not yet been finalised but **ENCOURAGED** all interested parties to attend including scientists, managers and industry.

149. The SC **NOTED** that electronic monitoring has been used successfully in Australia onboard their longline vessels which has ensured uninterrupted coverage which would not have otherwise been possible (using human observers) during the Covid-19 pandemic and Australia stated that they were encouraged to see the momentum growing towards more widespread use of this tool.

150. The SC **NOTED** that the Maldives and Seychelles are also in the process of developing EMS onboard parts of their fleet and considered it beneficial for them to join the ad-hoc working group.

151. The SC **NOTED** that the equipment requirements for the systems vary depending on the size and type of vessel in order to meet the minimum standards. The SC **NOTED** that in most cases data will be directly recovered by dry observers for analysis without a need for data entry by members of the crew.

152. The SC **NOTED** concerns about data confidentiality with such systems and **SUGGESTED** that this will be discussed as part of the dedicated working group.

10.1 Consideration of Resolution 16/04 On the implementation of a Pilot Project in view of promoting the Regional Observer Scheme of IOTC

153. The SC **NOTED** that the ROS pilot project had been paused indefinitely due to the inability of the Contractors to travel to the participating countries and provide the necessary training. It is hoped that the project will resume in early 2021.

11. PROGRAM OF WORK AND SCHEDULE OF WORKING PARTY AND SCIENTIFIC COMMITTEE MEETINGS

11.1 Progress on previous recommendations from WPs and the SC

154. The SC **NOTED** paper IOTC–2020–SC23–10 which provided the SC with an update on the progress made on its 2019 recommendations (also available in Appendix 34).

155. The SC **THANKED** the Secretariat for the update on progress and **NOTED** that encouraging progress was being made.

11.2 Program of Work (2021–2025) and assessment schedule

11.2.1 Program of Work

156. The SC **NOTED** IOTC–2020–SC23–08 which provided the SC with a proposed Program of Work for each of its working parties, including prioritisation of the elements requested by each working party.

157. The SC **NOTED** the proposed Program of Work and priorities for the SC and each of the working parties and **AGREED** to a consolidated Program of Work as outlined in Appendix 35a-g and in accordance with the IOTC Strategic Science Plan 2020-2024. The Chairpersons and Vice-Chairpersons of each working party will ensure that the efforts of their respective working parties 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.

158. The SC recalled the process for developing the consolidated SC Program of work (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 liaison 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.

159. The SC **AGREED** on the consolidated table of priorities across all working parties, as developed by each working party Chairperson, and **REQUESTED** that the IOTC Secretariat, in consultation with the Chairpersons and vice-Chairpersons of the SC and relevant working parties, develop ToRs for the specific projects to be carried out.

160. The SC **NOTED** that the consolidated table of priorities does not replace the full programme of work of each working party (Appendix 35a-g) and that adequate attention and focus should still be allocated to those activities where possible. The SC further **NOTED** that Table 3 has been developed by the SC and working party 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 working parties based on the objectives of the SC (as agreed in IOTC–2014–SC17–R, para. 179).

Table 3. Priority topics for obtaining the information necessary to develop stock status indicators for all Working Parties. Further details can be found in Appendix 35a-g.

Priority	1	2	3
WPTT	Stock assessment priorities – detailed review of the existing data sources, including: Size frequency data: Evaluation of the reliability of length composition from the longline fisheries (including recent and historical data), Tagging data: Further analysis of the tag release/recovery data set. Organisation of expert group to investigate tagging mortality Re-estimation of M using updated tagging data.	Fisheries Independent Monitoring Scoping study to investigate 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). It would be valuable to conduct a scoping exercise to evaluate the applicability to the tropical tuna species	CPUE standardization Develop standardised CPUE series for each tropical tuna fleet/fishery for the Indian Ocean
WPEB	Stock structure (connectivity and diversity): 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. This may include Next Generation Sequencing (NGS), Nuclear markers (i.e. microsatellite) as well as other components of close-kin mark recapture studies (CKMR).	Connectivity, movements, habitat use and post release mortality Electronic tags (PSATs, SPOT, Splash MiniPAT) to assess the efficiency of management resolutions on non-retention species (BSH in LL, marine turtles and rays in GIL and PS, whale sharks) and to determine connectivity, movement rates and mortality estimates.	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)) 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. Research started in Sri Lanka. Could look at IOTC priority species 3.3 Reproduction research Priority species: blue shark (BSH), shortfin mako shark (SMA) and oceanic whitetip shark (OCS), and silky shark (FAL)

			3.4 Ecological Risk Assessment (cetaceans)
WPNT	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. Sri Lanka (priority species: Frigate tuna, Kawakawa, bullet tuna) Indonesia (priority species: Kawakawa, Bullet tuna, Frigate tuna) Pakistan (priority species: Longtail tuna, Kawakawa, narrow-barred Spanish mackerel) Iran gillnet CPUEs for all species Capacity building support for CPCs to develop standardised CPUEs for their fisheries	Stock assessment / Stock indicators Explore alternative assessment approaches and develop improvements where necessary based on the data available to determine stock status for longtail tuna, kawakawa and Spanish mackerel 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. Exploration of priors and how these can be quantifiably and transparently developed Take into consideration the outputs of genetic studies to investigate stock structure and regional differences in populations Improve the presentation of management advice from different assessment approaches to better represent the uncertainty and improve communication between scientists and managers in the IOTC.	Data mining and collation Collate and characterize 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. The following data should be collated and made available for collaborative analysis: catch and effort by species and gear by landing site; operational data: stratify this by vessel, month, and year for the development as an indicator of CPUE over time; and 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)). Re-estimation of historic catches for assessment purposes (taking into account updated identification of uncertainties and knowledge of the history of the fisheries) • (Data support missions to priority countries: India, Oman, Pakistan)
WPTmT	**2.1.** Biological research (collaborative research to improve understanding of spatio-temporal patterns in age and growth and reproductive parameters).	**3.1.** Continue the development of standardized CPUE series for each albacore fishery for the Indian Ocean, with the aim of developing appropriate CPUE series for stock assessment purposes.	**5.1.** Further investigate the size information provided by CPCs in order to better understand the stock dynamics and inputs into the assessment models. This is particularly necessary for the purse seine data
WPB	Stock structure (connectivity and diversity) Continue work on determining stock structure of Swordfish, using complimentary data sources, including genetic and microchemistry information as well as other relevant sources/studies.	Biological and ecological information (incl. parameters for stock assessment and provide answers to the Commission)	Stock structure (connectivity and diversity) Tagging research (PSAT tags) to determine connectivity, movement rates and mortality estimates of billfish (Priority species: swordfish). Similar projects have been partially funded by EU, with a focus on

			epipelagic species. More tags are needed for swordfish.
WPDCS	Artisanal fisheries data collection 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 Kenya • Coastal fisheries of Somalia • Coastal fisheries of Pakistan • Coastal fisheries of Sri Lanka • Coastal fisheries of I.R. Iran	Compliance with IOTC Data Requirements - Data support missions Drafting 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: • Indonesia • Pakistan • India • Sri Lanka • Somalia	IOTC Data access Improving discoverability of IOTC scientific assets through standard metadata and DOIs
WPM	Management Strategy Evaluation Continuation of Management Strategy Evaluation for Albacore, Skipjack, Yellowfin, Bigeye tunas as well as Swordfish		

11.2.2 Assessment schedule

161. The SC **ADOPTED** a revised assessment schedule, ecological risk assessment and other core projects for 2021–25, 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 36.

11.2.3 Invited Experts

162. The SC **REQUESTED** that at least one 'scientific expert' be invited to each of the working parties in 2020 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.

11.2.4 Consultants

163. Noting the highly beneficial and relevant work done by IOTC stock assessment consultants 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.

11.2.5 Schedule of meetings for 2021 and 2022

164. The SC **NOTED** paper IOTC–2020–SC23–10 which outlined the proposed schedule for IOTC Working Parties and SC meetings for 2021 and 2022.

11.2.6 Data preparatory meetings

165. Acknowledging that holding data preparatory meetings prior to stock assessments is considered to be best practice (as identified by the yellowfin stock assessment external reviewer,the WPTT and the WPDCS) and noting that in both 2019 and 2020 data preparatory meetings were successfully held for the WPTmT and WPTT respectively, the SC **AGREED** to continue the practice of having data preparatory meetings in addition to stock assessment meetings for the major IOTC species. The SC **SUGGESTED** that data preparatory meetings could continue to be held virtually so as not to increase the travel and costs required for the already full IOTC timetable of meetings.

11.2.7 Final Meeting schedule

166. The SC **REQUESTED** that the schedule of Working Party and Scientific Committee meetings for 2021 and 2022 provided at Appendix 37 be communicated by the IOTC SC Chairperson to the Commission for its endorsement.

12. OTHER BUSINESS

167. There was no other business.

13. ADOPTION OF THE REPORT OF THE 23RD SESSION OF THE SCIENTIFIC COMMITTEE

168. The SC **RECOMMENDED** that the Commission consider the consolidated set of recommendations arising from SC23, provided at Appendix 38.

169. The report of the 23rd Session of the Scientific Committee (IOTC–2020–SC23–R) was **ADOPTED** by correspondence.

APPENDIX 1
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APPENDIX 2
AGENDA FOR THE 23RD SESSION OF THE SCIENTIFIC COMMITTEE

Date: 7 - 11 December 2020
Location: Virtual
Time: 12:00 – 16:00 daily
Chair: Dr Toshihide Kitakado (Japan)
Vice-Chair: Dr Denham Parker (South Africa)

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 24th Session of the Commission.
   - 4.2 Previous decisions of the Commission

5. **SCIENCE RELATED ACTIVITES OF THE IOTC SECRETARIAT IN 2020** (IOTC Secretariat)
   - 5.1 Report of the Secretariat – Activities in support of the IOTC science process in 2020

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

7. **REPORTS OF THE 2020 IOTC WORKING PARTY MEETINGS**
   - 7.1 IOTC–2020–WPNT10–R Report of the 10th Session of the Working Party on Neritic Tunas
     - 7.1.1 Longtail tuna stock assessment
     - 7.1.2 Narrow-barred Spanish Mackerel stock assessment
     - 7.1.3 Kawakawa stock assessment
   - 7.2 IOTC–2020–WPB18–R Report of the 18th Session of the Working Party on Billfish
     - 7.2.1 Swordfish stock assessment
     - 7.2.2 Revision of catch levels of Marlins under Resolution 18/05
   - 7.3 IOTC–2020–WPEB16–R Report of the 16th 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 Shortfin mako shark stock assessment
     - 7.3.3 Other Matters
   - 7.4 IOTC–2020–WPTT22–R Report of the 22nd Session of the Working Party on Tropical Tunas
     - 7.4.1 Skipjack tuna stock assessment
     - 7.4.2 Yellowfin tuna assessment update
     - 7.4.3 Other Matters
   - 7.5 IOTC–2020–WPM11–R Report of the 11th Session of the Working Party on Methods
     - 7.5.1 Management Strategy Evaluation Progress (Chairperson)
   - 7.6 IOTC–2020–WPDCS16–R Report of the 16th Session of the Working Party on Data Collection and Statistics
   - 7.7 Summary discussion of matters common to Working Parties (capacity building activities; connecting science and management, etc.)

8. **STATUS OF TUNA AND TUNA-LIKE RESOURCES IN THE INDIAN OCEAN** (Chairperson)
   - 8.1 Tuna – Highly migratory species
   - 8.2 Tuna and mackerel – Neritic species
   - 8.3 Billfish

9. STATUS OF SHARKS, MARINE TURTLES, SEABIRDS AND MARINE MAMMALS IN THE INDIAN OCEAN (Chairperson)

- 9.1 Sharks
- 9.2 Marine turtles
- 9.3 Seabirds
- 9.4 Marine Mammals

10. IMPLEMENTATION OF THE REGIONAL OBSERVER SCHEME (IOTC Secretariat)

- 10.1 Consideration of Resolution 16/04 On the implementation of a Pilot Project in view of promoting the Regional Observer Scheme of IOTC
  - 10.1.1 Update on the Pilot Project approved by the Commission in 2017

11. PROGRAM OF WORK AND SCHEDULE OF WORKING PARTY AND SCIENTIFIC COMMITTEE MEETINGS (IOTC Secretariat and Chairperson**)**

- 11.1 Progress on previous Recommendations from WPs and SC
- 11.2 Program of Work (2021–2025) and assessment schedule
- 11.3 Schedule of meetings for 2021 and 2022

12 OTHER BUSINESS (Chairperson)

13 REVIEW OF THE DRAFT, AND ADOPTION OF THE REPORT OF THE 23rd SESSION OF THE SCIENTIFIC COMMITTEE (Chairperson)

APPENDIX 3
LIST OF DOCUMENTS

Document	Title
IOTC–2020–SC23–01a	Draft: Agenda of the 23rd Session of the Scientific Committee
IOTC–2020–SC23–01b	Draft: Annotated agenda of the 23rd Session of the Scientific Committee
IOTC–2020–SC23–02	Draft: List of documents of the 23rd Session of the Scientific Committee
IOTC–2020–SC23–03	Outcomes of the 24th Session of the Commission (IOTC Secretariat)
IOTC–2020–SC23–04	Previous decisions of the Commission (IOTC Secretariat)
IOTC–2020–SC23–05	Report of the Secretariat – Activities in support of the IOTC science process in 2020 (IOTC Secretariat)
IOTC–2020–SC23–06	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)
IOTC–2020–SC23–07	Update on the implementation of the regional observer scheme (IOTC Secretariat)
IOTC–2020–SC23–08	Revision of the program of work (2021–2025) for the IOTC science process (IOTC Secretariat)
IOTC–2020–SC23–09	Proposed schedule of Working Party and Scientific Committee meetings for 2021 and 2022 (IOTC Secretariat)
IOTC–2020–SC23–10	Progress on SC22 recommendations (IOTC Secretariat)
IOTC–2020–SC23–11	Synthesis of population structure of IOTC species from PSTBS-IO project and recommended priorities for future work (Davies C et al.)
IOTC–2020–SC23–12	Minimum standards for designing and implementing Electronic Monitoring systems in Indian Ocean tuna fisheries (Murua H et al.)
IOTC–2020–SC23–ES01	Status of the Indian Ocean Albacore (ALB: *Thunnus alalunga*) resource
IOTC–2020–SC23–ES02	Status of the Indian Ocean bigeye tuna (BET: *Thunnus obesus*) resource
IOTC–2020–SC23–ES03	Status of the Indian Ocean skipjack tuna (SKJ: *Katsuwonus pelamis*) resource
IOTC–2020–SC23–ES04	Status of the Indian Ocean yellowfin tuna (YFT: *Thunnus albacares*) resource
IOTC–2020–SC23–ES05	Report on biology, stock status and management of southern bluefin tuna: 2019 (from CCSBT)
IOTC–2020–SC23–ES06	Status of the Indian Ocean bullet tuna (BLT: *Auxis rochei*) resource
IOTC–2020–SC23–ES07	Status of the Indian Ocean frigate tuna (FRI: *Auxis thazard*) resource
IOTC–2020–SC23–ES08	Status of the Indian Ocean kawakawa (KAW: *Euthynnus affinis*) resource
IOTC–2020–SC23–ES09	Status of the Indian Ocean longtail tuna (LOT: *Thunnus tonggol*) resource
IOTC–2020–SC23–ES10	Status of the Indian Ocean Indo-Pacific king mackerel (GUT: *Scomberomorus guttatus*) resource
IOTC–2020–SC23–ES11	Status of the Indian Ocean narrow-barred Spanish mackerel (COM: *Scomberomorus commerson*) resource
IOTC–2020–SC23–ES12	Status of the Indian Ocean black marlin (BLM: *Makaira indica*) resource
IOTC–2020–SC23–ES13	Status of the Indian Ocean blue marlin (BUM: *Makaira nigricans*) resource
IOTC–2020–SC23–ES14	Status of the Indian Ocean striped marlin (MLS: *Tetrapturus audax*) resource
IOTC–2020–SC23–ES15	Status of the Indian Ocean Indo-Pacific sailfish (SFA: *Istiophorus platypterus*) resource
IOTC–2020–SC23–ES16	Status of the Indian Ocean swordfish (SWO: *Xiphias gladius*) resource
IOTC–2020–SC23–ES17	Status of the Indian Ocean blue shark (BSH: *Prionace glauca*)
IOTC–2020–SC23–ES18	Status of the Indian Ocean oceanic whitetip shark (OCS: *Carcharhinus longimanus*)
IOTC–2020–SC23–ES19	Status of the Indian Ocean scalloped hammerhead shark (SPL: *Sphyrna lewini*)
IOTC–2020–SC23–ES20	Status of the Indian Ocean shortfin mako shark (SMA: *Isurus oxyrinchus*)

Document	Title
IOTC–2020–SC23–ES21	Status of the Indian Ocean silky shark (FAL: *Carcharhinus falciformis*)
IOTC–2020–SC23–ES22	Status of the Indian Ocean bigeye thresher shark (BTH: *Alopias superciliosus*)
IOTC–2020–SC23–ES23	Status of the Indian Ocean pelagic thresher shark (PTH: *Alopias pelagicus*)
IOTC–2020–SC23–ES24	Status of marine turtles in the Indian Ocean
IOTC–2020–SC23–ES25	Status of seabirds in the Indian Ocean
IOTC–2020–SC23–ES26	Status of cetaceans in the Indian Ocean
IOTC–2020–WPNT10–R	Report of the 10th Session of the Working Party on Neritic Tunas
IOTC–2020–WPB18–R	Report of the 18th Session of the Working Party on Billfish
IOTC–2020–WPEB16–R	Report of the 16th Session of the Working Party on Ecosystems and Bycatch
IOTC–2020–WPM11–R	Report of the 11th Session of the Working Party on Methods
IOTC–2020–WPDCS16–R	Report of the 16th Session of the Working Party on Data collection and Statistics
IOTC–2020–WPTT22(AS)–R	Report of the 22nd Session of the Working Party on Tropical Tunas (assessment Meeting)
IOTC–2020–SC23–NR01	Australia
IOTC–2020–SC23–NR02	Bangladesh
IOTC–2020–SC23–NR03	China
IOTC–2020–SC23–NR03	European Union
IOTC–2020–SC23–NR05	France (OT)
IOTC–2020–SC23–NR06	India
IOTC–2020–SC23–NR07	Indonesia
IOTC–2020–SC23–NR08	Japan
IOTC–2020–SC23–NR09	Kenya
IOTC–2020–SC23–NR10	Korea, Republic of
IOTC–2020–SC23–NR11	Madagascar
IOTC–2020–SC23–NR12	Malaysia
IOTC–2020–SC23–NR13	Maldives, Republic of
IOTC–2020–SC23–NR14	Mauritius
IOTC–2020–SC23–NR15	Oman
IOTC–2020–SC23–NR16	Pakistan
IOTC–2020–SC23–NR17	Philippines
IOTC–2020–SC23–NR18	Seychelles, Republic of
IOTC–2020–SC23–NR19	Somalia
IOTC–2020–SC23–NR20	South Africa, Republic of
IOTC–2020–SC23–NR21	Sri Lanka
IOTC–2020–SC23–NR22	Thailand
IOTC–2020–SC23–NR23	United Kingdom (BIOT)
IOTC–2020–SC23–NR24	Iran
Other Documents	
Information Papers	
IOTC–2020–SC23-INF01	SC23 Pre-Meeting Discussion Document (Secretariat)
IOTC–2020–SC23-INF02	Report of Taiwan,China 2020
IOTC–2020–SC23-INF03	Empirical Harvest Control Rules (Nishida T)

APPENDIX 4A
NATIONAL STATEMENTS

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

The SC noted the following statement made by the Republic of Mauritius:

23rd Session of IOTC Scientific Committee

7-11 December 2020

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

Statement by the Republic of Mauritius

The Republic of Mauritius reiterates that the United Kingdom is not entitled to be a member of the Indian Ocean Tuna Commission (IOTC) as a "coastal State situated wholly or partly within the Area [of competence of the Commission]" and wishes to place on record its objection to the participation of the United Kingdom in the 23rd Session of the IOTC Scientific Committee as a coastal State purporting to represent the Chagos Archipelago.

The Republic of Mauritius also objects to any document purportedly submitted by the United Kingdom in respect of the so-called "British Indian Ocean Territory" ("BIOT") to this meeting and to any reference made in the documents circulated for this meeting to "British Indian Ocean Territory", "British Indian Ocean Territories", "BIOT", "United Kingdom (BIOT)", "United Kingdom (OT)", "UK (OT)" or "British Indian Ocean Territory (Chagos Archipelago) waters".

The Republic of Mauritius wishes to recall that in its Advisory Opinion of 25 February 2019 on the legal consequences of the separation of the Chagos Archipelago from Mauritius in 1965, the International Court of Justice (ICJ) made clear that the Chagos Archipelago is, and has always formed, an integral part of the territory of the Republic of Mauritius. The Court, which carefully examined all the arguments presented by the United Kingdom and other UN Member States as well as the African Union before reaching the conclusion that the questions put to it by the UN General Assembly relate to the decolonization of Mauritius and not to a territorial dispute between two States, also concluded that:

a) the process of decolonization of the Republic of Mauritius was not lawfully completed when that country acceded to independence in 1968, following the separation of the Chagos Archipelago;

b) the United Kingdom's continued administration of the Chagos Archipelago constitutes a wrongful act entailing the international responsibility of the United Kingdom and is an unlawful act of a continuing character which arose as a result of the separation of the Chagos Archipelago from Mauritius;

c) the United Kingdom is under an obligation to bring an end to its administration of the Chagos Archipelago as rapidly as possible, thereby enabling the Republic of Mauritius to complete the decolonization of its territory in a manner consistent with the right of peoples to self-determination;

d) since respect for the right to self-determination is an obligation erga omnes, all States have a legal interest in protecting that right; and

e) all Member States are under an obligation to co-operate with the United Nations in order to complete the decolonization of the Republic of Mauritius.

The findings of the ICJ were endorsed in their entirety by the UN General Assembly in Resolution 73/295. In that Resolution, which was adopted by an overwhelming majority of 116 votes to 6, the General Assembly demanded the United Kingdom to withdraw its colonial administration unconditionally from the Chagos Archipelago within a period of no more than six months, that is, by 22 November 2019. The General Assembly also called upon the United Nations and all its specialized agencies as well as all other international, regional and intergovernmental organizations, including those established by treaty, to recognize that the Chagos Archipelago forms an integral part of the territory of the Republic of Mauritius, to support the decolonization of the Republic of Mauritius as rapidly as possible, and to refrain from impeding that process by recognizing, or giving effect to any measure taken by or on behalf of, the so-called "BIOT". Resolution 73/295 is accordingly binding on all United Nations bodies and entities, including the FAO, under which the IOTC falls. In this regard, at the direction of the UN Secretary-General, since February this year, the new, official United Nations map depicts the Chagos Archipelago as an integral part of the territory of the Republic of Mauritius. A copy of the map is attached herewith.

It follows that as a matter of international law, the Republic of Mauritius is the sole State lawfully entitled to exercise sovereignty and sovereign rights over the Chagos Archipelago and its maritime zones. As such, the United Kingdom is not and cannot be the coastal State in relation to the Chagos Archipelago. The United Kingdom is therefore not entitled to be a member of the IOTC as a coastal State. Nor can the United Kingdom or the so-called "BIOT Administration" lawfully grant approval for the conduct of marine scientific research in the maritime zones of the Chagos Archipelago.

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. In its Award of 18 March 2015, the Arbitral Tribunal constituted under Annex VII

to UNCLOS to hear the dispute 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.

In the light of the Award of the Arbitral Tribunal, the findings of the ICJ and the provisions of UN General Assembly Resolution 73/295, the 'MPA' purportedly established by the United Kingdom around the Chagos Archipelago is illegal and without effect. Any reference to or consideration given by the IOTC, including this meeting, to the purported 'MPA' will be in contradiction with international law.

Moreover, 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 Exclusive Economic Zone adjacent to the Island of Tromelin. Further, 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 Republic of Mauritius reaffirms that it has full and complete sovereignty over the Island of Tromelin, including its maritime zones.

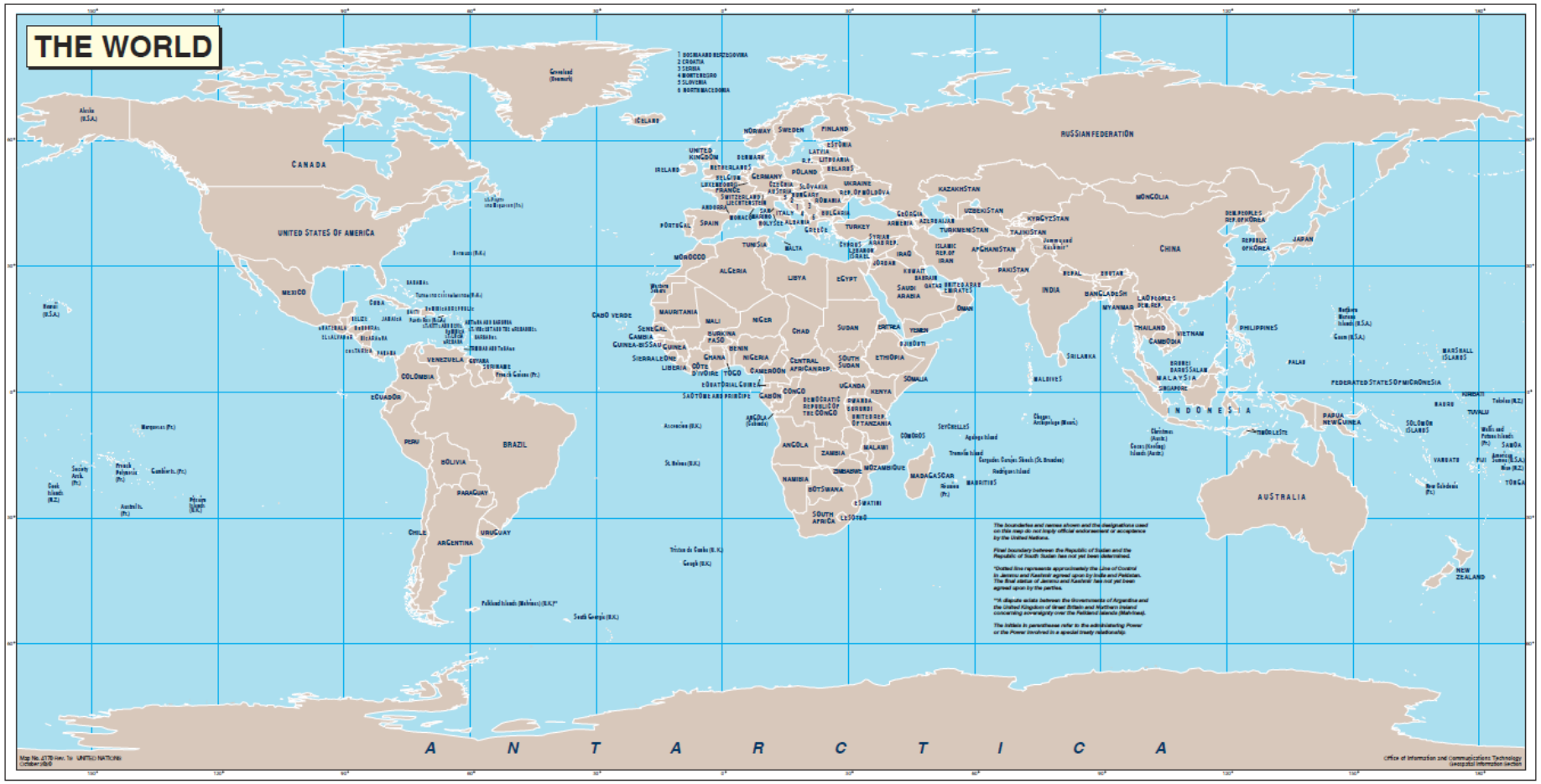
The Government of the Republic of Mauritius also objects to the use of terms such as "France (OT)" and "France (territories)" in the documents which have been circulated for this meeting, in so far as these terms purport to refer to the Island of Tromelin as a French territory. Consideration by this meeting of any document which purports to refer to the Island of Tromelin as a French territory, 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 France has sovereignty or analogous rights over the Island of Tromelin.

Subject to the foregoing, the delegation of the Republic of Mauritius has no objection to the adoption of the draft agenda.

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 and all documents of this meeting.

The Republic of Mauritius requests that this statement be annexed to the report of this meeting.


THE WORLD
CANADA
UNITED STATES OF AMERICA
MEXICO
BRAZIL
ARGENTINA
RUSSIAN FEDERATION
CHINA
INDIA
AUSTRALIA
INDONESIA
ANTARCTICA

The SC noted the following statement made by the United Kingdom (British Indian Ocean Territory):
UK Right of Reply:

Note Number: **OTD/002/2020**

The Overseas Territories Directorate of the Foreign, Commonwealth and Development Office presents its compliments to the Secretariat of the Indian Ocean Tuna Commission (IOTC) and Chair of the IOTC's 24th Annual Session. In advance of this Session, the United Kingdom wishes to restate its position on the British Indian Ocean Territory (BIOT).

The United Kingdom has no doubt about its sovereignty over the Chagos Archipelago, which has been under continuous British sovereignty since 1814. Mauritius has never held sovereignty over the Archipelago and we do not recognise its claim. However, we have a long-standing commitment, first made in 1965, to cede sovereignty of the territory to Mauritius when it is no longer required for defence purposes. We stand by that commitment.

The United Kingdom was disappointed that this matter was referred to the International Court of Justice (ICJ), contrary to the principle that the Court should not consider bilateral disputes without the consent of both States concerned. Nevertheless, the United Kingdom respects the ICJ and participated fully in the ICJ process at every stage and in good faith. An Advisory Opinion is advice provided to the United Nations General Assembly at its request; it is not a legally binding judgment. The UK Government has considered the content of the Opinion carefully, however we do not share the Court's approach.

UN Resolution 73/295, adopted following the ICJ's Advisory Opinion, does not and cannot create any legal obligations for UN Member States. Neither the non-binding Advisory Opinion nor the non-binding General Assembly resolution alter the legal situation, that of a sovereignty dispute between the United Kingdom and Mauritius. The General Assembly is not the appropriate forum to resolve such a bilateral dispute.

The United Kingdom, in respect of the British Indian Ocean Territory, is a full member of the IOTC. The United Kingdom deposited instrument of acceptance to the IOTC Agreement on 31st March 1995 and have been a party to the Agreement since it entered into force. 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.

The Overseas Territories Directorate of the Foreign, Commonwealth and Development Office avails itself of the opportunity to renew to the Secretariat of the Indian Ocean Tuna Commission the assurances of its highest consideration.

FOREIGN, COMMONWEALTH AND DEVELOPMENT OFFICE
LONDON

28 September 2020

The SC noted the following Response by France-OT to Mauritius about Tromelin:

Response by FRANCE-OT to MAURITIUS about TROMELIN
"France declares that it does not recognize the Mauritian declaration as having any legal value, because it ignores the fact that the island of Tromelin is a French territory over which France constantly exercises full and complete sovereignty.
Thus, France enjoys the sovereign rights or jurisdiction conferred on it by international law in the Exclusive Economic Zone adjacent to the island of Tromelin. Meetings of Indian Ocean RFMOs are not the place to discuss issues of territorial sovereignty, but France stresses that it will continue to maintain a constructive dialogue with the Republic of Mauritius on this subject. »

APPENDIX 4B
NATIONAL REPORT EXECUTIVE SUMMARIES (2020)

Australia (IOTC-2020-SC23-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 are relatively low due to reduced profitability, primarily as a result of lower fish prices and higher operating costs. In 2019, two Australian longliners from the Western Tuna and Billfish Fishery and two longliners from the Eastern Tuna and Billfish Fishery operated in the IOTC Area of Competence. They caught 15.6 t of albacore (Thunnus alalunga), 34.5 t of bigeye tuna (Thunnus obesus), 43.9 t of yellowfin tuna (Thunnus albacares), 112.7 t of swordfish (Xiphius gladius) and 0.8 t of striped marlin (Kajikia audax). In 2019, 0.003 t of shark was landed by the Australian longline fleet operating in the IOTC Area of Competence and 4,375 sharks were discarded/released. In addition, 12.8% of hooks deployed in the WTBF were observed with electronic monitoring in the 2019 calendar year. The actual catch of southern bluefin tuna (Thunnus maccoyii) in the purse seine fishery was 5,388 t in 2019. There was no skipjack tuna (Katsuwonus pelamis) caught by purse seine fishing.

Bangladesh (IOTC-2020-SC23-NR02)

Tuna and tuna like other highly migratory species have become high pace in the priority list to the government of Bangladesh for a couple of years especially being after demarcation of sea boundary with the neighbours that lead to open up the access of Bangladeshi fishers to the Area Beyond National Jurisdiction (ABNJ) of high seas. But, it is not possible yet to take this opportunity by harnessing tuna and tuna like bill fishes from expanded high seas because of initiation stage of such fishing industry. Simultaneously, the study of tuna and tuna like fishes of Bangladesh marine waters are one of the most poorly studied areas of the world although it possesses high potentiality. Proper attention is needed in every aspects of exploitation, handling and processing, export and marketing as well as in biological and institutional management strategies. Therefore, a pilot project has been launched to harness tuna and tuna like fishes from Bangladesh marine waters and ABNJ of high seas. Basically, there is no specific tuna fishery in Bangladesh. Tunas are by catch of industrial trawlers and artisanal gill netters. Statistically it shows that tunas comprises about 0.13% (155.42 mt) of the industrial catch and 0.14% (161.40 mt) of catch is mackerels in the year 2019-20. This report, thereby tried to articulate in a frame as per format of commission incorporating a salient feature of the marine fisheries of Bangladesh. Besides, there was no reporting of sea bird interactions with the both industrial and artisanal fishery during the reporting period. Similarly, there was no reporting of mortality of sea turtles, marine mammals and whale sharks, which are protected under existing rules and regulations.

China (IOTC-2020-SC23-NR03)

Deep-frozen longline targeting for tropical tuna and frozen longline targeting albacore 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 2019 was 88. The number of active deep-frozen longline vessels decreased from 75 in 2018 to 74in 2019. The tropical tunas catch (bigeye and yellowfin tuna) of Chinese longline fleet in 2019 was estimated at 5,049MT, which was 3,648 MT lower than that in 2018(8,697MT). The number of frozen longline increased from 10 in 2018 to 14 in 2019. The albacore longline catch for 2019was estimated at 2,489MT, lower than in 2018(5,449MT). Both the logbook and observer programs are being implemented for the Chinese longline fleets. In 2019, four scientific observers were deployed on board longline vessels to collect data for both target and bycatch species as required.

Comoros (IOTC-2020-SC23-NR25)

La pêche aux Comores est exclusivement artisanale, pratiquée sur des embarcations non pontées 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. Depuis 2017, la collecte de données est réalisée intégralement sur smartphone. La production annuelle issue de l'enquête de 2019 est estimé à 12 438 tonnes de thonidés sur un ensemble de 5006 embarcations. Pour le moment la pêche industrielle est inexistante au niveau national

Eritrea (No National Report Submitted)

European Union (IOTC-2020-SC23-NR04)

The EU fleet fishing in the waters of the Indian Ocean is composed of two main segments.
The first is an offshore segment including

- Purse seiners métiers targeting the three species of tropical tunas
  - Data 2019:
    - 28 active vessels
    - 37262 m^3.j transport capacity
    - 5.156 searching days and 6.030 days at sea
    - 248731 t of catch
    - • YFT 28,9 %
      • SKJ 64,9 %
      • BET 6,2 %
- Longliners targeting swordfish with significant associated catches of some pelagic shark species
  - Data 2019
    - 16 active vessels
    - 4.423 * 10^6 hooks
    - 7.896 t of catch
    - • SWO 39,4 %
      • BSH 47,3 %
      • SMA 7,1 %
- Longliners targeting swordfish with significant associated catches of tunas (La Réunion)
  - Data 2019
    - 19 active vessels (≥12m)
    - 4,05 * 10^6 hooks
    - 1.420 t of catch
    - • SWO 47,0 %
      • YFT & BET 31,0 %
      • ALB 14,0 %

The second is a coastal segment, comprising vessels of less than 12 m fishing for and harvesting large pelagic species and associated species, some of which use anchored fish aggregating devices (AFADs) around Mayotte and Reunion Island the two outermost regions of the European Union of the Indian Ocean. This coastal segment corresponds to the following métiers:

- Longliners
  - Data 2019
    - 22 vessels at Reunion Island (<12 m)
      - 0,521 * 10^6 hooks
      - 376,7 t of catch
        - SWO 42,4 %
        - YFT & BET 26,5 %
        - ALB 14,6 %
    - 3 vessels at Mayotte Island
      - 96 fishing days
      - 151,2 *10^3 hooks

- 86,0 t of catch (SWO-YFT-BET)

- Trolling line and hand-lines
  - Data 2019
    - Reunion :125 vessels
      - 5.846 fishing days
      - 467,8 t of catch (YFT- -DOX-WAH-BIL 91%)
      - Mayotte : 111 active out of 143yoles in the formal professional sector; 400 boats and 794 canoes in the non-professional sector (2016 data; 2017 N/A). Total production estimated at 1.044 t in 2018 (2,050 t in 2006 and between 965 and 1421 t in 2013/2016). The provisional estimate for 2019, only for professional boats, is 175t against 646 t in 2017.

The fishing capacity of the EU fleet authorized to deploy a fishing activity for large pelagic species in the IOTC Convention Area is governed by provisions on capacity limits set out in the IOTC Resolution and by European Union legislation. Furthermore, the conditions of access to certain fishing areas in waters under the jurisdiction of coastal states of the South West Indian Ocean are subject to specific provisions defined in public agreements engaging the European Union and called Sustainable Fisheries Partnership Agreements (SFPA). In accordance with IOTC Resolution 15/02, flag EU Member States (Spain, France, Italy, Portugal and United Kingdom) have submitted scientific data characterizing the activity of the EU fleet fishing in 2019 in the IOTC area of competence, and enabling the IOTC Scientific Committee to conduct its work.

France-territories (IOTC-2020-SC23-NR05)
Since Mayotte became part of the European Union territory (outermost region status) on 1st January 2014, the only French overseas territories (OCT status) in the Indian Ocean are the Scattered Islands (îles Eparses) administered by the préfet, administrateur supérieur of the French Austral and Antarctic Territories (Terres Australes et Antarctiques Françaises : TAAF). One of the Scattered Islands, Glorieuses, is a natural marine park since 22sd February 2014 (order n°2012-245). The whole EEZ is included in the park.

The Scattered Islands (France on behalf of its Overseas Territories) have no registered tuna fleet of their own. Nonetheless, the TAAF administration delivers fishing permits to EU and foreign longliners and purse seiners interested in fishing in waters under France-Overseas Territories jurisdiction. An observer programme is linked with the fishing agreement: scientific observers are trained by the TAAF administration to board on the authorized vessels. In 2019, the TAAF administration certified 10 observers with 8 new observers trained by the TAAF for the "Obspec" programme. Two (2) observers already trained were already embarked on purse-seiners in the previous year. The cruises with observer concerned 9 purse seiners under UE-Spain and Seychelles flag and one French-flagged longliner for the period between 23rd of February (start of the 1st cruise observed) and the 28th of May (end of the last cruise observed) 2019. There was a total of 403 days observed including 352 days on purse seiners. Only data collected on Seychelles and UE-Spain vessels representing 11 cruises are presented in this report because the data collected on the longliner was already presented in the EU – France National Report. Among cruises carried out on purse seiners, one of them had unusable data therefore the present report considers 317 days at sea achieved through 10 cruises. The geographical distribution of activities indicated that the observed days at sea were distributed principally between international waters (ABNJ, 40.5%) and in the EEZ of Seychelles and Madagascar (42.3%). Only 8 days at sea (2.5% of the total of days observed) were located in the Scattered Island EEZ. During the 317 days, 414 sets were observed (368 positive sets and 46 null sets) representing an average of 1.3 set/day. The total of observed catches was 12997.3 mt with one half from ABNJ waters and the other half from visited EEZ. For the 414 sets, 344 (83.1%) and 67 (16.2%) were carried out on fish aggregating devices and on free schools, respectively. Three (3) fishing sets were realized with an interaction with a whale shark despite the ban of fishing on this type of association (resolution 13/05). The percentage of FAD sets ranged from 52,8% to 100% depending on the vessels. Purse seine activities around FADs (1303 operations) were fully documented and concerned deployment at sea, visit, removal, abandonment, sunk, reinforcement and replacement.

The French research plan on highly migratory pelagic species (mostly by IRD & Ifremer) includes observatory (monitoring) activities with size sampling and morphometric measurements at landings and at sea for target and bycatch species, study of migratory behaviour, FAD studies, electronic monitoring to complement observer data,

genetic and microchemistry studies for the delimitation of stocks, adjustment of methods to mitigate bycatch and depredation, post-release mortality of oceanic whitetip shark caught by purse seine and longline, and innovative technique for a swift release of longline-caught marine megafauna and improvement of its survival. International, European or national calls for tender are the main source of funding for the projects. The 2019 ongoing and new projects are listed in the section 7 of this report.

In 2019 France was an active participant in all IOTC working groups, tabling 30 scientific contributions including the national reports proposed for the preparation of the EU-France report and the report of France-Overseas Territories intended for the Scientific Committee and the Commission.

India (IOTC-2020-SC23-NR06)
The total landings of tuna and tuna-like species (hereinafter referred to as tuna fishery) in India for 2019 was estimated at 199898 tonnes, showing a marginal decrease of 4.32percent over the previous year (208 928tonnes in 2018). Gillnets contributed 37.19 percentto the total landings of tuna fishery, followed by trawls (18.51%) and smalllonglines (12.14%). Pole and line fishing, practiced exclusively in the waters of the Lakshadweep Group of Islands, contributed 5.51percent to the total tuna landings. Other gears like small purse seines, ringseinesandgillnet-cum-longlines also contributed to the tuna landings in small quantities during the year. Marginal spatial variation was observed in the tuna landings along the mainland coastline. The western coast of India (FAO area 51) contributed a larger share to the landings (51.29%) and the balance 48.71percentcame from the east coast (FAO area 57). Tuna landings in 2019comprisedseven species, four representing the neritic (27.91%) and three from the oceanic group (30.11%). Yellowfin tuna (Thunnus albacares) (16.84%) and Kawakawa (Euthynnus affinis)contributed the maximum (16.9%),followed by Skipjack (Katsuwonus pelamis; 12.74%). There was no reporting of sea bird interactions with the tuna fishery during the reporting period. Similarly, there was no reporting of the mortality of sea turtles, marine mammals and whale sharks, which are protected under Schedule 1 of the Wildlife (Protection) Act of 1972 of India. The Central Marine Fisheries Research Institute of the Indian Council of Agricultural Research (ICAR-CMFRI), Fishery Survey of India (FSI) of the Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India and the Department of Fisheries of the coastal States and Union Territories (UTs) are the main agencies responsible for data collection and collation on tuna fishery.

Indonesia (IOTC-2020-SC23-NR07)
For fisheries management purpose, Indonesian waters are divided into eleven Fisheries Management Areas (FMA). Three of them located within the IOTC area of competence, namely FMA 572 (Western Sumatera and Sunda Strait), FMA 573 (South of Java to East Nusa Tenggara, Sawu Sea and western part of Timor Sea) 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.

Number of active fishing vessel operated in 2019 were 383 vessels dominated by longline vessel followed by purse seine vessel. Total catch of main species of tunas in 2019 was estimated around 189,021 tons which composed of albacore (3,921 mt), bigeye tuna (13,654 mt), skipjack tuna (128,939 mt) and yellowfin tuna (42,507 mt).
Nominal hook rates derived from logbook data 2019 for albacore, bigeye and yellowfin in kg/1000 hooks were 33.47, 18.85, and 52.22 respectively. Meanwhile, nominal hook rates for swordfish, Indo-Pacific sailfish and black marlin were increased compared than previous years, while hook rates for blue marlin, striped marlin, and short-billed spearfish continued to depleted. Observer coverage 2019 in longline vessel was reported 3.53% decreased from previous year in term proportion number of vessel observed. Interaction longline fishery with ERS still dominated by blue sharks. Interaction with seabird reported slightly increased from previous year involving petrels while interaction with marine turtle reported decreased from previous years and mitigation measures for those ERS has taken in account by fishermen.

Iran (Islamic Republic of) (IOTC-2020-SC23-NR24)
Iran (Islamic Republic of) is located in an area encircled with Caspian Sea in North and Persian Gulf and Oman Sea in the south. Fishery for tuna and tuna-like species is a major component in large pelagic fisheries in Iran and one of the most important activities in the Persian Gulf & Oman Sea. There are located between the longitudes of 48° 30' north to 61° 25' east. Fishing activities with its related occupations are considered as one of the main activities of

coastal communities, so that based on annual statistic for 2019 around 143 thousand individuals which are directly engaged in fishing activities. Tuna catch in Iran played an important role during previous years and not only for food security and coastal community's subsistence but also carried out an effective economic role in the country fisheries activity chain. The long Iranian coastline there are arournd193 port and landing places with more than 11 thousand vessels consist of fishing boat, dhows and vessel which are engaged in fishing in the coastal and offshore waters. There are four fishing gear types which targeting large pelagic species in the IOTC area of competence, included gillnet, purse seine, long line (by traditional boats) and also some of small trolling boats in coastal fisheries. Iran has taken various actions to implement the Scientific Committee recommendations and IOTC Resolutions. The Catch quantity of large pelagic species (including by-catch) was 275674 Mt in 2019 reported to the IOTC Secretariat. Total amount of catch mainly consist comprised of Tropical tuna with 36.2% (99965Mt), Neritic tuna45.5% (125341Mt) and billfish species with 6.4% (17678Mt), 1.3% (3528Mt) different species of shark and around 10.6% (29162Mt) other species.

Japan (IOTC-2020-SC23-NR08)

This Japanese national report describes following eight relevant topics stipulated in the 2020 national report guideline mainly in recent five years (2015-2019) (2019 is provisional) , i.e. (1) Fishery information (longline and purse seine fishery), (2) fleet information, (3) catch and effort by species and gear, (4) ecosystem and bycatch (sharks, seabirds, marine turtles), (5) national data collection and processing systems including “logbook data collection and verification”, “vessel monitoring system”, “observer scheme”, “port sampling programs” and “unloading and transshipment”, “Monitoring billfish catch”, and sampling plans for mobulid rays”, (6) national research programs, (7) Implementation of Scientific Committee recommendations and resolutions of the IOTC relevant to the Scientific Committee”, and (8) “literature cited”. Highlights from the eight topics are described as follows: Japan is currently operating longline and purse seine fisheries in the Indian Ocean. Catch and effort data are collected mainly through logbooks. Bigeye, yellowfin, albacore, southern bluefin tuna are main components of the catch by longliners, while three species (skipjack, yellowfin and bigeye tuna) are exploited by purse seiners. In recent years, catch and effort by longliners are in a low level mainly because of piracy activities off Somalia. Japan has been dispatching scientific observers in accordance with the Resolution 11/04, whose coverage has been more than the 5% compliance level in recent years. A number of information including bycatch and biological data, has been collected through the observer program. Japan has been conducting several research activities.

Kenya (IOTC-2020-SC23-NR09)

The Kenyan tuna and tuna-like fishing fleets comprise of the artisanal, semi-industrial, industrial and recreational fisheries which have an impact on IOTC’s priority species. The commercial artisanal fishing fleet is composed of a multi-gear and multi-species fleet operating in the territorial waters. The artisanal 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. In 2019, three (3) Kenya pelagic longline vessels operated in the IOTC area of competence. The IOTC species landed during the year included swordfish (388 tons), yellowfin tuna (188 tons) Bigeye tuna (51 tons), Blue sharks (66 tons) while other species combined (101 tons). Artisanal fishers landed 668 tons of Kingfish, 201 tons of sailfish, 1,170 tons of tuna and tunalike species and 564 tons of sharks and rays. Catches of scombrids declined compared to 3,476 tons recorded in 2018. 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-2020-SC23-NR10)

The number of active vessels in 2019 was 10 for longline fishery and 2 for purse seine fishery. With this fishing capacity, Korean tuna longline fishery caught 3,208 ton in 2019, which was 14% higher than that of 2018. The fishing efforts in 2019 were 5,899 thousand hooks and distributed in only the western Indian Ocean, while the fishing efforts averaged for 5 recent years (2015-2019) were 6,328 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. Korean tuna purse

seine fishery in the Indian Ocean recorded 20,650 ton in 2019. In 2019, 2 vessels of Korean tuna purse seine fishery operated mainly in the western and central tropical areas around 10°N-10°S. The fishing efforts in 2019 were 763 sets, which mainly distributed in the western and central tropical areas around 40°E-70°E. In 2019, 3 national scientific observers for longline fishery were dispatched onboard for implementing observer program and scientific data collection, which carried out 4.7% of observer coverage in terms of the number of hooks. And regional scientific observers were dispatched onboard for purse seine fishery.

Madagascar (IOTC-2020-SC23-NR11)
A Madagascar, la pêche thonière industrielle est assurée par des palangriers de moins de 24 mètres (entre 14 et 17 mètres) qui opèrent sur la côte Est de l'île. A partir de l'année 2018, le nombre des palangriers a été réduit à 5 s'ils étaient auparavant au nombre de 7. Depuis 2010, les techniques et les méthodes demeurent les mêmes. En général, les navires déploient entre 800 à 1300 hameçons par filage et ils effectuent une sortie relativement courte d'une durée de 4 à 7 jours afin de maintenir les captures fraiches en arrivant aux ports de débarquement que sont le port de Sainte Marie et celui de Toamasina. Le programme de collecte de fiches de pêche et d'échantillonnage au port de débarquement, mis en oeuvre depuis 2014 pour Sainte Marie et depuis aout 2016 pour Toamasina, nous permet de visualiser la distribution de taille des espèces captures par ces palangriers nationaux.

Les prises des palangriers varient suivant les années et tendent à diminuer de 2010 à 2019. Cette variation est légèrement proportionnelle à celle de l'effort de pêche (exprimé en nombre d'hameçons déployés) qui en 2018 a beaucoup diminué. Influencée par la diminution du nombre de navire en activité et évidemment par l'effort de pêche depuis 2018, la capture moyenne annuelle des palangriers ne cesse de baisser avec 335 tonnes. Elle est constituée de 50% de thons, 19% de poissons porte-épées, 12% de requins et 19% d'autres espèces. La capture en thons est majoritairement composée des thons obèses (18%), des germons (17%) et des albacores (15%).

En ce qui concerne le suivi de débarquement des poissons pélagiques issus de la petite pêche et de la pêche artisanale dans le Nord de Madagascar, outre les 19 sites de débarquement couverts en 2017, et les 10 autres sites de débarquements en 2018, 02 autres sites sont ajoutés au suivi en 2019. Les engins de pêche utilisés sont principalement le filet maillant, la ligne et la palangre. En effet, la capture moyenne annuelle de la petite pêche est estimée à 7315 tonnes ces deux dernières années dont les thons et espèces apparentées constituent les 23% de la capture. Les détails de capture et données de taille relatifs à cette filière sont figurés dans ce rapport.

Malaysia (IOTC-2020-SC23-NR12)
Total catch of marine fish from Malaysian waters in 2019 were 1.456 million mt, a slight increased 1.0% compared to 1.453 million in 2018. The total landing in 2019 were attributed to the catch from 51,123 registered vessels with trawlers, purse seines, drift nets contributed large percentage of the catches. In 2019, marine fish production from the west coast of Peninsular Malaysia (Malacca Straits) contribute 815,816 mt (56%) 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 82% (1,192,354 mt) and 18% (263,093 mt) from deep-sea 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 2012-2020 was launched 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 was regulated and limited to less than 30 kilowatts, although there have been incidences of non-compliance. Neritic tuna contributes 6% of Malaysia's marine fish landings in 2019. Purse seiners 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 86% 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 kawa kawa

and frigate tuna. In the year 2019, neritic tuna landings in west coast Peninsular Malaysia amounted to 17,500 mt; increasing by 15.7% compared to 14,746 mt in 2018. Meanwhile landings of neritic tuna in Malaysia ranged from 50,000 mt to 80,000 mt. The highest catch was recorded in 2019 with 87,400 mt respectively. There was a decreasing trend in landings from 2002 to 2005 before an increasing trend until 2008. Landings of neritic tuna in Malaysia appear to have stabilized from 2010 to 2018.

The catch of oceanic tuna in 2019 showed a 2% decreased from 2,867 mt in 2018 to 2,828 mt in 2019. Albacore showed a decreasing from 1,792.46 mt in 2018 to 1,618.65 mt in 2019. The fleet which consisted of six (6) fishing vessels and one (1) carrier, unloaded and exported the catches at Port Louis, Mauritius. Albacore tuna formed nearly 60% of the total catches in the form of frozen tuna. Meanwhile, eleven (11) fishing vessels unloaded and exported catches at Penang Port, Malaysia mostly are yellowfin and bigeye tuna in frozen and gutted forms.

For domestic vessels operating beyond 30 nm offshore, there are plan by the DOF Malaysia to implement observer on board and logbook system. The revised NPOA- Sharks II is published in 2014 and sharks and endangered species listed in the CITES also listed in Malaysia CITES Act 2008. On sea turtle, four (4) turtle conservation and information centres have regularly implementing awareness program for student and fishermen communities in the states of N.Sembilan, Perak, Penang and Melaka. Hatching program at these centers 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.

Malaysia have updated the national logbook to include all the species as requested in Resolution 19/04 for longliners and purse seiners, and monitor tuna landing and inspection at port by Port Inspector. DOF Malaysia also monitoring and tracking the deep-sea and tuna vessels using National VMS.

Under resolution 19/06, Malaysia longliners transhipped at sea monitor by the IOTC observer under ROP. Malaysia participated in the Regional Observer Program in 2018 for carrier vessel and fishing vessel to monitor transhipment at sea. DOF Malaysia also have installed CCTV on every vessel as a tool for EMS as an alternative for observer on board.

Maldives (IOTC-2020-SC23-NR13)

The Maldives tuna fishery comprises of four main components; pole-and-line, handline, longline and troll line. In terms of total landings, livebait pole-and-line is still the most important. The main target species is skipjack tuna (Katsuwonus pelamis) and yellowfin tuna (Thunnus albacares), but small amounts of juvenile bigeye tuna (Thunnus obesus), (about 5-10%) is caught along with yellowfin tuna. Handline fishery is now well-established as a major component, which targets large yellowfin tuna (> 70 cm FL) from the surface (<10m). The longline fleet has been operational intermittently in the past with foreign licensed vessels operating in the past, with a domestic fleet being in operation from 2011, licensing of which has been suspended since July 2019. Troll fishery is minor and used to target primarily neritic species of kawakawa (Euthynnus affinis) and frigate tuna (Auxis thazard), but occasionally also caught skipjack and yellowfin tuna.

The pole-and-line and handline fleets operate within about 100 miles although historically, the fleet operated much closer, and conducted daily trips, returning to the home island after the trip. The Longline Regulation which came in force in 2011 restricted its operation from within 100 from the shore to protect the pole-and-line and handline operations

Maldives reported 134,300 t of tunas in 2019, comprising of skipjack, yellowfin, bigeye, frigate and kawakawa. Of these 66% (89,042 t) was skipjack tuna and 33% (44,700 t) was yellowfin tuna. The remaining constituted bigeye tuna, frigate and kawakawa. Pole-and-line fishery landed 99% of skipjack tuna in 2019, and was the second most important gear for yellowfin tunas, landing 38% (17,240 t) of all yellowfin tuna caught in 2019. Handline gear almost exclusively lands yellowfin tuna (26,932 t in 2019) which represented 99% of all species landed by the gear. Longline catch of tunas decreased by 41% from 2018, landing 564 t comprising of 479 t of yellowfin tuna and 83 t of bigeye tuna. Catch of other tunas and billfish were below 8 t in 2019.

Catches of skipjack registered a drop in 2019 relative to 2018, by about 11%. Recent catches have been of the order of 69,000 – 100,000 t, yet, substantially less than the catch recorded in 2006. Caches of yellowfin observed a general decline in the past five years. No specialized vessel is required for handline fishing hence many pole-and-line vessels now carry both sets of gears and switch target fishery and gear depending on fishing opportunities.

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. Shark 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 non-targeted and ETP species. Maldives Marine Research Institute currently conducts scientific observations of fishing trips in accordance with the relevant IOTC Conservation and Management Measures.

Collection of data from logbooks is now fully established. A revision to the Regulation enforced early in 2019 requires mandatory reporting of logbook before the catches are sold for processors and exporters. An electronic logbook is being trialled which has been rolled out by during December 2019. Full implementation of electronic logbook has been delayed due to travel restrictions imposed due to the current pandemic. A new vessel monitoring system is being procured which will replace the old VMS on the vessels. It is expected by the end of 2021 all licensed tuna fishing vessels will be equipped with the new VMS in accordance with Resolution 15/03 On establishing a vessel monitoring system (VMS).

A new fisheries act (14/2019) was enacted in 2019 and superseded the previous act of 5/87. The Act requires development and implementation of management plans for all commercial fisheries including those on tunas and tuna-like species. It is expected that management plans will strengthen monitoring and management of the fisheries. A number of donor and local funded programs are being implemented to improve fishery and biological data collection, monitoring and management of the fisheries. 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.

Mauritius (IOTC-2020-SC23-NR14)
In 2019, Mauritius had 3 purse seiners, 1 supply vessel and 15 semi-industrial longliners operating in the tuna fishery. The three purse seiners are large freezer vessels having an overall length of 89.4 M each. The longliners are semi-industrial boats less than 24 Metres in length. Ten out of the 15 semi-industrial longliners operated outside the Mauritius EEZ and the remaining 5 longliners operated exclusively inside the EEZ.

The semi-industrial longline fleet operating exclusively inside the EEZ of Mauritius comprised 5 boats which undertook 21 fishing trips for a total of 167 fishing days and a deployment of 224574 hooks. The majority of the catch consisted of yellowfin (31%), albacore (24%) and swordfish (20%). Their total catch amounted to 58 tonnes. The CPUE was 0.26kg/ hook.

Ten semi-industrial longliners operated outside the EEZ and carried out 154 trips for a total of 1159 fishing days. They landed 746t of fish with a deployment of 1328892 hooks. The CPUE was 0.56kg/hook. Majority of their catch consisted of yellowfin (41%) followed by swordfish (34%). The area of operation was between latitudes13oS and 27oS and longitudes 34oE and 42oE.

The Mauritian purse seiners operated between latitudes 13oN to 13oS and longitudes 44o to 68oE. Total catch of the three purse seiners amounted to 27 082t comprising of 45% yellowfin, 47% skipjack and 7% bigeye tuna for 739 positive sets out of a total of 808 sets. Observers were deployed on the three Mauritian purse seiners for a total of 169 days at sea covering 181 sets.

Sampling exercises were carried out on local semi-industrial longliners. 806 fishes were sampled on the semi-industrial longliners operating inside the EEZ and 11583 fish were sampled from the semi-industrial longliners operating outside the EEZ and. In the artisanal fishery, 278 fishes were sampled for length frequency. Sampling

exercises were also carried out on the Mauritian purse seiners when they called at Port Louis and 2621 fish were measured.

Mozambique (No National Report Submitted)

Oman (IOTC-2020-SC23-NR15)

The total production of the Omani fishery sector amounted to around 580,000 Tons in 2019 with an increase of approximately 5% compared to 2018. Artisanal fisheries contributions reached 96% of the total fish landings compared to 3.5% from the industrial fishing sector. Tuna species considered as highly valuable products for Omani consumers, have experienced significant increases in the total annual production with about 4.5% increase then 2018. This increase finds its origin, in the dynamism shown by the traditional fleet on the tuna coastal resources and probably the slowdown of the fishing pressure in the Yemen waters. At the annual IOTC meeting in 2018, the Sultanate has submitted a revised version of its Fleet Development Plan which is scheduled to be implemented in the upcoming years.

A number of licenses have been delivered for chartering tuna longliners. On the other hand, Artisanal and coastal fleets have, however, increased slightly in the number of vessels and fishermen. For the monitoring aspects of the Tuna fishery, the Omani Government has introduced the logbook data collection scheme, the Vessel Monitoring System (Upgrading the system is ongoing), Port Sampling Program (PSP), and a scheme to enhance the quality of data gathered in order to contribute to manage and sustain efficiently the Omani fisheries.

Pakistan (IOTC-2020-SC23-NR16)

Tuna and tuna like fishes are one of the components of pelagic resources. In Pakistan, mainly neritic and oceanic species are caught 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 2019 was 48,320 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 Maritime Affairs.
Tuna and allied resources called as large pelagic resources. The large pelagic resources contributed 48,320 ton. Major share of the landing was by tunas (51.53%) followed by seerfishes (9.17%), dolphinfish (9.17%) and billfish (25.77%). Among the tunas, yellowfin was dominating with 24.61%, followed by tuna-nei (28.17%), frigate (27.90%), longtail (11.87 %), kawakawa (4.52%) and skipjack (2.88%). There were some landings of bullet tuna and striped bonito as well. It may be noted that there is a major decrease in the landings of tuna and tuna like species in the gillnet fisheries of Pakistan. As compared to 2018 the landings of these species have decreased by a factor of 31.53 % in 2019. The landings of tuna and tuna like species was 70,569 m.tons during 2018 which has dropped to a level of 48,320 m. tons in 2019. This major decrease in the landings of tuna and tuna like species is attributed to many factors which include early closure of fishing season in early April 2019 (as compared to June) because of extremely low catches in March and April 2019 as well as extreme low prices of tuna in the market. Usually a voluntary two-month close season is observed between June and July, however, the new fishing season was started only in late August 2019. The close season, therefore, remained effective for about four and half months (mid April to end August). In addition, there was extremely high sea surface temperature during August to October (possibly oceanic heat wave) in major part of the Arabian sea resulted in poor catches of tuna, therefore, only a few tuna boats remained operated during this period. Unprecedented jellyfish bloom of Crambionella orsini during September and December (and even onward in 2020) forced fishermen to stop fishing operations during this period because of excessive entanglement and choking of fishing net.

Significant progress has been made during the years from 2016-2018, 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 guitarfishes and

wedgefishes 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 regulation is punishable with fine and imprisonment.

Philippines (IOTC-2020-SC23-NR17)

In the past five years, the Philippines has only one active vessel in the IOTC Convention Area (10^{o} S to 5^{o} N – 075^{o} E to 090^{o} E), the FV Marilou 888, a purse seiner, with a GT of 349. The vessel was only active from 07 October to 19 December 2017. A total of 25,551 kg bigeye, 72,680 kg yellow fin and 144,566 kg skipjack were caught during the fishing operations and all catches were landed in General Santos City Fish Port, Philippines. There were also 34 Silky Sharks (FAL) encountered during the trip, 12 of which were released alive and 22 released dead (no sharks were retained in the vessel). In addition, one olive ridley turtle (LKV) which was released alive and one smooth tail mobula (RMO) which was released dead were recorded. The entire trip of the FV Marilou 888 was 100% observer covered and the vessel was VMS equipped. As with previous operations of the Philippines Fishing Fleet, the mandatory application of the conservation and management measures for sharks and other species was observed during the operations of the vessel.

Seychelles (IOTC-2020-SC23-NR18)

The Seychelles National Report summarizes activities of the Seychelles' fishing fleet targeting tuna and tuna-like species in the WIO for the year 2018 in comparison with previous years. It also summarizes research, and data collection related activities as well as actions undertaken in 2018 to implement Scientific Committee recommendations and IOTC Conservation and Management Measures.

Over the past five years, the Seychelles purse seine fleet has remained the same comprising of 13 vessels. The number of supply vessels has decreased from 9 vessel is 2016 to 6 vessels in 2019. In 2019 the nominal effort increased slightly by 136 days (5%) when compared to the previous year to reach a total of 2,922 days fished whilst the catches decreased by 9% from 123,310 MT in 2018 to 112,621 MT in 2019 resulting in a mean catch rate of 38.54 MT/Fishing day. Catches of yellowfin tuna and skipjack tuna decreased by 6% and 10% respectively whilst catches of bigeye tuna increased by 1% when compared to the previous year.

The Seychelles Industrial longline fleet comprised of 58 vessels in 2019 compared to 54 vessels in 2018. The total catch reported by the industrial longline fleet for 2018 was estimated at 17,578 MT of which 5,855 MT consisted of yellowfin tuna. The estimated catch rate has remained more or less similar to the previous year estimated at 0.45 Mt/1000 hooks for the year 2018.

In 2018, the Semi industrial fishery recorded the highest catch since the beginning of the fishery with a reported total catch of 1,267 Mt representing a 9% increase compared to the previous year catches.
Similarly, 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. It should be highlighted that major delays were encountered in statistical operations for longline fishery for year 2019 due to technical and administrative related issues in late 2019 and Covid19 pandemic in early 2020. Hence statistics for the year 2019 for longline fisheries will not be presented in this report and will be communicated to the Secretariat later.

Sierra Leone (No National Report Submitted)

Somalia (IOTC-2020-SC23-NR19)

The Somali EEZ is one of the most productive ecosystems in the global oceans. Because of a major upwelling created by the Southwest monsoon that supports much fish. As a result of the nutrient-rich water upwelling from the depths of the Indian Ocean, the coast of Somalia has made one of the most productive fish grounds in the world, Rashid. & Mahamudu (2014) and Glaser, et al. (2015).

Somalia was hindered by a lack of up-to-date scientific information on catch and fishing effort statistics, and other data relevant for the management and conservation of fish stock and marine mammals in Somali waters. There was no reliable and timely statistics, vital for effective policy formulation, for measuring progress, and for accurate

reporting on domestic fisheries, Sheik Heile, (2013). Somalia has made important progress in the past years towards data collection that will improve our contributions to IOTC reporting. In 2019, we transitioned the collection of catch and effort data from a collection of unorganized, informal groups (universities, NGOs, ministry) to a harmonized, nationwide effort led by the MFMR. Data collection began only in Dec 2019, so the data are not reflected in the 2019 National Report. However, data collected in Jan-Aug 2020 will provide an empirical foundation for 2020 report, and in 2021 we will be able to report a full year of catch and effort data from around the country as our data collection expands. We have also made important progress in improving technical capacity for data collection. A series of workshops have improved the statistical capacity of our ministries, and the training of 18 enumerators in important landing sites has created a standardized approach to data collection throughout the country. Finally, amendment of Fisheries Law will further Somalia's commitment to IOTC CMMs and to supporting a strong national fleet.

South Africa (IOTC-2020-SC23-NR20)

South Africa has two commercial fishing sectors that target tuna – the Large Pelagic Longline and the Tuna Pole-Line (baitboat) sectors. The latter sector mainly targets (Thunnus alalunga) and to a lesser degree yellowfin tuna (Thunnus albacares) and rarely operates in the IOTC Area of Competence. The Large Pelagic Longline sector comprises two fleets with different histories: The South African-flagged Large Pelagic Longline vessels that traditionally used swordfish (Xiphias gladius) targeting methods, and the Japanese-flagged vessels that operate under joint-ventures and fish for South African Rights Holders. The Japanese-flagged vessels typically target tropical tunas and southern bluefin tuna (Thunnus maccoyii) with their effort focused in the Indian Ocean. In 2019, a total of 23 longline vessels were active in the IOTC area of competence, which is less than in 2018 (25). Effort increased marginally - the number of hooks set in 2019 was 1 355 677, compared to 1 325 446 in 2018. Catches increased for albacore (320%), swordfish (83%), yellowfin tuna (17%), bigeye tuna (12%) and southern bluefin tuna (10%). For the same period, significant decreases in catch were observed for both shark species: blue shark (62%) and shortfin mako shark (68%). This is a result of stricter National permit conditions to avoid excess shark bycatch. A single Tuna Pole-Line trip occurred in the Indian Ocean in 2019 which caught 0.25 tons of albacore in 12 hours of fishing. Observer coverage exceeded IOTC requirements as 59% of hooks set (804 121 hooks) in the IOTC area of competence in 2019 were observed.

Sri Lanka (IOTC-2020-SC23-NR21)

The total production of tuna and tuna like species of Sri Lanka in year 2019 was 121,167t. 80% of the catch was from the EEZ. 37% of the total catch was Yellow fin tuna, 34% Skipjack tuna and 4% was bigeye tuna. 16% of the catch was bill fish while Sword fish dominate in the catch. The total shark catch was 1508t. The YFT catch reductions adhered as per 19/01. Large scale Gill net are being surveyed and converted to comply with the resolution 17/07.
Over 4000 multi day boats engaged in large pelagic fishing in both high seas and within EEZ. 1449 vessels were authorized to fish in high seas and only 1424 vessels were active. 99% of the high seas operating vessels are <24m. VMS is mandatory for high seas operating vessels. Major fishing gears used were long line and gill net. The gill nets are being discouraged and transformed to selective gears. 38% , 8% and 18% of vessels were exclusively operated for longline, gill net and ring net respectively. 36% of the vessels used multi-gear of more or less combinations of the above gears in seasonal or incidental manner.

Multi-gear vessels are being promoted to long line by introducing mechanized line haulers and the upgrading of vessel conditions to accommodate better cooling systems to improve the fish quality and reduce the post economic loss. High fuel cost has restricted the year round vessel operations and most vessels are being kept anchored. Electronic catch data collection system is being implemented and carried out parallel to the paper log books. On board observers were deployed in all vessels >24m and pilot project on EMS is on going. Port State Measures are being implemented through epsm application. Coastal data collection system is being improved by introducing better sampling techniques and to achieve the length frequency data in required proportion.

Sudan (No National Report Submitted)

Tanzania (No National Report Submitted)

Thailand (IOTC-2020-SC23-NR22)

Thailand has advance for implementing a comprehensive system to combat IUU fishing. It started to take a reforms of legal framework and implementing regulations, the fisheries management limiting the fishing license issuance in compliance with the quantity of aquatic animals, the fleet management putting control over fishing vessels of all sizes and types, the monitoring, control and surveillance through port-in and port-out control. Thailand has implemented PSM and assigned 19 PSM ports for port entry of foreign vessel. Moreover, for Thai oversea vessels installation of vessel monitoring system (VMS), and especially installation of electronic reporting system (ERS) electronic monitoring system (EM) for oversea fishing fleet, as well as the development of traceability system for catches from Thai-flagged vessel.

In 2019, Thailand had no fishing vessel operated in high sea of IOTC competent. Thailand had only domestic purse seiner fishery in the Andaman Sea. Their operated the fishing from shores is 10 to 30 nautical miles and depth of water range from 20-80 m. The average catch rate of neritic tuna was 480.68 kg/day. Bullet tuna (39.41%) is the main composition, followed by Kawakawa 34.96%, Longtail tuna 18.12%, Frigate tuna 4.95% and Spanish mackerel 2.56%. The CPUE of 5 species in 2019 showed 189.41 kg/day, 168.06 kg/day, 87.10 kg/day, 23.80 kg/day and 12.31 kg/day, respectively.

At Present, DOF is launch authorizing Thai-flagged overseas fishing vessels. Currently, there has been applications from begin with Thai-flagged overseas fishing fleet. These vessels operate in SIOFA area and target demersal fish species. No application has been submitted for vessels operating in the IOTC area.

United Kingdom (BIOT) (IOTC-2020-SC23-NR23)
The United Kingdom (BIOT) waters are a no take Marine Protected Area (MPA) to commercial fishing. 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 UK(BIOT) National Report summarises fishing in its recreational fishery in 2019 and provides details of research activities undertaken to date within the MPA.

The recreational fishery landed 8.7 tonnes of tuna and tuna like species on Diego Garcia in 2019. Principle target tuna species of the industrial fisheries (yellowfin and skipjack tunas, no bigeye were caught) contributed 34.7% 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 19/01 seeks to address this, UK(BIOT) have been taking action to reduce the number of yellowfin tuna caught in the BIOT recreational fishery and encouraging their live-release. Length frequency data were recorded for a sample of 211 yellowfin tuna from this fishery. The mean length was 89cm. 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 2019 the BIOT Environment Officer continued to take forward the current conservation priorities. In 2019/20 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 (No National Report Submitted)

Liberia (No National Report Submitted)

Senegal (No National Report Submitted)

APPENDIX 5

STATUS OF DEVELOPMENT AND IMPLEMENTATION OF NATIONAL PLANS OF ACTION (NPOA) FOR SEABIRDS AND SHARKS AND IMPLEMENTATION OF THE FAO GUIDELINES TO REDUCE MARINE TURTLE MORTALITY IN FISHING OPERATIONS (2019)

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 NPOA in 2018.		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 fulfilled 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. In 2018 Australia finalised, 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 fulfil Australia's obligations under the FAO-Sea turtles Guidelines.
Bangladesh							**Sharks:** Bangladesh currently do not have a NPOA for sharks. The Wildlife Conservation and Security Act introduced in 2012 lays out general rules on requirements for hunting wild animals but no specific mention of sharks. The Wildlife Conservation and Security Act was introduced in 2012 states: No person shall hunt any wild animal without license, or import or export any wild animal without a CITES certificate **Seabirds:** Bangladesh currently do not have a NPOA for seabirds. The Wildlife Conservation and Security Act introduced in 2012 lays out general rules on permits required to hunt wild animals but no specific mention of seabirds **Marine turtles:** Bangladesh currently have no information on their implementation of FAO guidelines on sea turtles. The Wildlife Conservation and Security Act introduced in 2012 lays out general rules on requirements for hunting wild animals but no specific mention of turtles

China **–Taiwan,China**		– 1st: May 2006 2nd: May 2012		– 1st: May 2006 2nd: Jul 2014			**Sharks:** China is currently considering developing an NPOA for sharks. **Seabirds:** China is currently considering developing an NPOA for seabirds **Marine turtles:** No information received by the Secretariat. **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 imbricata, Lepidochelys olivacea* and *Dermochelys coriacea* are listed into List of Protected Species. Domestic Fisheries Management Regulation on Far Sea Fisheries request all fishing vessels must carry line cutters, de-hookers and hauling nets in order to facilitate the appropriate handling and prompt release of marine turtles caught or entangled.
Comoros		–		–			**Sharks:** No NPOA has been developed. Shark fishing is prohibited but measures are difficult to enforce due to the artisanal nature of the fisheries. A campaign to raise awareness of measures is being implemented to improve compliance. Shark catches and size frequency data are submitted to IOTC **Seabirds:** No NPOA has been developed. There is no fleet in operation south of 25 degrees south and no long-line fleet. The main fishery is artisanal operating within 24 miles of the coast where there is low risk of interactions with seabirds. **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 2012 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 which will be in force from 2018-2027. **Marine turtles:** Implemented in 2015 for the five species of marine turtles that are present in the southwest Indian Ocean.
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 (Revised in 2016) **Seabirds:** NPOA–Seabird implementation report submitted to COFI in July 2012 (Revised in 2016). **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 2021.

							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 plans to develop a NPOA for seabirds after the NPOA Sharks has been finalised. **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. Kenya plans to develop a NPOA for turtles after the NPOA Sharks has been finalised.
Korea, Republic of		08-Aug-11		2019 – domestic fisheries		–	**Sharks:** Currently being implemented. **Seabirds:** NPOA seabirds was submitted to FAO in 2019. **Marine turtles:** All Rep. of Korea vessels fully implement Res 12/04 and the FAO-Sea Turtles Guidelines.
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, in the pole-and-line, handline 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^{0}S. 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 10th September 2014. The "Turtle Assessment Report (TAR)" will be finalized by February 2015 and necessary guidelines / action plan will be finalized by June 2015. As per clause-5 (c) of Pakistan Fish Inspection & Quality Control Act, 1997, "Aquatic turtles, tortoises, snakes, mammals including dugongs, dolphins, porpoises and whales etc" are totally forbidden for export and domestic consumption.
Philippines		Sept. 2009		–			**Sharks:** Under periodic review. **Seabirds:** Development has not begun. **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 includes 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 first approved and published in 2013. An update of the NPOA was provided in 2018. **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		2020		–			**Sharks:** An updated NPOA Sharks has been developed for the years 2020-2024. **Seabirds:** Development of NPOA seabirds has not begun. Thailand does not have longliners operating in the southern region of the Indian Ocean far from Thailand or large purse seine vessels operating in the Indian Ocean as a whole. The Notification of the Department of Fisheries, Thai fishing vessels operating in Indian Ocean Tuna Commission Competence Area B.E.2561 has been in force since 2018 and includes requirements for line-cutters and dehookers to be carried for releasing marine animals and for any fishing vessel operating south of 25°S to follow the measures for mitigating capture of seabirds **Marine turtles:** Thailand reports on progress of the implementation of FAO guidelines on turtles in their National Report to IOTC. Laws relating to

							conservation of marine turtles include: a prohibition on catching marine turtles; discarding of any marine turtles caught and recording details on catches; and a requirement to take care of injured marine turtles that have been caught.
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							
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 6

SCHEDULE OF WORK FOR THE DEVELOPMENT OF MANAGEMENT PROCEDURES FOR KEY SPECIES IN THE IOTC AREA

Year	Albacore	Skipjack	Yellowfin	Bigeye	Swordfish
2020	**WPs/SC**: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.	**WPs/SC**: Apply harvest control rule (HCR) using results from 2020 stock assessment to calculate total annual catch limit. (Secretariat to advise CPCs of catch limit.) Extend the HCR to develop full candidate MPs and undertake MSE to provide advice on the performance of candidate MPs.	**WPs/SC**: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.	**WPs/SC**: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.	**WPs/SC**: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.
2021	**TCMP**: Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an	**TCMP**: Provide advice to the Commission on outcomes from the application of the HCR.	**TCMP**: Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an	**TCMP**: Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an	**TCMP**: Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an

	MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.	Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.	MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.	MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.	MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.
	Commission: Consider work and advice from subsidiary bodies. Decision and adoption of an MP or provide direction to the WPs/SC on the need for further MSE of candidate or alternative MPs.	**Commission**: Consider work and advice from subsidiary bodies. Decision and adoption of an MP or provide direction to the WPs/SC on the need for further MSE of candidate or alternative MPs.	**Commission**: Consider work and advice from subsidiary bodies. Decision and adoption of an MP.	**Commission**: Consider work and advice from subsidiary bodies. Decision and adoption of an MP or provide direction to the WPs/SC on the need to undertake further MSE of candidate or alternative MPs.	**Commission**: Consider work and advice from subsidiary bodies and provide direction to the WPs/SC on the need to undertake further MSE of candidate or alternative MPs.
	WPs/SC: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.	**WPs/SC**: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.		**WPs/SC**: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.	**WPs/SC**: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.
2022	**TCMP**: Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.	**TCMP**: Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.		**TCMP**: Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.	**TCMP**: Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.
	Commission: Consider work and advice from subsidiary bodies. Decision and adoption of an	**Commission**: Consider work and advice from subsidiary bodies. Decision and adoption of an		**Commission**: Consider work and advice from subsidiary bodies.	**Commission**: Consider work and advice from subsidiary bodies. Decision and adoption of an

	MP or provide direction to the WPs/SC on the need for further MSE of candidate or alternative MPs.	MP or provide direction to the WPs/SC on the need for further MSE of candidate or alternative MPs.		Decision and adoption of an MP.	MP or provide direction to the WPs/SC on the need to undertake further MSE of candidate or alternative MPs.
	WPs/SC: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.	**WPs/SC**: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.			**WPs/SC**: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs.
2023	**TCMP**: Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.	**TCMP**: Provide advice to Commission on elements of candidate MPs, and any proposed Resolutions for an MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.			**TCMP**: Provide advice to the Commission on elements of candidate MPs, and any proposed Resolutions for an MP, that require a decision by the Commission, including the performance of candidate MPs against Commission objectives.
	Commission: Consider work and advice from subsidiary bodies. Decision and adoption of an MP.	**Commission**: Consider work and advice from subsidiary bodies. Decision and adoption of an MP.			**Commission**: Consider work and advice from subsidiary bodies. Decision and adoption of an MP or provide direction to the WPs/SC on the need for further MSE of candidate or alternative MPs.
					WPs/SC: Consider recommendations from the Commission and undertake MSE to provide advice on the performance of candidate MPs,

APPENDIX 7

LIST OF CHAIRS, VICE-CHAIRS AND THEIR RESPECTIVE TERMS FOR THE IOTC SCIENTIFIC COMMITTEE AND ITS SUBSIDIARY 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 Toshihide Kitakado	Japan	30–Dec–19	End of SC in 2021	1st term
	Vice-Chair	Dr Denham Parker	South Africa	30–Dec–19	End of SC in 2021	1st term
WPB	Chair	Dr Denham Parker	South Africa	12–Sept–19	End of WPB in 2021	1st term
	Vice-Chair	Dr Jie Cao	China	12–Sep–19	End of WPB in 2021	1st term
WPTmT	Chair	Dr Jiangfeng Zhu	China	21–July–16	End of WPTmT in 2022	2nd term
	Vice-Chair	Dr Toshihide Kitakado	Japan	21–July–16	End of WPTmT in 2022	2nd term
WPTT	Chair	Dr Gorka Merino	EU,Spain	03–Nov–18	End of WPTT in 2020*	1st term
	Vice-Chair	Dr Shiham Adam	Maldives, Rep. of	13–Nov–18	End of WPTT in 2020*	1st term
WPEB	Chair	Dr Sylvain Bonhommeau	EU,France	08–Sept–17	End of WPEB in 2021	2nd term
	Vice-Chair	Dr Mohamed Koya; Dr Mariana Tolotti	India / EU France	7–Sept–19	End of WPEB in 2021	1st term
WPNT	Chair	Ms Ririk Sulistyaningsih	Indonesia	5–July–19	End of WPNT in 2021	1st term
	Vice-Chair	Dr Farhad Kaymaram	I.R. Iran	5–July–19	End of WPNT in 2021	1st term
WPDCS	Chair	Mr Stephen Ndegwa	Kenya	28–Nov–17	End of WPDCS in 2021	2nd term
	Vice-Chair	Dr Julien Barde	EU,France	28–Nov–17	End of WPDCS in 2021	2nd term
WPM	Chair	Dr Hilario Murua	ISSF	19–Oct–19	End of WPM in 2021	1st term
	Vice-Chair	Ms Daniela Rosa	EU,Portugal	19–Oct–19	End of WPM in 2021	1st term

*Consistent with IOTC Circular 2020-37 Annex 1 - Suspension of Rules of Procedure of the Indian Ocean Tuna Commission, the Chairs due for re-election in 2020 were extended for a further year.

APPENDIX 8
EXECUTIVE SUMMARY: ALBACORE

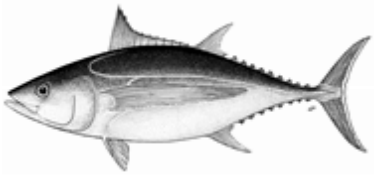


Table 1. Status of albacore (*Thunnus alalunga*) in the Indian Ocean

Area	Indicators – 2019 assessment		Status[3]
Indian Ocean[1]	Catch 2019[2] (MT)	39,876	
	Average catch 2015–2019 (MT)	38,365	
	MSY (1,000 MT) (95% CI)	35.7 (27.3–44.4)	
	F_{MSY} (95% CI)	0.21 (0.195-0.237)	
	SB_{MSY} (1,000 MT) (95% CI)	23.2 (17.6–29.2)	
	F_{2017}/F_{MSY} (95% CI)	1.346 (0.588–2.171)	
	SB_{2017}/SB_{MSY} (95% CI)	1.281 (0.574–2.071)	
	SB_{2017}/SB_{1950}	0.262	

[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 for 2019: 13%
[3] The stock status refers to the most recent years' data used in the last assessment conducted in 2019. i.e. 2017

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)		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new stock assessment was carried out for albacore in 2019 to update the assessment undertaken in 2016. The stock assessment was carried out using Stock Synthesis III (SS3), a fully integrated model that is currently also used to provide scientific advice for the three tropical tunas stocks in the Indian Ocean. The model used in 2019 is based on the model developed in 2016 with a series of revisions that were noted during the WPTmT data preparatory meeting held in January 2019. There are some noticeable changes in spatial distribution of longline catches compared to the previous assessment data set, with historical catch shifted to equatorial regions (LL1 and LL2) from southern fisheries (LL3 and LL4). This is due to revisions in the historical catch data carried out since the last assessment.

The current assessment has utilised CPUE series that are significantly different from the last assessment. In particular a revised approach to the analysis of the joint LL CPUE series was conducted and the resulting indices were included in the SS3 model. The final set of model options included alternative models using the northwest and southwest CPUE indices. Both sets of indices show a considerable decline from 1979 to current. The two sets of indices effectively monitor different components of the albacore stock. The CPUE in the southwest area (LL3) is mostly likely to represent the abundance of albacore tuna at the time, as the indices were primarily based on a main target fishery with more consistent fishing operations. The southwest area also represents a significant proportion of the albacore biomass in the Indian Ocean. The LL1 CPUE indices largely represent bycatch of the tropical tuna fisheries. The assessment results were sensitive to the influence of the length composition data sets in the models. There is concern regarding the information content of these data. Consequently, the final set of model options included alternative treatments of these data including down-weighting or excluding these data.

Trends in the CPUE series suggest that the longline vulnerable biomass has declined to around 45-50% 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 2017 were marginally above the MSY level of the SS3 model. Fishing mortality represented as F_{2017}/F_{MSY} is 1.346 (0.588–2.171). Biomass is estimated to be above the SB_{MSY} level (1.281 (0.574–2.071)) from the SS3 model (**Table 1**, **Fig. 2**). These changes in stock status since the previous assessment are possibly due to decreases in the CPUE in recent years, while catches have remained relatively stable. Also, there has been a large redistribution of catch to the southern regions which impacts on small fish (and therefore influences the computation of F_{MSY}). In addition, the latest assessment uses a revised growth curve which also impacts FMSY. 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** but is **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. The impacts of piracy in the western Indian Ocean 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. However, in recent years the effort distribution in the Indian Ocean has been rather dynamic. Projections indicate that under current catch assumptions, the biomass will continue to decline as recent recruitment levels are estimated to be low. The recruitment in the terminal years of the assessment model are estimated to be well below average levels and this is projected to cause the stock to decline considerably over the short term. However, these recruitment estimates are poorly determined. Therefore, it is cautioned that the short-term projections are more influenced by the recent low recruitment levels, whereas the long-term projections are more determined by the assumptions of average recruitment levels over the longer-term period.

Management advice. Although considerable uncertainty remains in the SS3 assessment conducted in 2019, particularly due to the conflicts in key data inputs, a precautionary approach to the management of albacore tuna should be applied. The K2SM indicates that catch reductions are required in order to prevent the biomass from declining to below MSY levels in the short term, due to the low recent recruitment levels. Although there is considerable uncertainty in the projections, current catches are exceeding the estimated MSY level (35,700 MT; **Table 2**).

The following should be noted:

- The primary sources of data that drive the assessment, total catches, CPUE and length data, are highly uncertain and should be developed further as a priority.
- The catch estimates for 2019 (39,876 MT) are above the current estimated MSY levels (**Table 1**).
- 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 above the provisional target reference point of F_{MSY}, but below 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 2015-2019)**: 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 2015-2019)**: 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.

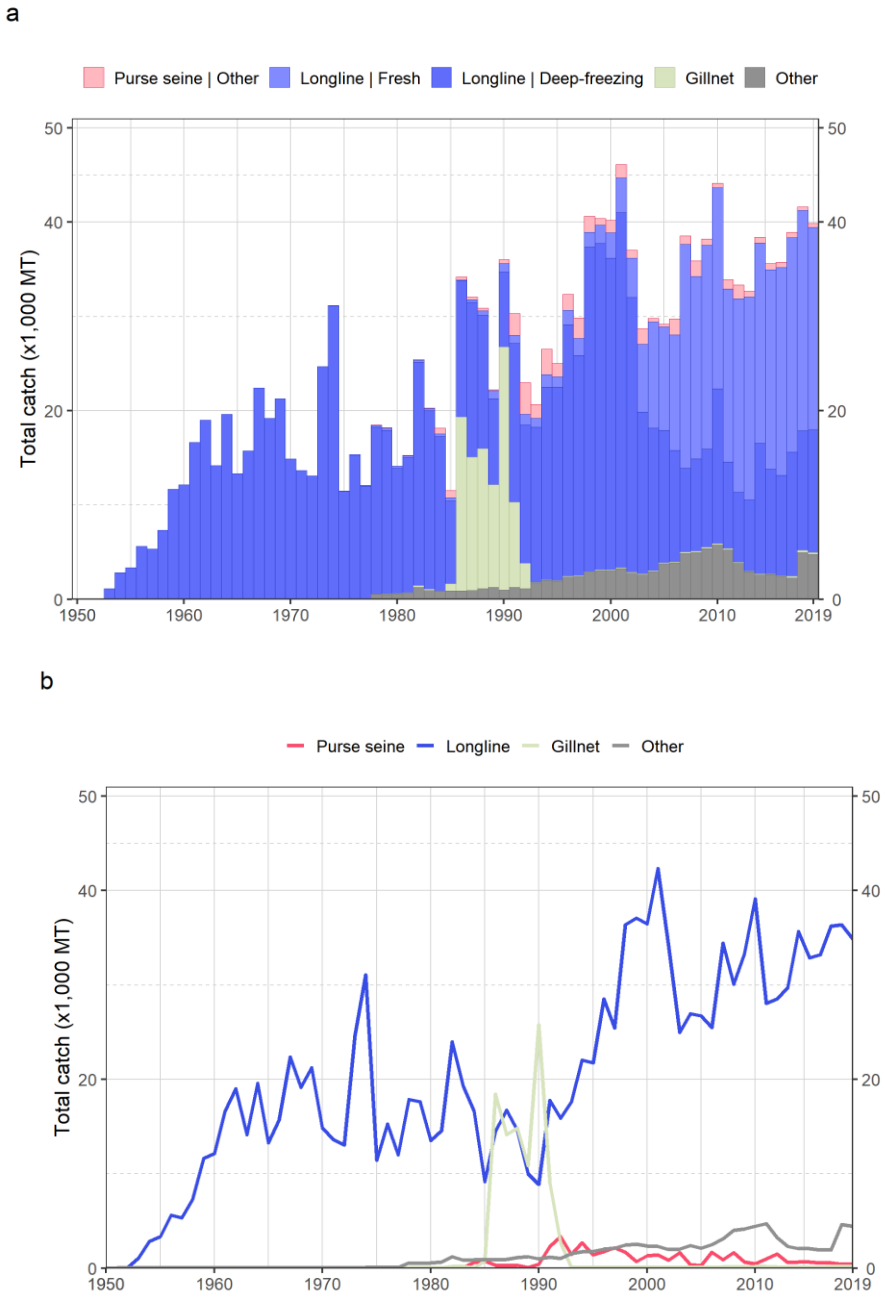


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for albacore tuna during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Longline: fresh and deep-freezing longline; Gillnet: gillnet, including offshore gillnet and driftnets from Taiwan, China; Other: all remaining fishing gears

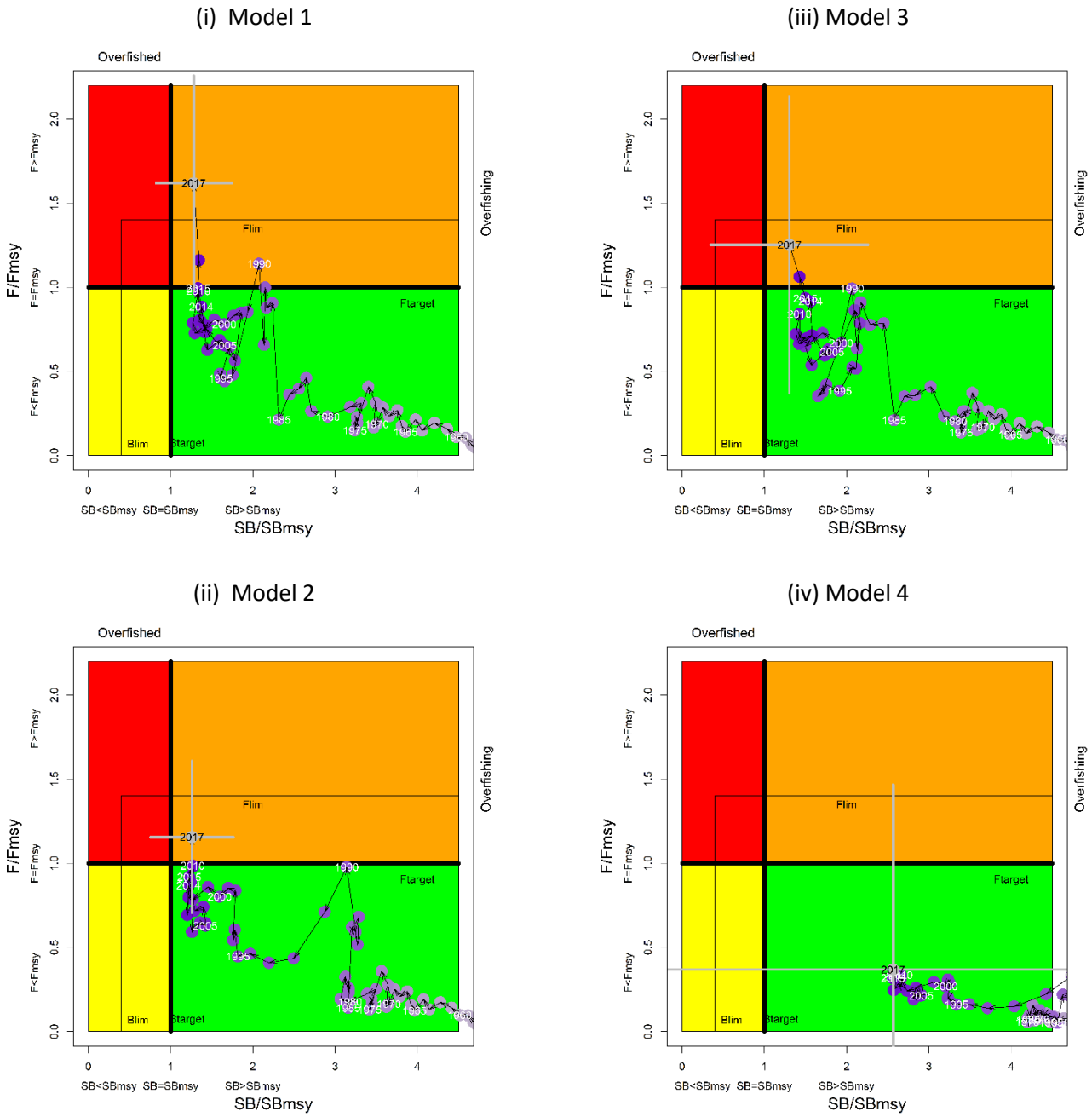


Fig. 2. Albacore: SS3 Indian Ocean assessment Kobe plot for the four model options considered: (i) Model 1 (ii) Model 2 (iii) Model 3 (iv) Model 4. Purple circles indicate the trajectory of the point estimates for the spawning biomass (SB) ratio and fishing mortality (F) ratio for each year 1950–2017 (the grey lines represent the 95 percentiles of the 2017 estimate). Target (F_{target} and SB_{target}) and limit (F_{lim} and SB_{lim}) reference points are shown

Table 2. Albacore: SS3 aggregated Indian Ocean assessment Kobe II Strategy Matrix based on the model options (i) Model 1 (ii) Model 2 (iii) Model 3 (Model 4 was not used for management advice). Probability (percentage) of violating the MSY-based target (top) and limit (bottom) reference points for constant catch projections (2017 catch level, ± 10%, ± 20%, ± 30% ± 40%) projected for 3 and 10 years

Reference point and projection timeframe	**Alternative catch projections (relative to the catch level for 2017) and probability (%) of violating MSY-based target reference points ($SB_{targ} = SB_{MSY}$; $F_{targ} = F_{MSY}$)**								
	60% (22,901)	70% (26,718)	80% (30,534)	90% (34,351)	100% (38,168)	110% (41,985)	120% (45,802)	130% (49,618)	140% (53,435)
$SB_{2020} < SB_{MSY}$	0.614	0.678	0.715	0.769	0.818	0.828	0.87	0.883	0.898
$F_{2020} > F_{MSY}$	0.074	0.224	0.4	0.556	0.654	0.731	0.766	0.788	0.782
$SB_{2027} < SB_{MSY}$	0.176	0.307	0.456	0.572	0.713	0.823	0.898	1	1
$F_{2027} > F_{MSY}$	0.002	0.085	0.287	0.473	0.718	0.878	1	1	1
Reference point and projection timeframe	**Alternative catch projections (relative to the catch level for 2017) and probability (%) of violating MSY-based target reference points ($SB_{targ} = SB_{MSY}$; $F_{targ} = F_{MSY}$)**								
	60% (22,901)	70% (26,718)	80% (30,534)	90% (34,351)	100% (38,168)	110% (41,985)	120% (45,802)	130% (49,618)	140% (53,435)
$SB_{2020} < SB_{Lim}$	0.039	0.065	0.084	0.124	0.161	0.19	0.253	0.314	0.373
$F_{2020} > F_{Lim}$	0.003	0.037	0.129	0.277	0.414	0.537	0.629	0.696	0.712
$SB_{2027} < SB_{Lim}$	0.059	0.12	0.22	0.325	0.462	0.648	0.749	1	1
$F_{2027} > F_{Lim}$	0	0.006	0.127	0.309	0.622	0.843	1	1	1

APPENDIX 9
EXECUTIVE SUMMARY: BIGEYE TUNA

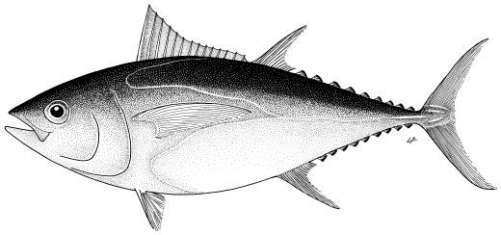


Table 1. Status of bigeye tuna (*Thunnus obesus*) in the Indian Ocean

Area[1]	Indicator	Value	Status[3]
Indian Ocean[5]	Catch in 2019 (MT)[2]	73,165[4]	38.2%*
	Average catch 2015-2019 (MT)	88,303	
	MSY (1,000 MT) (80% CI)	87 (75-108)	
	F_{MSY} (80% CI)	0.24 (0.18-0.36)	
	SB_{MSY} (1,000 MT) (80% CI)	503 (370-748)	
	F_{2018} / F_{MSY} (80% CI)	1.20 (0.70-2.05)	
	SB_{2018} / SB_{MSY} (80% CI)	1.22 (0.82-1.81)	
	SB_{2018} / SB_0 (80% CI)	0.31 (0.21-0.34)	

[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 for catches in 2019: 17%
[3]The stock status refers to the most recent years' data used in the assessment conducted in 2019, i.e. 2018
[4]Considering the alternative purse seine log-associated catch composition for the EU fleet in 2018 as per IOTC-2019-WPTT21-R[E]
[5]Results of management quantities presented here are for the revised catches – see footnote 4
*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 (SB_{2018} / SB_{MSY}<1)	Stock not overfished (SB_{2018} / SB_{MSY}≥ 1)
Stock subject to overfishing (F_{2018} / F_{MSY}≥ 1)	34.6%	38.2%
Stock not subject to overfishing (F_{2018} / F_{MSY}≤ 1)	0%	27.2%
Not assessed / Uncertain		

The percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. In 2019 a new stock assessment was carried out for bigeye tuna in the IOTC area of competence to update the stock status undertaken in 2016. Two models were applied to the bigeye stock (JABBA and Stock Synthesis (SS3)). The stock assessment selected to provide scientific advice was carried out using SS3, a fully integrated model used to provide scientific advice for the three tropical tunas stocks in the Indian Ocean. The reported stock status is based on the SS3 model formulation using a grid of 18 model configurations designed to capture the uncertainty on stock recruitment relationship, the influence of tagging information and selectivity of longline fleets. Due to concerns on the reported catch data for 2018, the stock status is based on SS3 model formulations using the best catch estimate by the Scientific Committee (for details see WPTT report). Spawning biomass in 2018 was estimated to be 31% of the unfished levels in 2018 (**Table 1**) and 122% (82–181%) of the level that can support MSY. The assessment outcome is qualitatively different to the stock assessment conducted in 2016 due to the increase of catch of small size, changes in modelling assumptions about longline selectivity, and the abundance index developed in 2019. Considering the characterized uncertainty, the assessment indicates that SB_{2018} is above SB_{MSY} with high probability (65.4%) and that fishing mortality is above F_{MSY} also with high probability (72.8%). The median value of MSY from the model runs presented with SS3 was 87,000 MT with a range between 75,000 and 108,000 MT (a median level 16% lower than the estimate in 2016). Catches in 2018 (~81,413 MT) remain lower than the estimated median MSY values from the stock assessment conducted in 2019 but within the range of estimated MSY. The average catch over the previous five years (2014–18; ~89,717 MT) is just above the estimated median MSY and within the range of estimated values. Thus, on the weight-of-evidence available in 2019, the bigeye tuna stock is determined to be **not overfished** but **subject to overfishing** (**Table 1**).

Outlook. Declines in longline effort since 2007, particularly from the Japanese, Taiwanese and Rep. of Korea longline fleets lowered the pressure on the Indian Ocean bigeye tuna stock since 2007. However, recent increase in catch from purse seine fleets have increased this pressure and the stock is estimated to be subject to overfishing. The estimated MSY has declined significantly (16%) from the previous estimate (from 2016) due to the increase of purse seine catch in the overall change in catch composition, changes in modelling assumptions about longline selectivity, and the inclusion of a more pessimistic abundance index in the western tropical region. The Kobe strategy matrix (K2SM) based on the plausible model runs from SS3 in 2019 illustrates the levels of quantified risk associated with varying catch levels over time that could be used to inform future management actions (**Table 2**). The projections produced to estimate the K2SM (**Table 2**) are, in the short term, driven by the below average recruitment estimated for the recent years. The SS3 projections from the 2019 assessment show that there is a risk of breaching MSY-based reference points by 2021, and 2028 if catches are maintained at 2018 levels at the2018 selectivity and therefore size distribution of catch (**Table 2**). Should the management objective of maintaining biomass at levels higher than SB_{MSY} with more than 50% probability in 2028 be pursued, the overall catch should be reduced 10% from 2018 levels (73,272 MT).

Management advice. The stock status determination changed qualitatively in 2019 to not overfished but subject to overfishing. If catches remain at 2018 levels there is a risk of breaching MSY reference points with 58.9% and 60.8% probability in 2021 and 2028. Maintaining catches of at least 10% below 2018 levels will likely reduce the probabilities of breaching reference levels to 49.1% in 2028. Continued monitoring and improvement in data collection, reporting and analyses is required to reduce the uncertainty in assessments (**Table 2**).

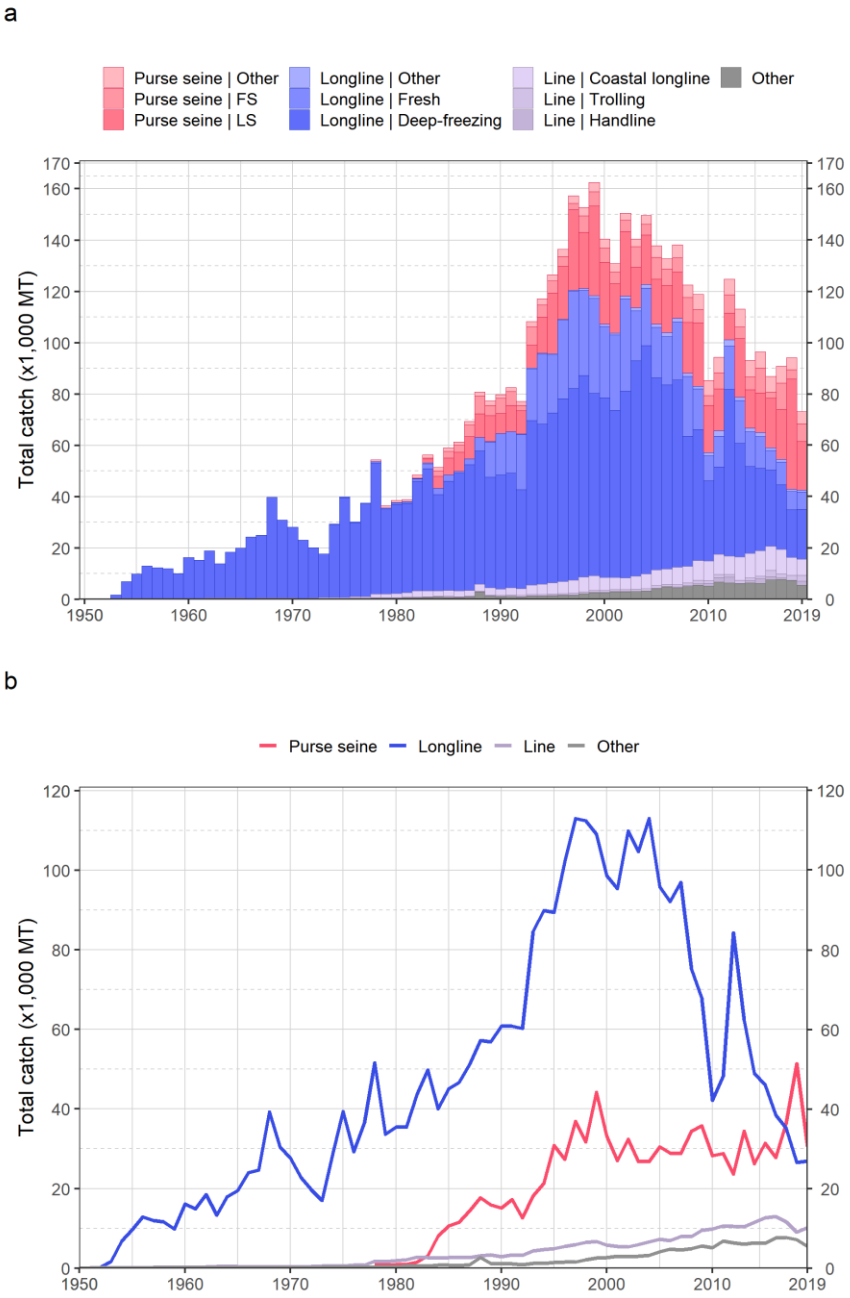


Fig. 1. Annual time series of (a) cumulative nominal catches (MT) by gear and (b) individual nominal catches (MT) by gear group for bigeye tuna during 1950–2019. LS = drifting log or FAD-associated school and FS = free-swimming school. Purse seine: coastal purse seine, purse seine, ring net; Longline: deep-freezing and fresh longlines, swordfish and sharks-targeted longlines; Line: coastal longline, trolling and handline; Other: all remaining fishing gears

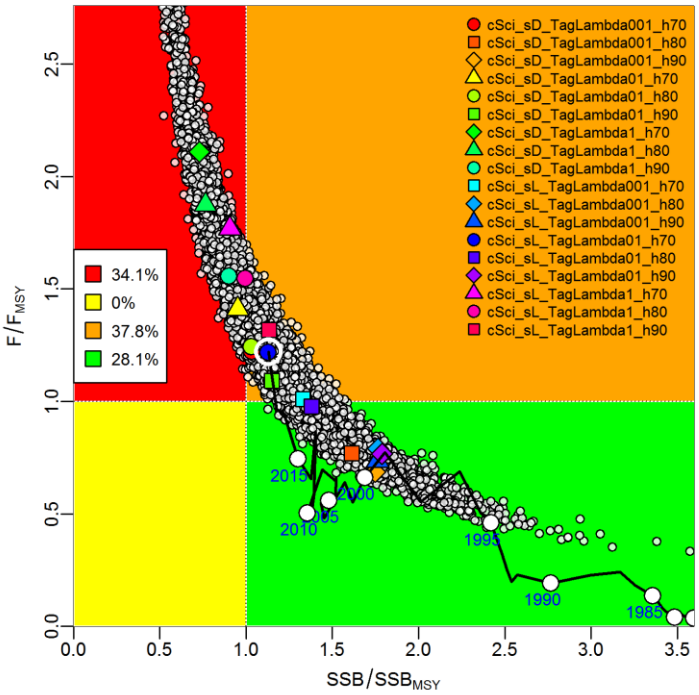


Fig. 2. Bigeye tuna: SS3 Aggregated Indian Ocean assessment Kobe plot. The coloured points represent stock status estimates from the 18 model options. The grey dots represent 5,000 estimates of 2018 stock status from the multivariate normal approximation from the mean and variance-covariance of the 18 model options. The legend indicates the estimated probability of the stock status being in each of the Kobe quadrant. The white circle (around the blue dot) represents the median stock status in 2018

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 average catch level from 2018 (81,413 MT); -10%, -20%, -30%, -40%) projected for 3 and 10 years

Reference point and projection timeframe	**Alternative catch projections (relative to the catch level from 2018) and weighted probability (%) scenarios that exceed reference point**				
	60% (48,848 MT)	**70%** (56,990 MT)	**80%** (65,130 MT)	**90%** (73,272 MT)	**100%** (81,413 MT)
$SB_{2021} < SB_{MSY}$	51.1	53.3	54.2	57.1	58.9
$F_{2021} > F_{MSY}$	7.3	17.8	32	47.9	62.8
$SB_{2028} < SB_{MSY}$	8	19.5	35.1	49.1	60.8
$F_{2028} > F_{MSY}$	1.1	6.9	19.8	37.7	55.6
Reference point and projection timeframe	**Alternative catch projections (relative to the catch level from 2018) and probability (%) of violating MSY-based limit reference points (SB_{lim} = 0.5 SB_{MSY}; F_{Lim} = 1.3 F_{MSY})**				
	60% (48,848 MT)	**70%** (56,990 MT)	**80%** (65,130 MT)	**90%** (73,272 MT)	**100%** (81,413 MT)
$SB_{2021} < SB_{LIM}$	0	0	0	0	0
$F_{2021} > F_{LIM}$	6.0	11.0	17.0	28.0	39.0
$SB_{2028} < SB_{LIM}$	0.0	0.0	6.0	11.0	22.0
$F_{2028} > F_{LIM}$	0.0	6.0	17.0	22.0	39.0

APPENDIX 10
EXECUTIVE SUMMARY: SKIPJACK TUNA

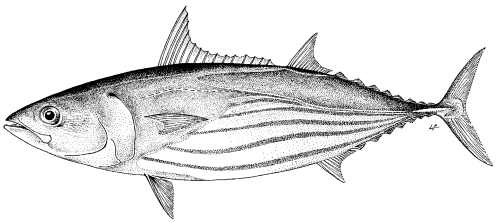


Table 1. Status of skipjack tuna (*Katsuwonus pelamis*) in the Indian Ocean

Area[1]	Indicator	Value	Status[2]
Indian Ocean	Catch in 2019 (MT)	547,248	60.4%*
	Average catch 2015-2019 (MT)	506,555	
	$C_{40\%SB0}$ (MT) (80% CI)	535,964 (461,995–674,536)	
	C_{2019} / $C_{40\%SB0}$ (80% CI)	1.02 (0.81–1.18)	
	$E_{40\%SB0}$ [3] (80% CI)	0.59 (0.53–0.66)	
	E_{2019} / $E_{40\%SB0}$ (80% CI)	0.92 (0.67-1.21)	
	SB_0 (MT) (80% CI)	1,992,089 (1,691,710–2,547,087)	
	SB_{2019} (MT) (80% CI)	870,461 (660,411–1,253,181)	
	$SB_{40\%SB0}$ (MT) (80% CI)	794,310 (672,825–1,019,056)	
	$SB_{20\%SB0}$ (MT) (80% CI)	397,155 (336,412–509,528)	
	SB_{2019} / SB_0 (80% CI)	0.45 (0.38-0.5)	
	SB_{2019} / $SB_{40\%SB0}$ (80% CI)	1.11 (0.95-1.29)	
	SB_{2019} / SB_{MSY} (80% CI)	1.99 (1.47-2.63)	
	MSY (MT) (80% CI)	601,088 (500,131–767,012)	
	E_{2019} / E_{MSY} (80% CI)	0.48 (0.35-0.81)	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2]The stock status refers to the most recent years' data used in the assessment conducted in 2020, i.e. 2019
[3] $E_{40\%SB0}$ is the equilibrium annual exploitation rate (Etarg) associated with the stock at Btarg, and is a key control parameter in the skipjack harvest control rule as stipulated in Resolution 16/02. Note that Resolution 16/02 did not specify the exploitation rate associated with the stock at Blim.
*Estimated probability that the stock is in the respective quadrant of the Kobe plat t (shown below), derived from the confidence intervals associated with the current stock status

Colour key	Stock overfished (SB_{2019} / $SB_{40\%SB0}$<1)	Stock not overfished (SB_{2019} / $SB_{40\%SB0}$≥ 1)
Stock subject to overfishing (E_{2019} / $E_{40\%SB0}$≥ 1)	19.5%	19.5%
Stock not subject to overfishing (E_{2019} / $E_{40\%SB0}$≤ 1)	0.6%	60.4%
Not assessed / Uncertain		

The percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new stock assessment was carried out for skipjack tuna in 2020 using Stock Synthesis with data up to 2019. The outcome of the 2020 stock assessment model does not differ substantially from the previous assessment (2017) despite the large catches recorded in the period 2018-2019, which exceeded the catch limits established in 2017 for this period.

The final overall estimate of stock status indicates that the stock is above the adopted target for this stock and that the current exploitation rate is just below the target. Also, the models estimate that the spawning biomass remains above its SB_{MSY} and the fishing mortality remains below E_{MSY} with very high probability. Over the history of the fishery, biomass has been well above the adopted limit reference point ($0.2*SB_0$). The recent catches have been within the range of estimated target yield (see $C_{40\%SB0}$). Current spawning biomass relative to unexploited levels is estimated at 45% (**Table 1**). Thus, on the weight-of-evidence available in 2020, the skipjack tuna stock is determined to be: (i) above the adopted biomass target reference point; (ii) **not overfished** ($SB_{2019}>SB_{40\%SB0}$); (iii) with fishing mortality below the adopted target fishing mortality, and; (iv) **not subject to overfishing** ($E_{2019}<E_{40\%SB0}$).

Outlook. Total catches in 2018 were 30% larger than the resulting catch limit from the skipjack HCR for the period 2018-2020 (470,029 t), which raises concern in the WPTT. It is important to note that reaching the management objectives defined in Resolution 16/02 requires that the catch limits adopted by the skipjack HCR are implemented effectively. It should be noted that skipjack catches for most gears have increased from 2017 to 2018 (+44% for purse seine (log/FAD-associated), +12% for gillnet and +13% for pole-and-line). In 2019, catch was reduced considerably compared to 2018. Due to its specific life history attributes, skipjack can respond quickly to ambient foraging conditions driven by ocean productivity, which seem to have been favourable in recent years. Environmental indicators should be closely monitored to inform on the potential increase/decrease of stock productivity. There remains considerable uncertainty in the assessment: The assumption of two hypotheses for the effort creep since 1995 for the standardized European purse seine CPUE was included in the model grid. The range of runs analysed illustrate a range of stock status to be between 36% and 51% of SB_{2019} / SB_0 based on all runs examined. It is important to note the differences between the runs that apply an additional effort creep parameter to the standardized series of CPUE (median $SB_{2019}/SB_0=0.44$) and those that do not (median SB_{2019} / $SB_0=0.45$). Also, there was contrast between runs that fully weighted tagging information (median SB_{2019} / $SB_0=0.42$) and those that reduced their influence (median $SB_{2019}/SB_0=0.48$).

Management advice. The catch limit calculated applying the HCR specified in Resolution 16/02 is 513,572t for the period 2021 -2023. The SC noted that this catch limit is higher than for the previous period. This is attributed to the new stock assessment which estimates a higher productivity of the stock and a higher stock level relative to the target reference point, possibly due to skipjack life history characteristics and favourable environmental conditions. Thus, it is likely that the recent catches that have exceeded the limits established for the period 2018-2020 have been sustained by favourable environmental conditions. Therefore, the Commission needs to ensure that catches of skipjack tuna during this period do not exceed the agreed limit.

The following key points should also be noted:

- **Reference points**: Commission in 2016 agreed to Resolution 16/02 on *harvest control rules for skipjack tuna in the IOTC area of competence*;
- **Biomass**: Current spawning biomass was considered to be above 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 16/02;
- **Main fishing gears** (average catches 2015-19): Purse seine ~53% (FAD/log associated school ~42%; free-swimming school ~2.4%; other ~8.3%); Pole-and-line ~19%; Gillnet ~19%; Other gears ~9% (**Fig. 1**);
- **Main fleets** (average catches 2015-19): European Union ~26% (EU-Spain: ~18.6%; EU-France: ~6.7%; EU-Italy: 0.4%); Maldives ~16%; Indonesia ~16%; Seychelles ~13%; I.R. Iran ~9%; Sri Lanka ~9%.

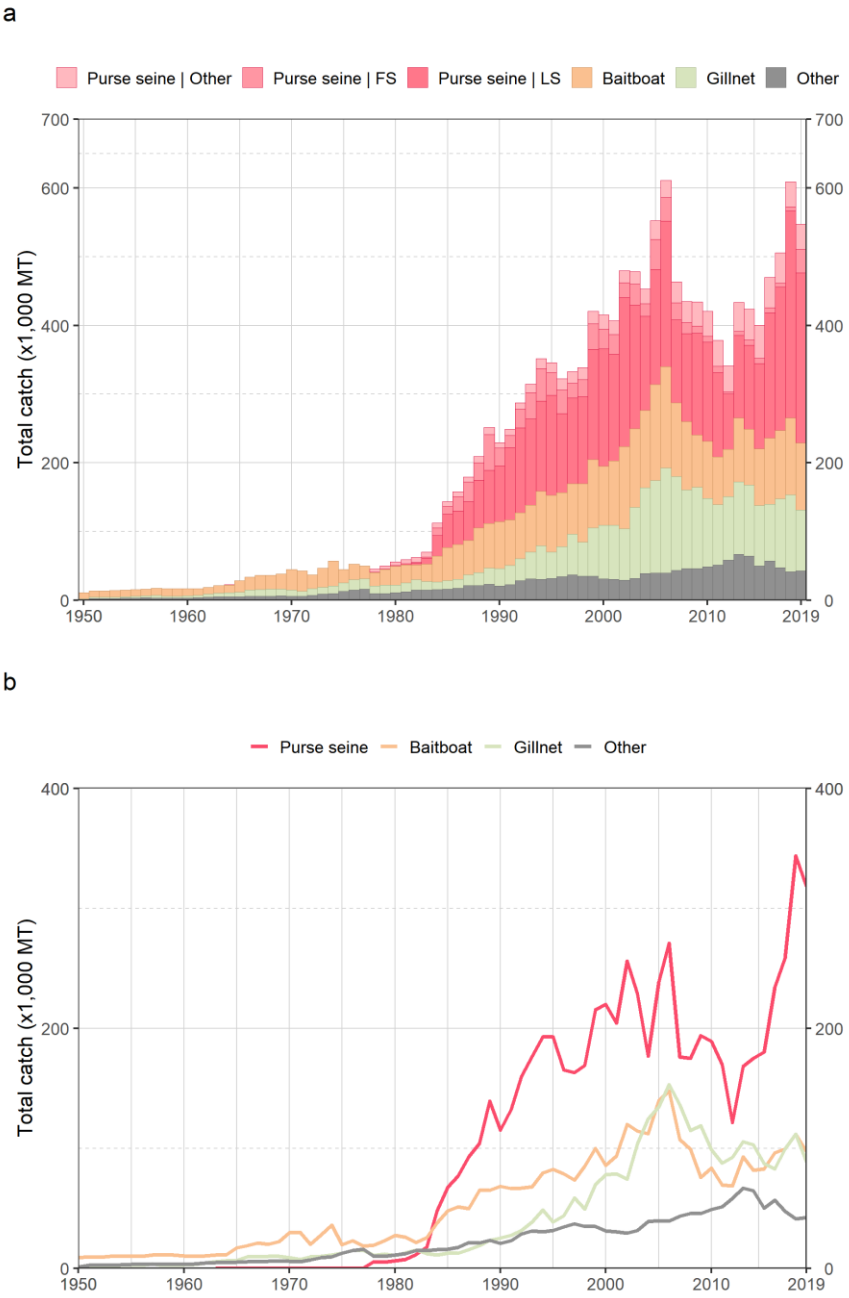


Fig. 1. Annual time series of (a) cumulative nominal catches (MT) by gear and (b) individual nominal catches (MT) by gear group for skipjack tuna during 1950–2019. LS = drifting log or FAD-associated school and FS = free-swimming school. Purse seine: coastal purse seine, purse seine, ring net; Baitboat: coastal and offshore baitboats; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining fishing gears

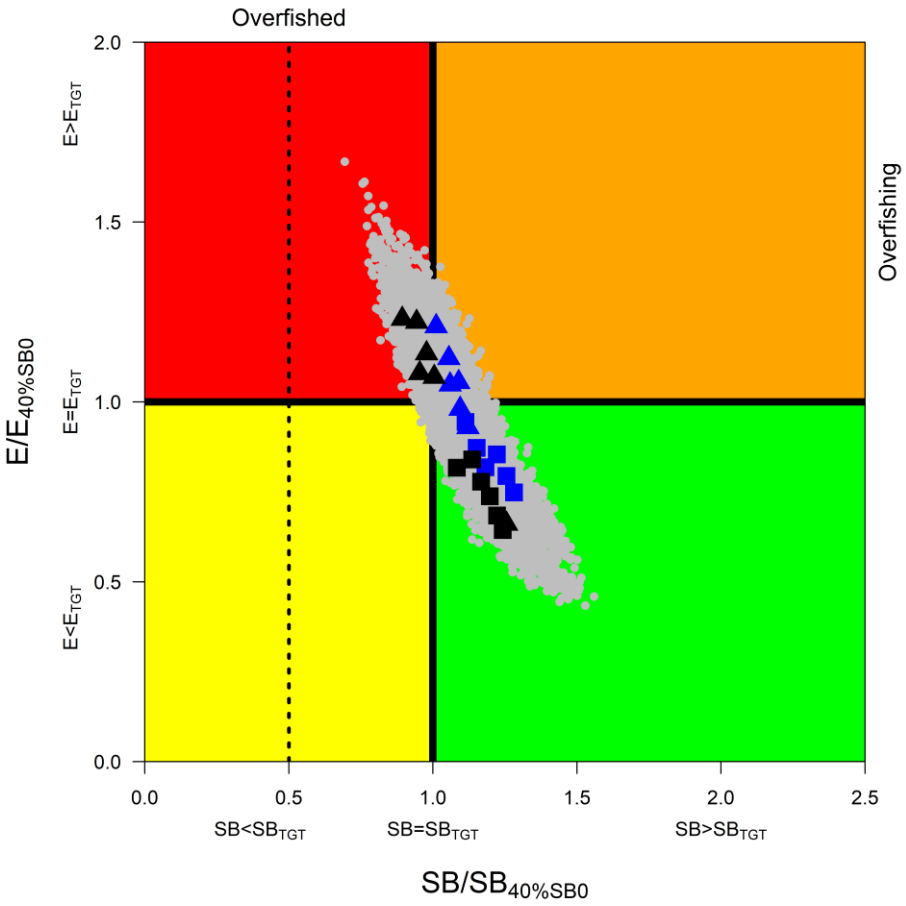


Fig. 2. Skipjack tuna: SS3 Aggregated Indian Ocean assessment Kobe plot of the 2020 uncertainty grid. Symbols represent MPD estimates of current stock status relative to $SB_{40\%SB0}$ (x-axis) and $E_{40\%SB0}$ (y-axis) for the individual models (blue, no effort creep; black, additional effort creep; triangle, full weighting of tagging data; square, tagging data downweighted). Grey dots represent uncertainty from individual models. The vertical dashed line represents the limit reference point for Indian Ocean skipjack tuna (SB_{lim} = 20%SB_0)

APPENDIX 11
EXECUTIVE SUMMARY: YELLOWFIN TUNA

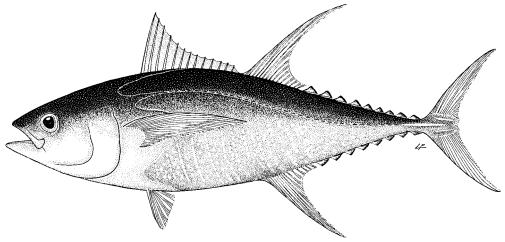


Table 1. Status of yellowfin tuna (*Thunnus albacares*) in the Indian Ocean

Area[1]	Indicator	Value	Status[3]
Indian Ocean	Catch in 2019 (MT)[2]	427,240[4]	94%*
	Average catch 2015-2019 (MT)	424,103[4]	
	MSY (1,000 MT) (80% CI)	403 (339-436)	
	F_{MSY} (80% CI)	0.15 (0.13-0.17)	
	SB_{MSY} (1,000 MT) (80% CI)	1,069 (789-1,387)	
	F_{2017} / F_{MSY} (80% CI)	1.20 (1.00-1.71)	
	SB_{2017} / SB_{MSY} (80% CI)	0.83 (0.74-0.97)	
	SB_{2017} / SB_0 (80% CI)	0.30 (0.27-0.33)	

[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 for catches in 2019: 14%
[3]The stock status refers to the most recent years' data used in the assessment conducted in 2018, i.e. 2017
[4]Considering the alternative purse seine log-associated catch composition for the EU fleet in 2018 as per IOTC-2019-WPTT21-R[E]
*Estimated probability that the stock is in the respective quadrant of the Kobe Plot (shown below). Median and quantiles calculated from the uncertainty grid taking into account of weighting on models

Colour key	Stock overfished (SB_{2017} / SB_{MSY}<1)	Stock not overfished (SB_{2017} / SB_{MSY}≥ 1)
Stock subject to overfishing (F_{2017} / F_{MSY}≥ 1)	94%	4%
Stock not subject to overfishing (F_{2017} / F_{MSY}≤ 1)	2%	0%
Not assessed / Uncertain		

The percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was carried out for yellowfin tuna in 2020, thus, stock status is determined on the basis of the 2018 assessment and other information presented in 2020. The 2018 stock assessment was carried out using Stock Synthesis III (SS3), a fully integrated model that is currently used to provide scientific advice for the three tropical tunas stocks in the Indian Ocean. The model used in 2018 is based on the model developed in 2016 with a series of revisions that were noted during the WPTT. The model uses four types of data: catch, size frequency, tagging and joint longline CPUE indices. The 2018 assessment results were based on a grid of 24 SS3 model runs which are recognized as insufficient to explore the spectrum of uncertainties and scenarios, noting the large uncertainty associated with data quality (e.g., spatial representativeness of CPUE coverage, estimation of catch and inconsistency in length-composition) and lack of considering model statistical uncertainty. Some of these uncertainties were explored in 2019 following the Workplan the Scientific Committee adopted in 2018. However, due to the complexity of the work, lack of agreement on key model aspects and time constraints, no new management advice was provided in 2019. According to the 2018 stock assessment, spawning biomass in 2017 was estimated to be 30.0% of the unfished levels (**Table 1**). According to the information available in 2019, the total catch has remained relatively stable at levels around the estimated MSY since 2012 (i.e., between 339,000 MT and 436,000 MT), with the 2018 catch being the largest since 2010 (440,833 MT), and exceeding the MSY range considering the best catch estimate by the Scientific Committee (for details see WPTT report). The 2018 stock assessment estimates SB_{2017} / SB_{MSY} at 0.83 (0.74-0.97) and F_{2017} / F_{MSY} at 1.20 (1.00-1.71). However, it is noted that the quantified uncertainty in stock status is likely underestimating the underlying uncertainty of the assessment. On the weight-of-evidence available in 2018, 2019 and 2020, the yellowfin tuna stock is determined to remain **overfished** and **subject to overfishing** (**Table 1** and **Fig. 1**).

Outlook. The increase in catches in recent years has substantially increased the pressure on the Indian Ocean stock, resulting in fishing mortality exceeding the MSY-related levels. The results of projections of the Stock Synthesis are no longer provided in the form of K2SM because subsequent investigation has shown some critical errors in the projections and estimations for computing probabilities in the K2SM developed in 2018. As such the K2SM is not suitable for use to provide management advice. Nonetheless, there is a high risk of continuing to exceed the MSY-based reference points if catches remain at or above 2017 levels (~409,000 MT in 2017 as used in the assessment). In order to provide more updated information with respect to the 2018 assessment Fig.3 reports the trend(s) of the relevant fishery-based indicator(s) updated up to 2019.

Management advice. The decline in stock status to below MSY reference level is not well understood due to various uncertainties. As a precautionary measure, the Commission should ensure that CPCs take all necessary action to achieve the catch reductions in their fleets, as per Res 19/01, to reduce overfishing. It is recommended that catches be reduced to a level at least below the C_{MSY} estimate (403, 000 MT) from the 2018 assessment until new information based on the 2021 stock assessment and its associated projections are carried out. It is reminded that F_{2017} was 20% above the target reference point.

In the 2018 Scientific Committee a Workplan was developed to address the issues identified in the assessment review, aimed at increasing the Committee's ability to provide more concrete and robust advice by the 2019 meeting of the Scientific Committee. The workplan started in January 2019 which aimed at addressing the issues identified by the WPTT and the external reviewer in 2018. The draft workplan is attached as Appendix 38 of the 2018 Scientific Committee Report (IOTC-2018-SC21-R). The Commission should ensure that this workplan is budgeted appropriately. Despite the progress made to reduce the uncertainties inherent to this assessment, the WPTT agreed that no new K2SM could be provided in 2019 and 2020.

The Commission has an interim plan for the rebuilding the yellowfin stock, with catch limitations based on 2014/2015 levels (Resolution 19/01, which superseded 17/01 and 18/01). Some of the fisheries subject to catch reductions had fully achieved a decrease in catches in 2019 in accordance with the levels of reductions specified in the Resolution; however, these reductions were offset by increases in the catches from CPCs exempt and some CPCs subject to limitations on their catches of yellowfin tuna (see Appendix 33). Thus, the total catches of yellowfin in 2019 increased by around 5.22% from 2014 levels. The Commission should ensure that any revision of the management measure can effectively achieve any prescribed catch reduction to ensure the effectiveness of the management measure.

The following key points should also be noted:

- Maximum Sustainable Yield (MSY): estimate for the Indian Ocean stock is 403,000 MT with a range between 339,000-436,000 MT (**Table 1**). The 2015-2019 average catches (424,103 MT) were just above the estimated MSY level. The last year (2019), catch has been substantially higher than the median MSY.
- **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**: 2017 fishing mortality is considered to be 20% above the interim target reference point of F_{MSY}, and below the interim limit reference point of $1.4*F_{MSY}$ (**Fig. 2**).
- **Biomass**: 2017 spawning biomass is considered to be 17 % below the interim target reference point of SB_{MSY} and above the interim limit reference point of $0.4*SB_{MSY}$ (**Fig. 2**).
- **Main fishing gears** (average catches 2015-19): Purse seine ~35% (FAD associated school ~23%; free swimming school ~10%); Line: 31%; Gillnet ~20%; Longline ~9%; All other gears ~5% (**Fig. 1**).
- **Main fleets** (average catches 2015-19): European Union ~19% (EU-Spain ~12%; EU-France ~7%); I.R. Iran ~12%; Maldives ~12%; Seychelles ~10%; Sri Lanka ~9%; All other fleets ~38%.

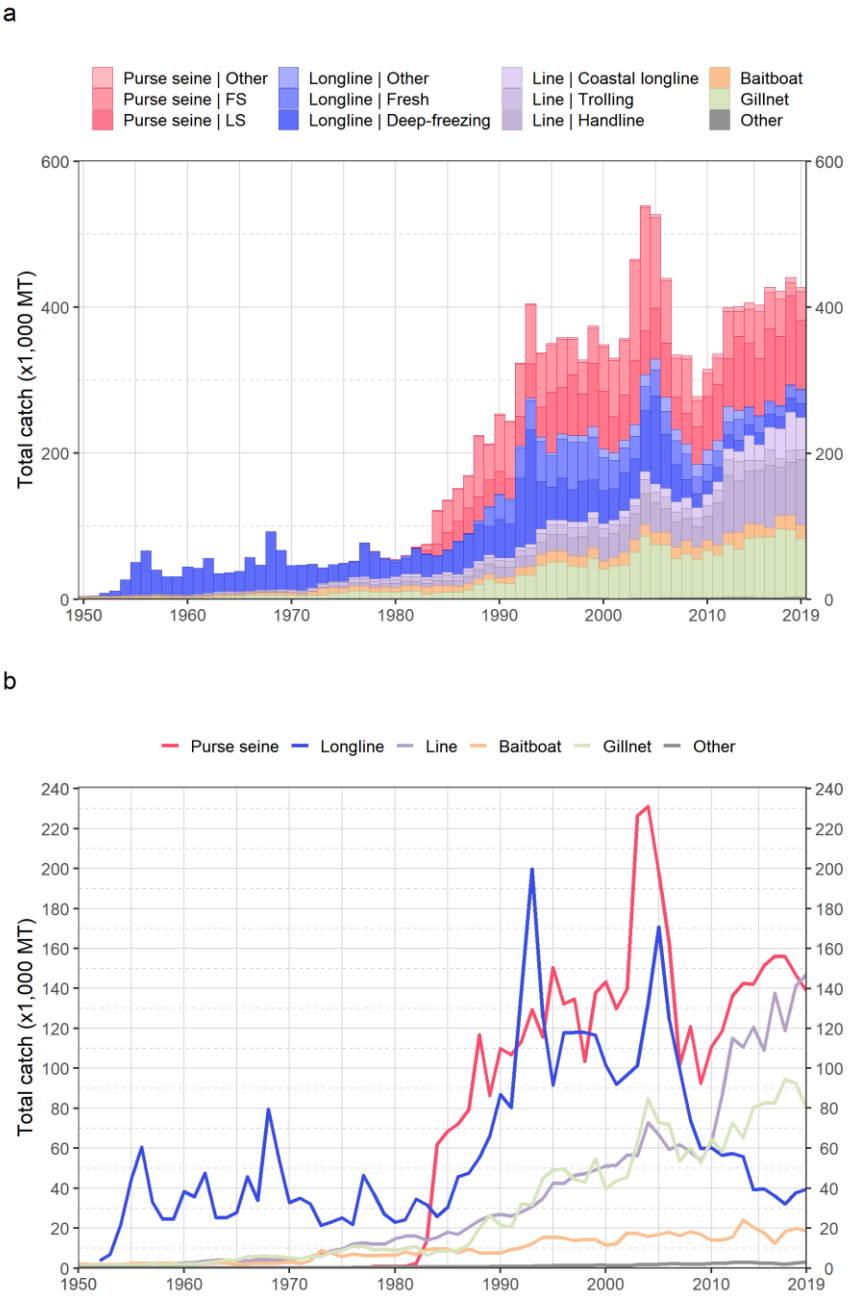


Fig. 1a-b. Annual time series of (a) cumulative nominal catches (MT) by gear and (b) individual nominal catches (MT) by gear group for yellowfin tuna during 1950–2019. LS = drifting log or FAD-associated school and FS = free-swimming school. Purse seine: coastal purse seine, purse seine, ring net; Longline: deep-freezing and fresh longlines, swordfish and sharks-targeted longlines; Line: coastal longline, trolling and handline; Baitboat: coastal and offshore baitboats; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining fishing gears

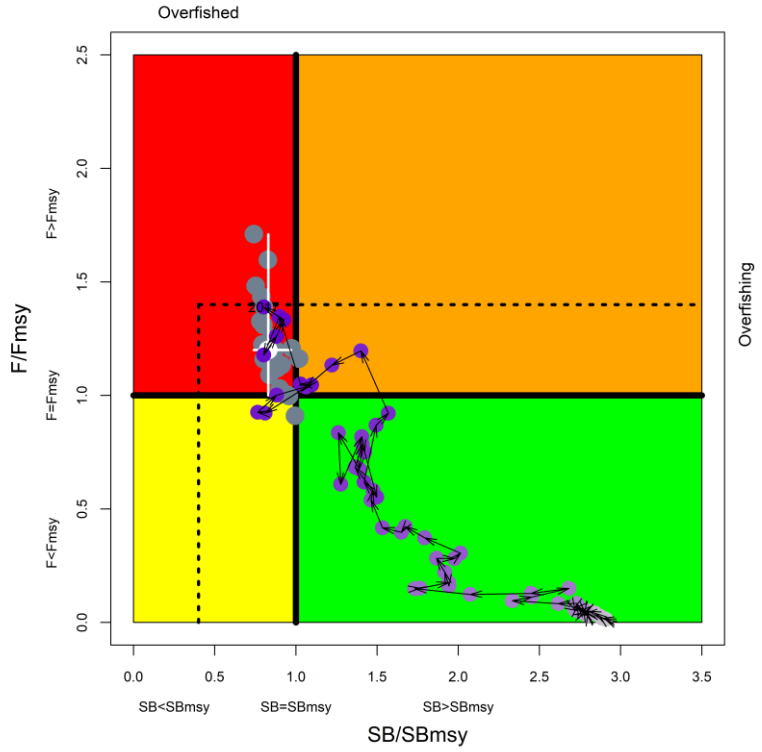


Fig. 2. Yellowfin tuna: Stock synthesis Kobe plot. Blue dots indicate the trajectory of the point estimates for the SB/SB_{MSY} ratio and F/F_{MSY} ratio for each year 1950–2017. The white line represents the 80% confidence interval associated with the 2017 stock status. Dotted black lines are the interim limit reference points adopted by the Commission via Resolution 15/10. The grey circles represent 2017 stock status for each grid run

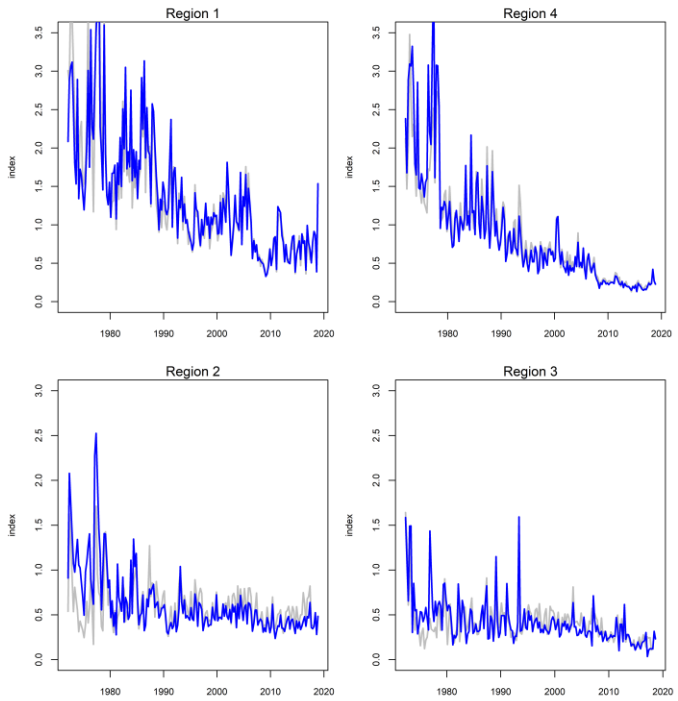


Fig 3: Joint longline CPUE indices by region (1972-2018). The grey lines are indices used in 2018 assessment (1972 – 2017)

APPENDIX 12
EXECUTIVE SUMMARY: SWORDFISH

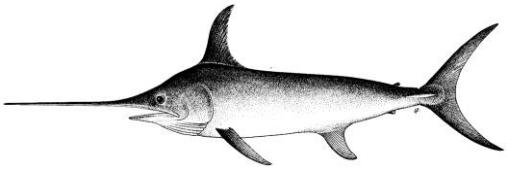


Table 1. Status of swordfish (*Xiphias gladius*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination
Indian Ocean	Catch 2019[2] (MT) Average catch 2015-2019 (MT)	32,671 31,712	**98%**
	MSY (1,000 MT) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 MT) (80% CI) F_{2018}/F_{MSY} (80% CI) SB_{2018}/SB_{MSY} (80% CI) SB_{2018}/SB_{1950} (80% CI)	33 (27–40) 0.23 (0.15–0.31) 59 (41–77) 0.60 (0.40–0.83) 1.75 (1.28–2.35) 0.42 (0.36–0.47)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2019 catch estimated or partially estimated by IOTC Secretariat: 5%

Colour key	Stock overfished ($SB_{year}/SB_{MSY}< 1$)	Stock not overfished ($SB_{year}/SB_{MSY}\geq 1$)
Stock subject to overfishing ($F_{year}/F_{MSY}> 1$)	0.005	0.005
Stock not subject to overfishing ($F_{year}/F_{MSY}\leq 1$)	0.01	0.98
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new assessment was undertaken in 2020 using stock synthesis with fisheries data up to 2018. 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 as a whole ($F_{2018}/F_{MSY}< 1$; $SB_{2018}/SB_{MSY}> 1$). The two alternative models (ASPIC and JABBA) applied to swordfish also indicated that the stock was above a biomass level that would produce MSY. Spawning biomass in 2018 was estimated to be 40-83% of the unfished levels. Most recent catches of 32,671 MT in 2019 are just below the *MSY* level (33,000 MT). On the weight-of-evidence available in 2020, the stock is determined to be ***not overfished*** and ***not subject to overfishing*** (**Table 1**, **Fig. 2**).

Outlook. The decrease in longline catch and effort from 2005 to 2011 lowered the pressure on the Indian Ocean stock as a whole, 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 2028 if catches are maintained at 2018 levels (<5% risk that $SB_{2028}< SB_{MSY}$, and <10% risk that $F_{2028}> F_{MSY}$) (**Table 1**). However, the Southern regions exhibit declining biomass trends which indicate higher depletion in these regions, compared to northern regions.

***Management advice*.** The most recent catches (32,671 MT in 2019) are at approximately the MSY level (33,000 MT). Under the current levels of catches, the spawning biomass is projected to remain relatively stable, with a high probability of maintaining at or above the SB_{MSY} for the longer term. Nevertheless, the Commission should consider limiting the catches so as not to exceed the 2018 catch level (30,847 t) to ensure that the probability of exceeding the SB_{MSY} target reference points in the long term remains minimal (2%). Projections indicate that an increase of 40% or more from 2018 catch levels will likely result in the biomass dropping below the SB_{MSY} level for the longer

term (>75% probability). Taking into account the updated information regarding swordfish stock structure (IOTC-2020-WPB18-09), as well as the differential CPUE and biomass trends between regions, the WPB should continue to discuss the swordfish stock assessment model specifications and consider the feasibility of including a multi-stock assessment in 2023. Recognising that there is recurring evidence for localised depletion in the southern regions (particularly the South West) the WPB expresses concern and suggests this should be further monitored.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Estimate for the Indian Ocean is 33,000 MT.
- **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 gears (average catches 2015-19)**: Offshore longline catches, including sharks and swordfish-targeted longlines, comprised more than 60% of total swordfish catches in the Indian Ocean in recent years. The remaining catches mainly came from coastal longline (~22%) and gillnets (~13%) (**Fig. 2**).
- **Main fleets (average catches 2015-19):** Over 63% of swordfish catches are accounted for by four fleets: Sri Lanka (longline-gillnet): ~25%; Taiwan,China (longline): ~21%; India (coastal longline):~9%; EU,Spain (swordfish-targeted longline): ~9%.

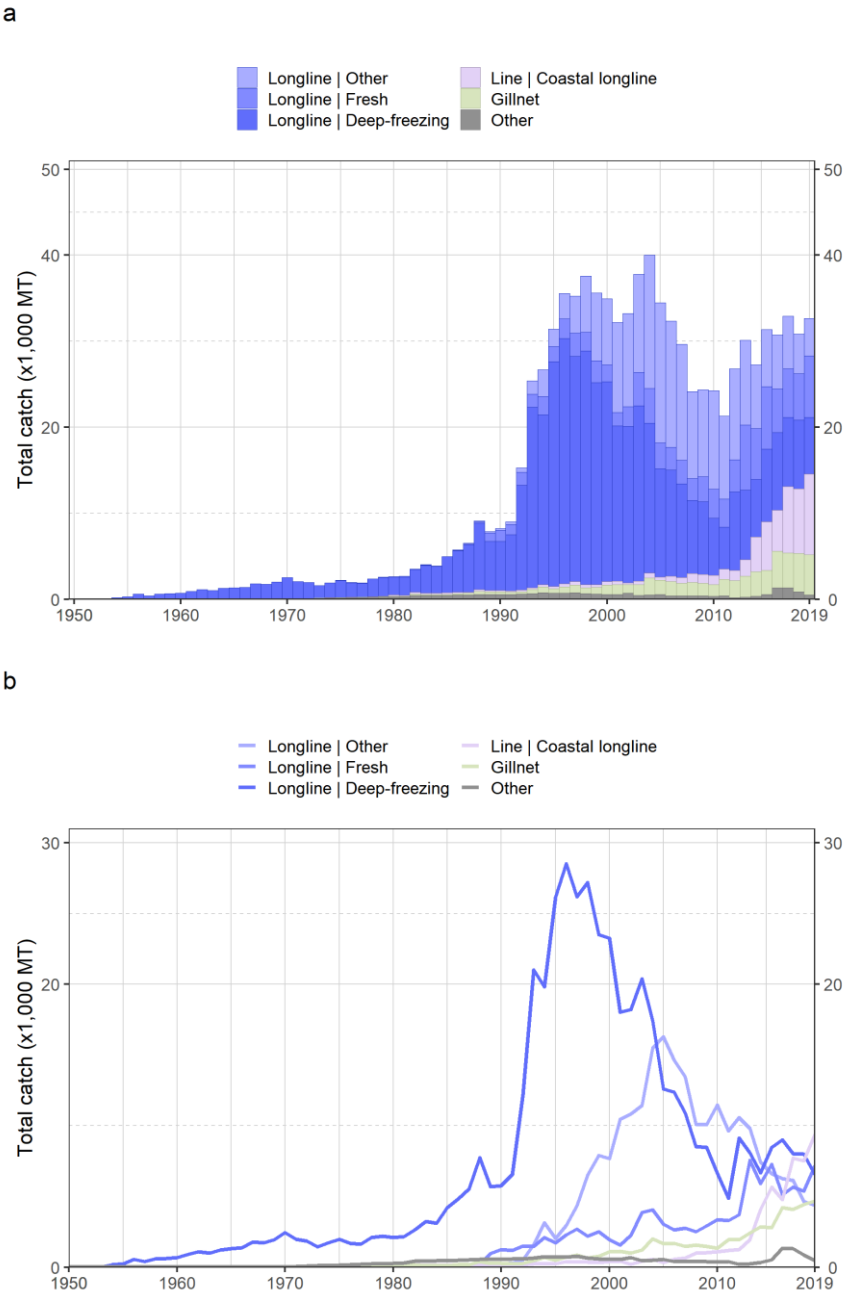


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for swordfish during 1950–2019. Longline|Other: Swordfish and sharks-targeting longlines; Longline|Fresh: fresh longline; Longline|Deep-freezing: deep-freezing longline; Line|Coastal longline: coastal longline; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining gears

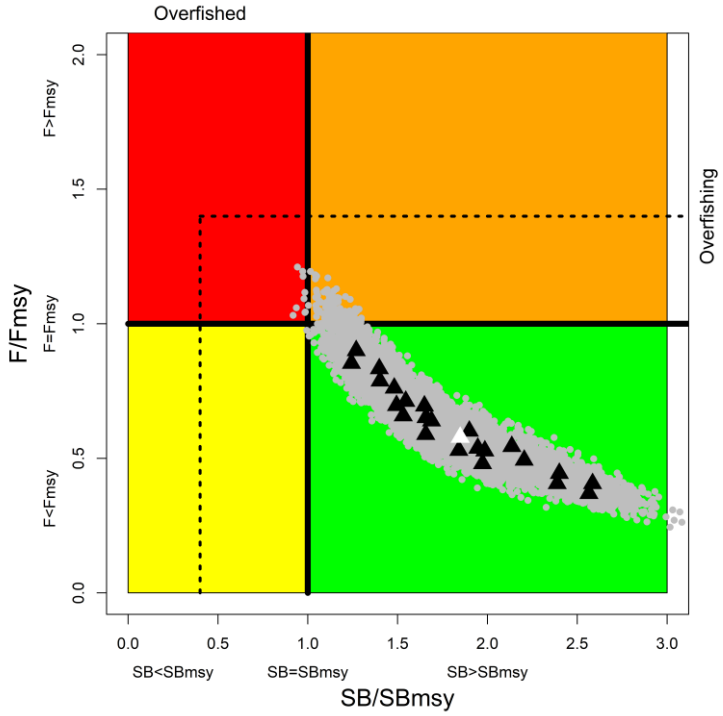


Fig. 2. Swordfish: current stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the final model grid. Triangles represent MPD estimates from individual models (white triangle represent the estimate from the basic model). Grey dots represent uncertainty from individual models. The dashed lines represent limit reference points for Indian Ocean swordfish (SB_{lim} = 0.4 SB_{MSY} and F_{lim} = 1.4*FMSY)

Table 2. Swordfish: SS3 aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of exceeding the MSY-based target reference points for five constant catch projections relative to 2018* catch level (30,847 t), 0%, ± 20%, ± 40%) projected for 10 years

Pr ($SB<SB_{MSY}$)

Catch	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
60%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100%	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02
120%	0.00	0.00	0.01	0.02	0.03	0.06	0.08	0.11	0.13	0.18
140%	0.00	0.01	0.01	0.04	0.10	0.17	0.25	0.32	0.40	0.47

Pr ($F>F_{MSY}$)

Catch	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
60%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100%	0.02	0.03	0.04	0.04	0.04	0.05	0.06	0.07	0.06	0.07
120%	0.10	0.13	0.18	0.21	0.26	0.30	0.32	0.35	0.38	0.42
140%	0.25	0.34	0.44	0.51	0.57	0.62	0.66	0.70	0.73	0.78

** 2018 catches, at the time of the last swordfish assessment conducted in 2020.*

APPENDIX 13
EXECUTIVE SUMMARY: BLACK MARLIN

Table 1. Status of black marlin (*Makaira indica*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination
Indian Ocean	Catch 2019 (MT)[2]	17,415	
	Average catch 2015–2019 (MT)	18,599	
	MSY (1,000 MT) (80% CI)	12.93 (9.44-18.20)	
	F_{MSY} (80% CI)	0.18 (0.11-0.30)	
	B_{MSY} (1,000 MT) (80% CI)	72.66 (45.52-119.47)	
	F_{2017}/F_{MSY} (80% CI)	0.96 (0.77-1.12)	
	B_{2017}/B_{MSY} (80% CI)	1.68 (1.32-2.10)	
	B_{2017}/B_0 (80% CI)	0.62 (0.49-0.78)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2019 catch fully or partially estimated by the IOTC Secretariat: 37%

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. No new stock assessment for black marlin was carried out in 2020, thus, the stock status is determined on the basis of the 2018 assessment based on JABBA and other indicators presented in 2019. This assessment suggests that the point estimate for the stock in 2017 is in the green zone in the Kobe plot with F/F_{MSY}=0.96 (0.77-1.12) and B/B_{MSY}=1.68 (1.32-2.10). The Kobe plot from the JABBA model indicated that the stock is not **subject to overfishing** and is currently not **overfished** (**Table 1**; **Fig. 2**), however these status estimates are subject to a high degree of uncertainty. The recent sharp increases in total catches (e.g., from 13,000 MT in 2012 to over 21,000 MT by 2016), and conflicts in information in CPUE and catch data lead to large uncertainties in the assessment outputs. This caused the point estimate of the stock status to change from the red to the green zones of the Kobe plot without any evidence of a rebuilding trend. **As such, the results of the assessment are uncertain and should be interpreted with caution.**

Outlook. While the recent high catches seem to be mainly due to developing coastal fisheries operating in the core habitat of the species, the CPUE indicators are from industrial fleets operating mostly offshore on the edges of the species distribution. However, the recent increases in catches are much higher than MSY and are a cause for concern and will likely continue to drive the population towards overfished status.

Management advice. Current catches (>17,400 MT in 2019) (**Fig. 1**) are higher than MSY estimate (12,930 MT), which is likely to associate with high uncertainty. The catch limits as stipulated in Resolution 18/05 have also been exceeded. The Commission should provide mechanisms to ensure that catch limits are not exceeded by all concerned fisheries. Projections were not carried out due to the poor predictive capabilities identified in the assessment diagnostics.

The following key points should be noted:

- **Maximum Sustainable Yield (MSY)**: Estimate for the whole Indian Ocean is 12,930 MT.
- **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 gears (average catches 2015-19)**: Black marlin are largely considered to be a non-target species of industrial and artisanal fisheries. Gillnets account for more than 50% of total catches in the Indian Ocean, followed by coastal longline, troll and handlines (32%), with remaining catches recorded under longlines (11%) (**Fig. 1**).
- **Main fleets (average catches 2015-19):** More than 75% of the total catches of black marlin are accounted for by three fleets: I.R. Iran (gillnet): 32%; India (gillnet and trolling): 24%; Sri Lanka (gillnet and fresh longline): 20%.

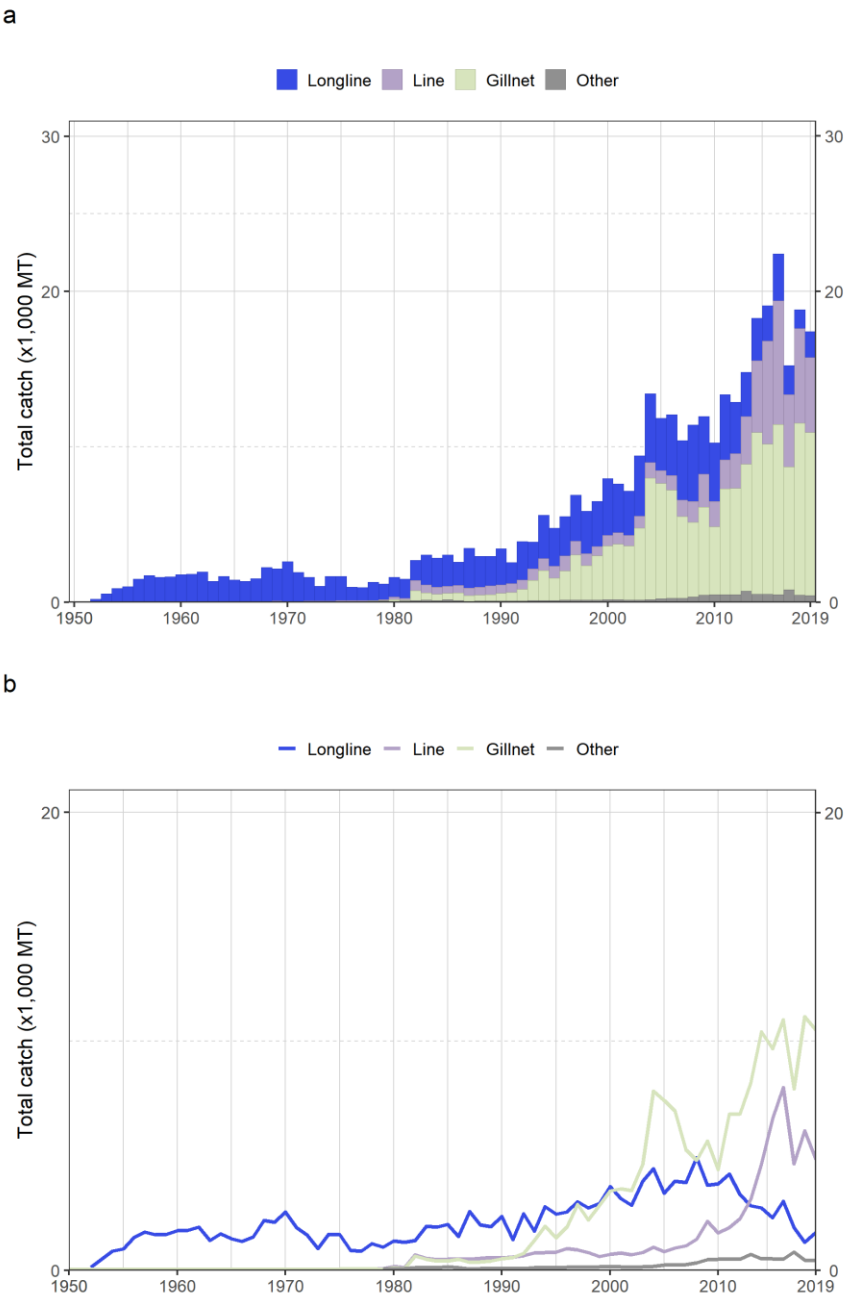


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for black marlin during 1950–2019. Longline: deep-freezing and fresh longlines, swordfish and sharks-targeted longlines; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining gears

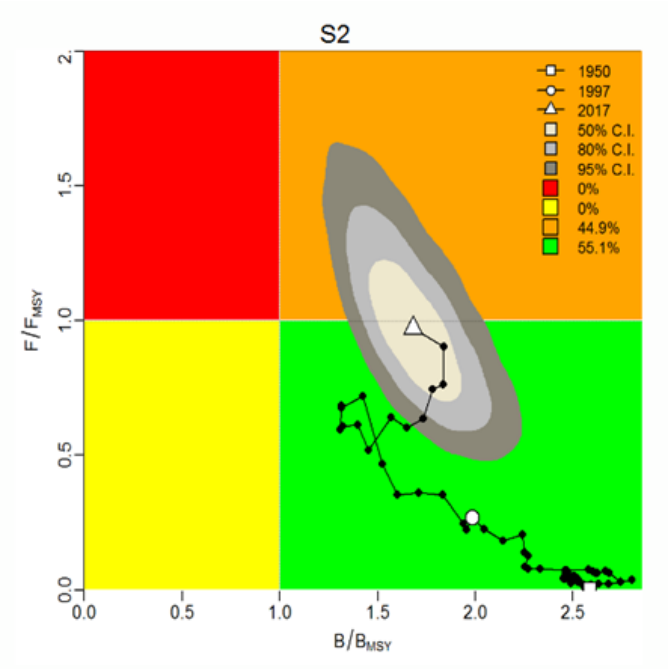


Fig. 2. Black marlin: JABBA Indian Ocean assessment Kobe plots for black marlin (contours are the 50, 80 and 95 percentiles of the 2017 estimate). Black line indicates the trajectory of the point estimates for the total biomass (B) ratio and fishing mortality (F) ratio for each year 1950–2017

APPENDIX 14
EXECUTIVE SUMMARY: BLUE MARLIN

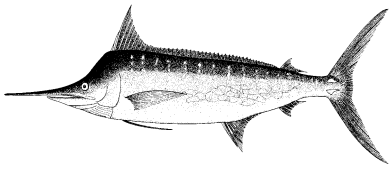


Table 1. Status of blue marlin (*Makaira nigricans*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination
Indian Ocean	Catch 2019[2] (MT) Average catch 2015-2019 (MT)	8,316 8,958	87%*
	MSY (1,000 MT) (80% CI) F_{MSY} (80% CI) B_{MSY} (1,000 MT) (80% CI) F_{2017}/F_{MSY} (80% CI) B_{2017}/B_{MSY} (80% CI) B_{2017}/B_0 (80% CI)	9.98 (8.18 –11.86) 0.21 (0.13 – 0.35) 47 (29.9 – 75.3) 1.47 (0.96 – 2.35) 0.82 (0.56 – 1.15) 0.41 (0.28 – 0.57)	

[1] Boundaries for the Indian Ocean are defined as the IOTC area of competence
[2] Proportion of 2019 catch estimated or partially estimated by IOTC Secretariat: 26%
* 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)	87%	10%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	0%	3%
Not assessed/Uncertain		

The percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. Stock status based on the Bayesian State-Space Surplus Production model JABBA suggests that there is an 87% probability that the Indian Ocean blue marlin stock in 2017 is in the red zone of the Kobe plot, indicating the stock is **overfished** and **subject to overfishing (**B_{2017}/B_{MSY}=0.82 and F_{2017}/F_{MSY}=1.47) as shown in **Table 1** and **Fig. 2**. The most recent catch is lower than the estimate of MSY ($Catch_{2019}$ = 8,316 MT; MSY = 9,984 MT). The previous assessment of blue marlin (Andrade 2016) concluded that in 2015 the stock was subject to overfishing but not overfished. The change in stock status can be attributed to increased catches for the period 2015-2017 as well as improved standardisation of CPUE indices, which includes the area disaggregation of JPN and TWN indices to account for fleet dynamics.

Outlook. The B_{2017}/B_{MSY} trajectory declined from the mid-1980s to 2008 and a steady increase of F/F_{MSY} since the mid-1980s has continued unabated. Periodic data conflict between the CPUE indices included in the assessment, particularly JPN and TWN, inflate uncertainty in B_{2017}/B_{MSY} and F_{2017}/F_{MSY} point estimates. However, a 'drop one' sensitivity analysis indicated that omitting any of the CPUE time-series would not alter the stock status.

Management advice. The current catches of blue marlin (average of 8,958 MT in the last 5 years, 2015-2019) are lower than MSY (9,984 MT). The assessment conducted in 2017 indicated that the stock was overfished and subject to overfishing. In order to achieve the Commission objectives of being in the green zone of the Kobe Plot by 2027

($F_{2027} < F_{MSY}$ and $B_{2027} > B_{MSY}$) with at least a 60% chance, the catches of blue marlin would have to be reduced by 35% compared to the average of the last 3 years, to a maximum value of approximately 7,800 MT.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the Indian Ocean blue marlin stock is 9,980 MT (estimated range 8,180–11,860 MT).
- **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 2015-19)**: Blue marlin are largely considered to be a non-target species of industrial and artisanal fisheries. Longline catches account for around 68% of total catches in the Indian Ocean, followed by gillnets (15%), with remaining catches recorded under coastal longline, troll and handlines (**Fig. 1**).
- **Main fleets (average catches 2015-19):** Around 70% of the total catches of blue marlin are accounted for by three fleets: Taiwan,China (longline): 43%; Sri Lanka (gillnet, hook and line and longline): 21% and Indonesia (longline and hook-and-line): 7%.

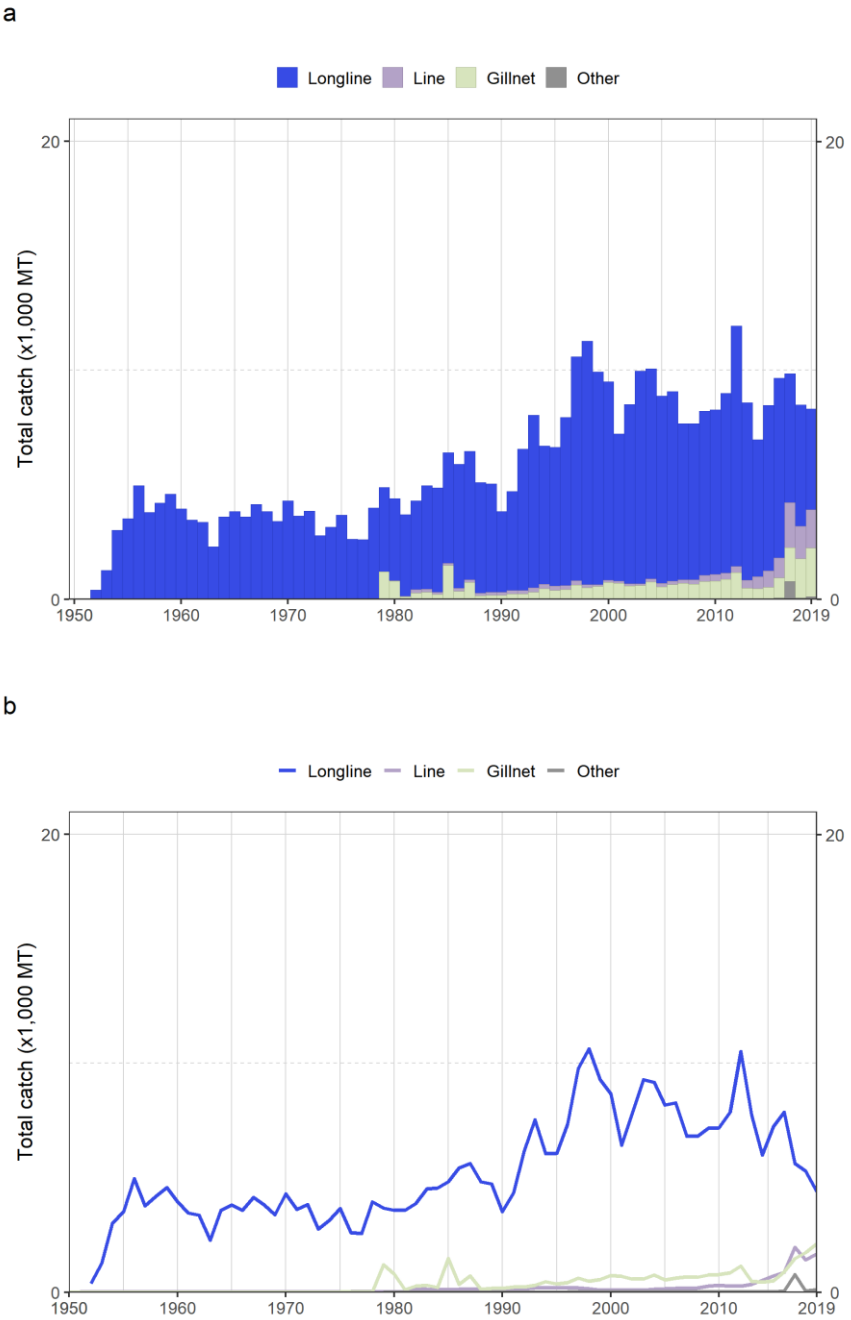


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for blue marlin during 1950–2019. Longline: deep-freezing and fresh longlines, swordfish and sharks-targeted longlines; Line: coastal longline, handline, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining gears

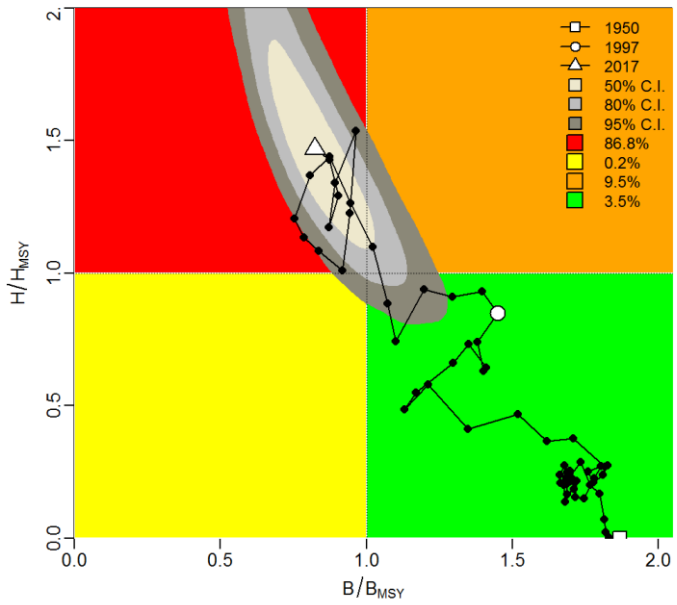


Fig. 2. Kobe stock status plot for the Indian Ocean stock of blue marlin, from the final JABBA base case (the black line traces the trajectory of the stock over time. Contours represent the smoothed probability distribution for 2018 (isopleths are probability relative to the maximum)

Table 2. Blue Marlin: Indian Ocean JABBA Kobe II Strategy Matrix. Probability (percentage) of achieving the green quadrant of the KOBE plot nine constant catch projections, with future catch assuming to be 30–110% (in increments of 10%) of the 2017 catch level (12,029 MT)

TAC | Year	2019	2020	2021	2022	2023	2024	2025	2026	2027
30% (3609)	20	39	58	71	81	87	91	93	95
40% (4812)	20	36	51	63	72	79	83	87	90
50% (6014)	21	33	44	54	62	68	73	77	81
60% (7217)	20	29	38	45	51	56	60	64	67
70% (8420)	20	26	32	37	41	45	47	50	52
80% (9623)	20	23	26	28	30	31	33	34	35
90% (10826)	17	18	19	19	20	20	20	20	20
100% (12029)	11	11	11	10	10	10	10	9	9
110% (13232)	7	6	6	6	5	5	4	4	4

APPENDIX 15
EXECUTIVE SUMMARY: STRIPED MARLIN

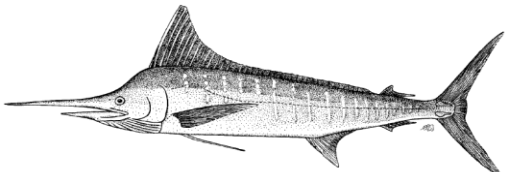


Table 1. Status of striped marlin (*Tetrapturus audax*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination
Indian Ocean	Catch 2019[2] (MT)	2,860	99.8%*
	Average catch 2015-2019 (MT)	3,455	
	MSY (1,000 MT) (JABBA)	4.73 (4.27–5.18)[3]	
	F_{MSY} (JABBA)	0.26 (0.20–0.34)	
	B_{MSY} (1,000 MT) (JABBA)	17.94 (14.21–23.13)	
	F_{2017}/F_{MSY} (JABBA)	1.99 (1.21–3.62)	
	B_{2017}/B_{MSY} (JABBA)	0.33 (0.18–0.54)	
	SB_{2017}/SB_{MSY} (SS3)[4]	0.373	
	B_{2017}/K(JABBA)	0.12 (0.07–0.20)	
	SB_{2017}/SB_{1950} (SS3)	0.13 (0.09–0.14)	

[1] Boundaries for the Indian Ocean are defined as IOTC area of competence
[2] Proportion of 2019 catch estimated or partially estimated by IOTC Secretariat: 19%
[3] JABBA estimates are the range of central values shown in Fig. 2
[4] SS3 is the only model that used SB/SB_{MSY}, all others used B/B_{MSY}
* 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)	99.8%	0.0%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	0.2%	0.0%
Not assessed/Uncertain		

The percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment for striped marlin was carried out in 2020, thus, the stock status is determined on the basis of the 2018 assessment and other indicators presented in 2019. In 2018 a stock assessment was conducted based on two different models: JABBA, a Bayesian state-space production model; and SS3, an integrated length-based model. Both models were very consistent and confirmed the results from 2012, 2013, 2015 and 2017 assessments, indicating that the stock is subject to overfishing ($F>F_{MSY}$) and overfished, with the biomass for at least the past ten years below the level which would produce MSY ($B<B_{MSY}$). On the weight-of-evidence available in 2018, the stock status of striped marlin is determined to be ***overfished*** and ***subject to overfishing*** (**Table 1**; **Fig. 2**).

Outlook. The decrease in longline catches and fishing effort in the years 2009–11 reduced the pressure on the Indian Ocean stock. However, given the increase in catches reported since 2011 (mostly from coastal fisheries), combined with the results obtained from the last stock assessments conducted in 2012, 2013, 2015, 2017 and 2018, the outlook is pessimistic. As requested by IOTC Resolution 18/05, K2SM probabilities are provided with options to reduce fishing mortality with a view to recover the stocks to the green zone of the Kobe Plot with levels of probability ranging from 60% to 90% by 2026 at latest (**Table 2**).

Management advice. Current or increasing catches have a very high risk of further decline in the stock status. Current catches of 2,860 t (2019) (**Fig. 1**) are lower than MSY (4,730 MT) but the stock has been overfished for more than two decades and is now in a highly depleted state. If the Commission wishes to recover the stock to the green quadrant of the Kobe plot with a probability ranging from 60% to 90% by 2026, it needs to provide mechanisms to ensure the maximum annual catches remain between 1,500 MT – 2,200 MT (**Table 2**).

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: estimates for the Indian Ocean stock are highly uncertain and estimates range between 4,270 MT – 5,180 MT. 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.
- **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 gears (average catches 2015-19)**: Striped marlin is largely considered to be a non-target species of industrial fisheries. Gillnets account for ~47% of total catches in the Indian Ocean, followed by longlines (~43%). The remaining catches are mostly recorded under coastal longline (**Fig. 1**).
- **Main fleets (average catches 2015-19):** Around 75% of the total catches of striped marlin are accounted for by four fleets: I.R. Iran (gillnet): 26%; Pakistan (gillnet): 18%; Taiwan,China (longline): 17% and Indonesia (coastal and offshore longline): 16%.

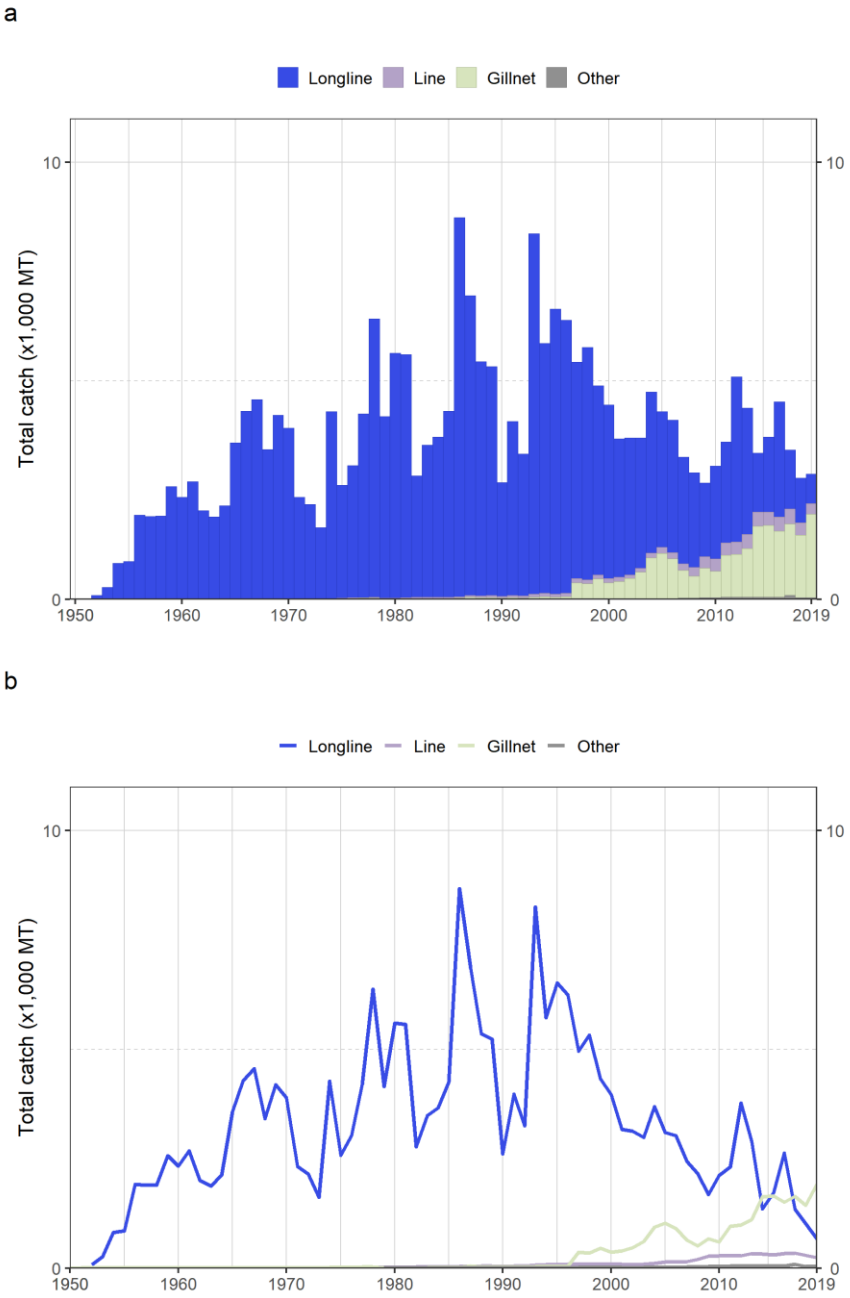


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for striped marlin during 1950–2019. Longline: deep-freezing and fresh longlines, swordfish and sharks-targeted longlines; Line: coastal longline, handline, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining gears

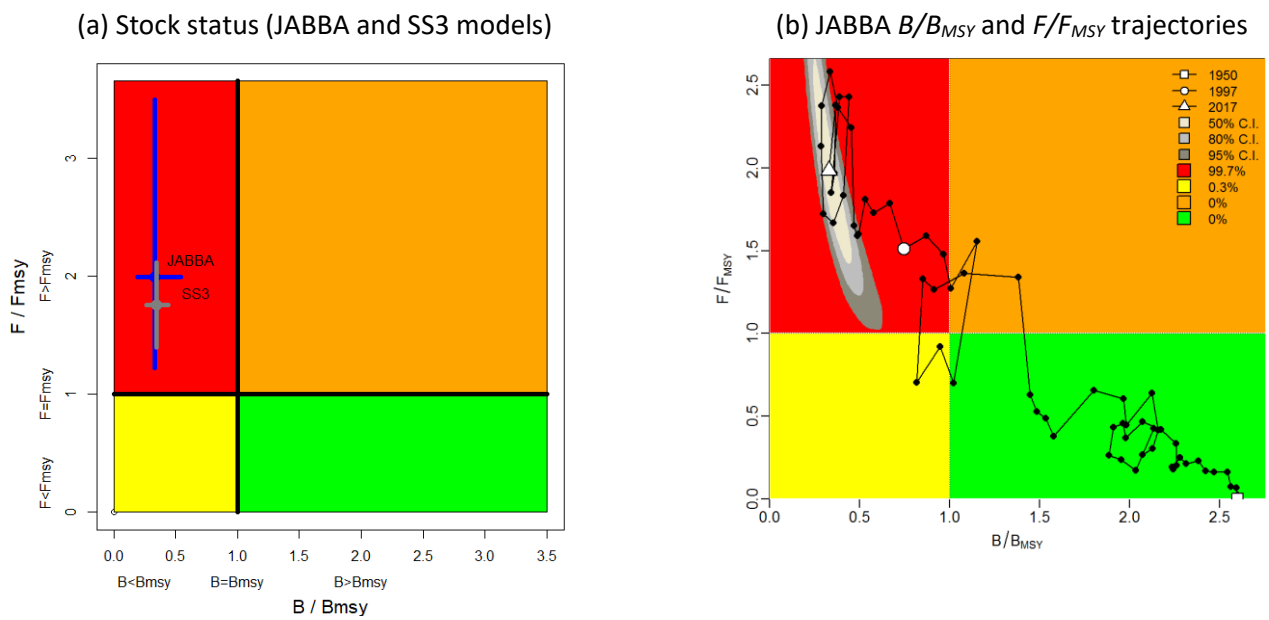


Fig. 2. (a) Striped marlin: Stock status from the Indian Ocean assessment JABBA (Bayesian State Space Surplus Production Model) and SS3 models with the confidence intervals (left); (b) Trajectories (1950-2017) of *B/B_{MSY} and F/F_{MSY}* from the JABBA model. NB: SS3 refers to SB/SB_{MSY} while the JABBA model's output refers to B/B_{MSY}

Table 2. Striped marlin: JABBA Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based target reference points for nine constant catch projections relative to the average 2015-2017 catch level (3,512 MT)*, ± 10%, ± 20%, ± 30% ± 40%) projected for 3 and 10 years. Figures between brackets indicate catch levels

Reference point and projection timeframe	**Alternative catch projections (relative to the average catch level from 2015-2017* (3,512 MT)) and probability (%) of exceeding MSY-based target reference points (Btarg = B_{MSY}; Ftarg = F_{MSY})**								
	60% (2,107)	**70%** (2,459)	**80%** (2,810)	**90%** (3,161)	**100%** (3,512)	**110%** (3,864)	**120%** (4,215)	**130%** (4,566)	**140%** (4,917)
$B_{2020} < B_{MSY}$	99	100	100	100	100	100	100	100	100
$F_{2020} > F_{MSY}$	48	70	87	95	99	100	100	100	100
$B_{2027} < B_{MSY}$	25	43	64	81	92	97	99	100	100
$F_{2027} > F_{MSY}$	9	21	40	63	83	94	99	100	100

** 2015-2017 average catches, based on low catch scenario (IOTC-2018-WPB16-DATA03b).*

Table 3. Striped marlin: Probability (percentage) of achieving the KOBE green quadrat from 2018-2027 for a range of constant catch projections (JABBA)

TAC | Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1500	0	0	2	11	29	51	70	83	90	94
1600	0	0	2	10	25	47	66	79	87	92
1700	0	0	2	8	23	42	61	75	84	90
1800	0	0	1	7	20	38	56	71	81	87
1900	0	0	1	6	17	34	52	66	77	84
2000	0	0	1	5	15	30	48	62	73	80
2100	0	0	1	4	13	26	42	56	68	76
2200	0	0	1	4	11	23	38	52	62	71
2300	0	0	1	3	9	20	33	46	57	66
2400	0	0	1	3	8	17	29	41	52	61
2500	0	0	1	3	7	15	25	36	47	55

APPENDIX 16
EXECUTIVE SUMMARY: INDO-PACIFIC SAILFISH

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

Area[1]	Indicators		2020 stock status determination
Indian Ocean	Catch 2019[2] (MT)	29,872	
	Average catch 2015-2019 (MT)	30,306	
	MSY (1,000 MT) (80% CI)	23.9 (16.1 – 35.4)	
	F_{MSY} (80% CI)	0.19 (0.14 - 0.24)	
	B_{MSY} (1,000 MT) (80% CI)	129 (81–206)	
	F_{2017}/F_{MSY} (80% CI)	1.22 (1 – 2.22)	
	B_{2017}/B_{MSY} (80% CI)	1.14 (0.63 – 1.39)	
	B_{2017}/B_0 (80% CI)	0.57 (0.31 – 0.70)	

[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 2018: 26%

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)	17%	60%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	5%	16%
Not assessed/Uncertain		

The percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment for Indo-Pacific sailfish was carried out in 2020, thus, the stock status is determined on the basis of the 2019 assessment using the C-MSY model. The data poor stock assessment techniques indicated that F was above F_{MSY} (F/F_{MSY}=1.22) and B is above B_{MSY} (B/B_{MSY}=1.14). Another alternative model using the Stock Reduction Analysis (SRA) techniques produced similar results. The stock appears to show a continued increase in catches which is a cause of concern (**Fig. 1**), indicating that fishing mortality levels may be becoming too high (**Fig. 2**). However, both assessment models rely on catch data only, and the catch series is highly uncertain. In addition, 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 also a cause for concern. On the weight-of-evidence available in 2019, the stock status cannot be assessed and is determined to be uncertain.

Outlook. Catches since 2009 have exceeded the estimated MSY, and have also increased by 58% between 2008 and 2017. This increase in coastal gillnet catches and fishing 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. It is also noted that 2019 catches (29,872 MT) exceed the catch limit prescribed in Resolution 18/05 (25,000 MT).

Management advice. The catch limits as stipulated in Resolution 18/05 have been exceeded. The Commission should provide mechanisms to ensure that catch limits are not exceeded by all concerned fisheries. 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.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY):** Estimate for the Indian Ocean stock is 23,900 MT.
- **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 Indo-Pacific sailfish.
- **Main fishing gear (average catches 2015-19)**: Gillnets account for around 70% of total catches in the Indian Ocean, followed by lines (coastal longline, troll and hand lines) (24%), with remaining catches recorded under longlines and other gears (**Fig. 1**).
- **Main fleets (average catches 2015-19):** If we exclude the Republic of Tanzania (whose catch data have been repeated in recent years by the Secretariat, due to the lack of explicit reporting from the country), then three quarters of the total catches of Indo-Pacific sailfish are accounted for by four countries situated in the Arabian Sea: I.R. Iran (gillnets): 34%; India (gillnets and trolling): 26%; Pakistan (gillnets): 8%; and Sri Lanka (gillnets and fresh longline): 8%.

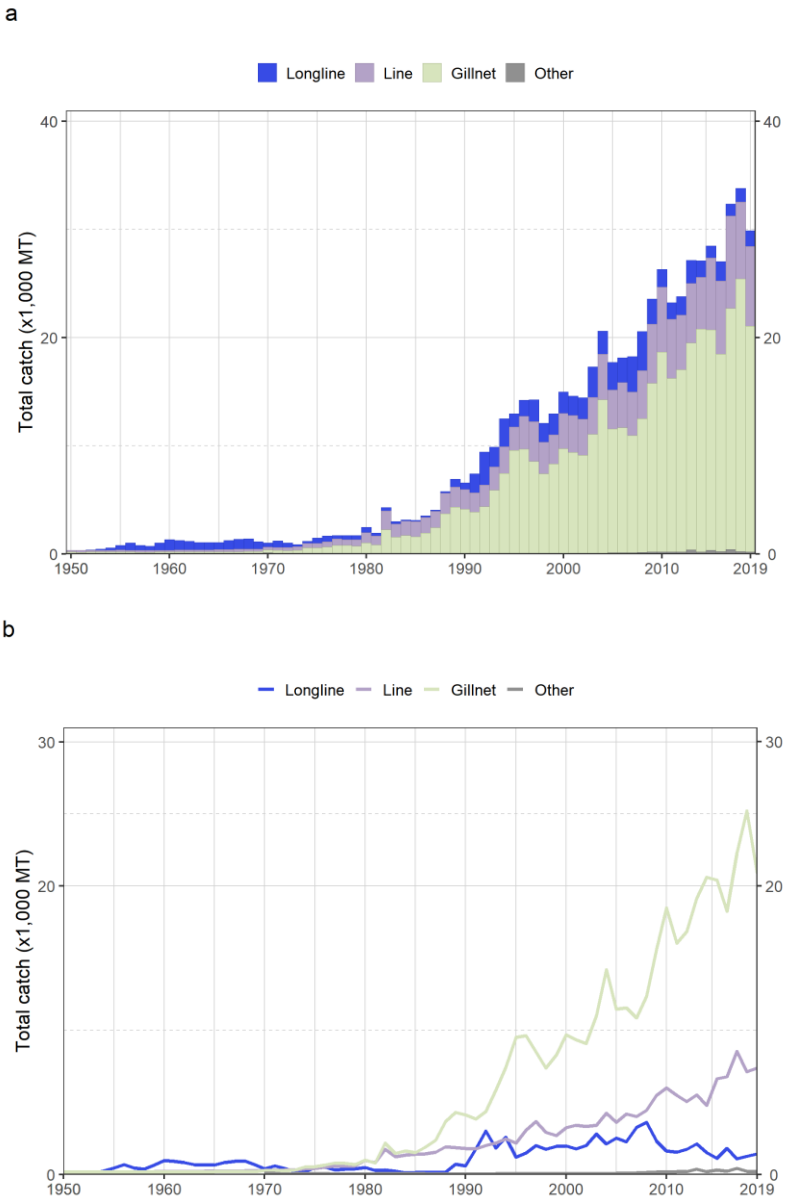


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for Indo-Pacific sailfish during 1950–2019. Longline: deep-freezing and fresh longlines, swordfish and sharks-targeted longlines; Line: coastal longline, handline, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining gears

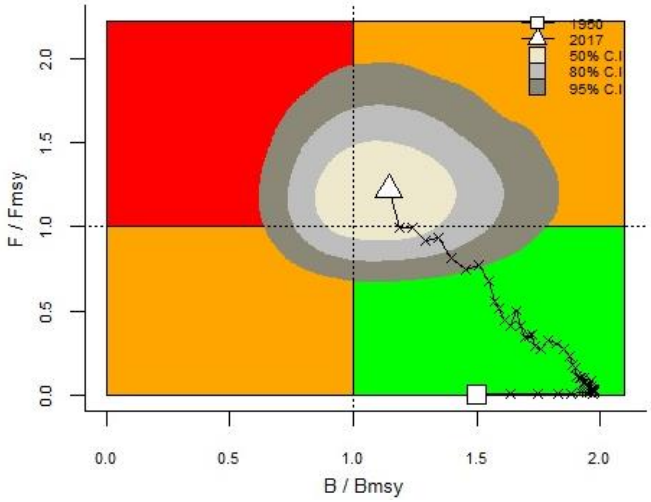


Fig. 2. Indo-Pacific sailfish: Stock reduction analysis (C-MSY Method) of aggregated Indian Ocean assessment Kobe plot (contours are the 50, 65 and 90 percentiles of the 2017 estimate). Black lines indicate the trajectory of the point estimates (blue circles) for the biomass (B) ratio and fishing mortality (F) ratio for each year 1950–2017

APPENDIX 17
EXECUTIVE SUMMARY: BULLET TUNA

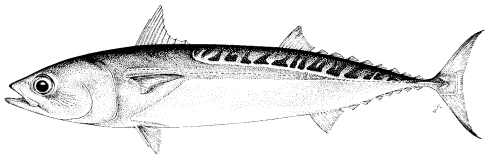


Table 1. Status of bullet tuna (*Auxis rochei*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination
Indian Ocean	Catch 2019[2] (MT)	22,245	
	Average catch 2015–2019 (MT)	18,878	
	MSY (MT) (80% CI)	unknown	
	F_{MSY} (80% CI)	unknown	
	B_{MSY} (MT) (80% CI)	unknown	
	$F_{current}/F_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_0$ (80% CI)	unknown	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2019 catch estimated or partially estimated by the IOTC Secretariat: 23%

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 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. Until recently annual catches for bullet tuna have fluctuated but remained around 9,000 t. However, catches in 2018 increased from around 16,000 MT to 31,000 MT – mostly due to an increase in catches reported by Indonesia purse seine fisheries (**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 should be focused 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.).

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 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 MT). 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, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Research emphasis should be focused 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.).
- 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 2019 catches (reference year 2018), 10% 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 to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2015-19)**: bullet tuna is mainly caught using purse seine (~48%), handlines and trolling (~26%), and gillnets (~17%) (**Fig. 1**).
- **Main fleets (average catches 2015-19)**: Catches are highly concentrated: in recent years over 90% of catches in the Indian Ocean have been accounted for by fisheries in India, Indonesia, Thailand and Sri Lanka.

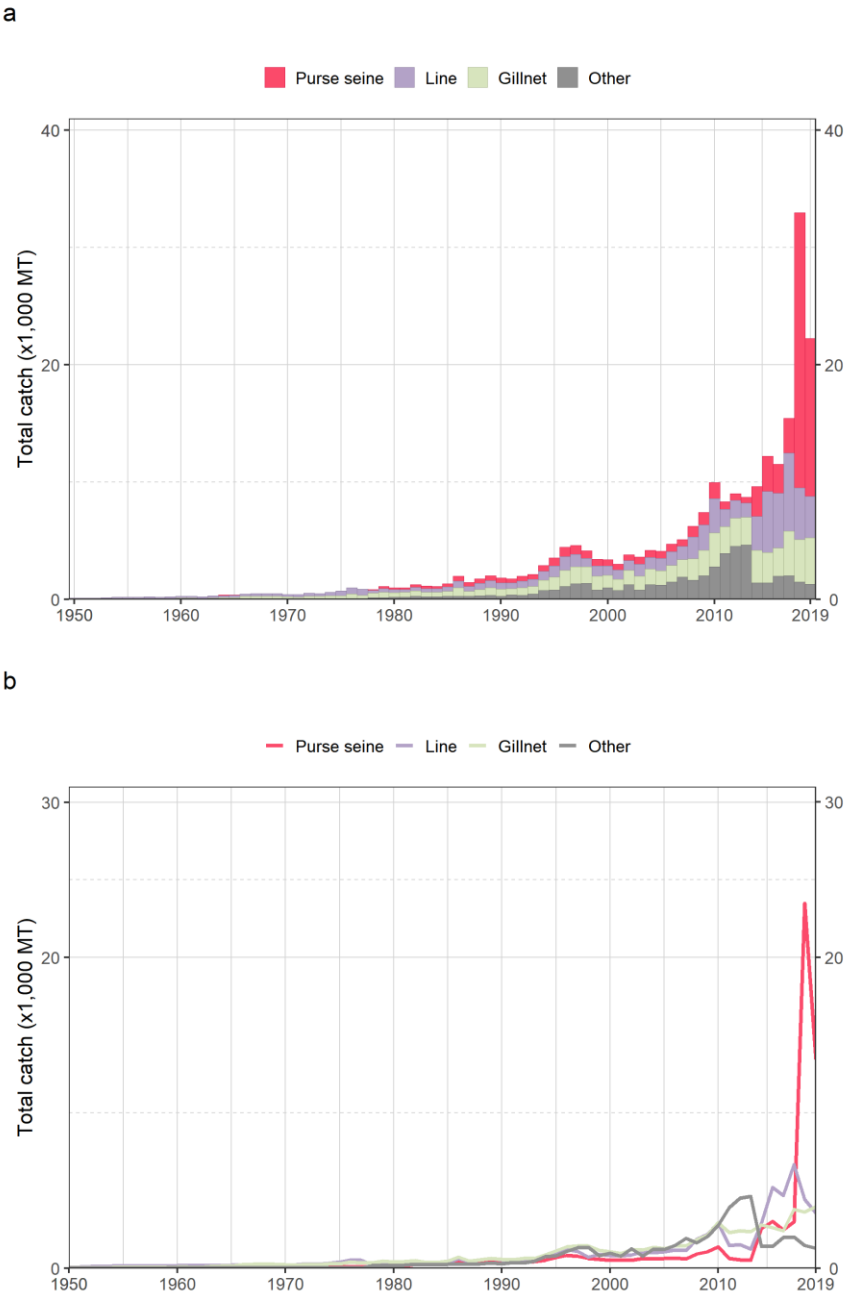


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for bullet tuna during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining fishing gears

APPENDIX 18
EXECUTIVE SUMMARY: FRIGATE TUNA

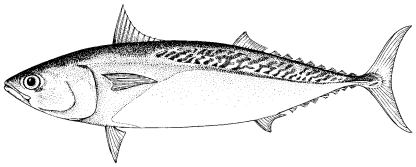


Table 1. Status of frigate tuna (*Auxis thazard*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination
Indian Ocean	Catch 2019[2] (MT)	84,738	
	Average catch 2015–2019 (MT)	93,846	
	MSY (MT) (80% CI)	unknown	
	F_{MSY} (80% CI)	unknown	
	B_{MSY} (MT) (80% CI)	unknown	
	$F_{current}/F_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_0$ (80% CI)	unknown	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2019 catch estimated or partially estimated by IOTC Secretariat: 64%

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. Estimated catches have increased steadily since the late-1970s, reaching around 30,000 MT in the late-1980's, to between 51,000 and 58,000 MT by the mid-1990s, and steadily increasing to over 90,000 t in the following ten years. Between 2010 and 2014 catches have increased to over 105,000 MT, rising to the highest levels recorded; although catches have since decline marginally to between 92,000 – 102,000 MT since 2014. 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 should be focused 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.).

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 MT). 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 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 should be focused 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.).
- 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 2019 catches (reference year 2018), 65% 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 to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2015-19)**: frigate tuna is mainly caught using gillnets (~41%), coastal longline and trolling, handlines and trolling (~33%), and to a lesser extent coastal purse seine nets. The species is also a bycatch for industrial purse seine vessels and the target of some ring net fisheries.
- **Main fleets (average catches 2015–19)**: Catches of frigate tuna are highly concentrated: Indonesia accounts for around 60% of the catches, while over 90% of catches are accounted for by four countries (Indonesia, Pakistan, I.R. Iran and India).

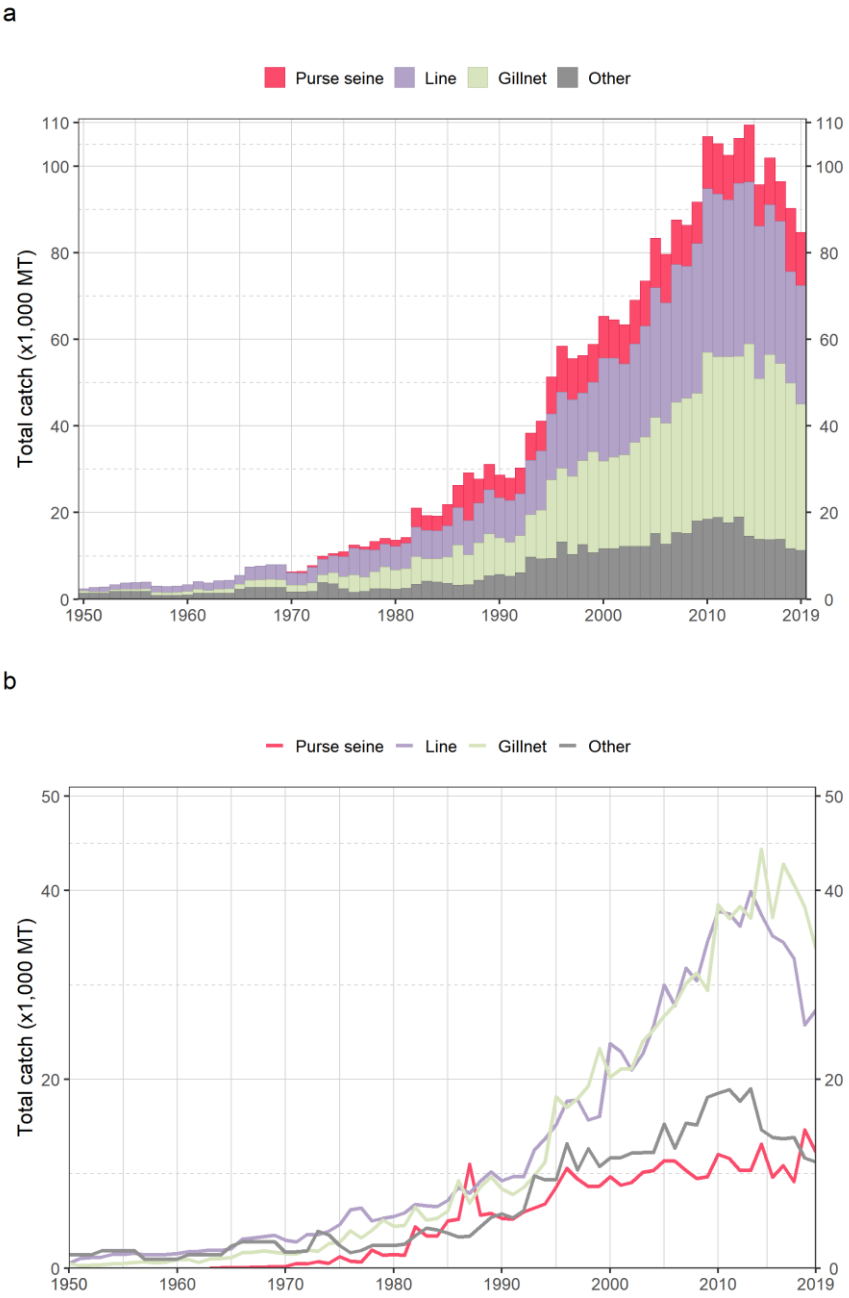


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for frigate tuna during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining fishing gears

APPENDIX 19
EXECUTIVE SUMMARY: KAWAKAWA

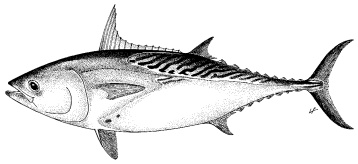


Table 1. Status of kawakawa (*Euthynnus affinis*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination[3]
Indian Ocean	Catch 2019[2] (MT) Average catch 2015-2019 (MT)	128,042 148,084	**50%**
	MSY (MT) (80% CI) F_{MSY} (80% CI) B_{MSY} (MT) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	148,825 (124,114 – 222,505) 0.44 (0.21–0.82) 355,670 (192,080 – 764,530) 0.98 (0.85–1.11) 1.13 (0.75–1.58)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2019 catch estimated or partially estimated by IOTC Secretariat: 41%
[3] The stock status refers to the most recent years' data used in the assessment conducted in 2020. i.e. 2018

Colour key	Stock overfished ($SB_{year}/SB_{MSY}< 1$)	Stock not overfished ($SB_{year}/SB_{MSY}\geq 1$)
Stock subject to overfishing ($F_{year}/F_{MSY}> 1$)	35%	15%
Stock not subject to overfishing ($F_{year}/F_{MSY}\leq 1$)	0%	50%
Not assessed/Uncertain		

The percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new stock assessment was carried out in 2020 using data-limited assessment techniques. The OCOM model indicated that F was just F_{MSY} (F/F_{MSY}=0.98) and B above B_{MSY} (B/B_{MSY}=1.13). The estimated probability of the stock currently being in green quadrant of the Kobe plot is about 50%. Due to the quality of the data being used, the simple modelling approach employed in 2020, and the large increase in kawakawa catches over the last decade (Fig. 1), measures need to be taken in order to reduce the level of catches which have surpassed the estimated MSY levels for all years since 2011 – despite the decrease in catches from their peak 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., 33% of catches partially or fully estimated by the IOTC Secretariat in 2018) 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. Continued increase in the annual catches for kawakawa is also likely to further increase the pressure on the Indian Ocean stock. Research emphasis should be focused 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.). However, it should be noted that catches have since declined from 168,174 MT (2013) to 159,121 MT (2017).

Management Advice. However, the assessment models rely on catch data, which is considered to be highly uncertain. The catch in 2018 was above the estimated MSY. The available gillnet CPUE of kawakawa showed a somewhat increasing trend although the reliability of the index as abundance indices remains unknown. Despite the substantial uncertainties, the stock is probably very close to being fished at MSY levels and that higher catches may not be sustained in the longer term. A precautionary approach to management is recommended.

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean is estimated to be 148,825 MT with a range between 124,114 and 222,505 MT 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, 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 should be focused 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.).
- 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 33% of the catches (in 2019, with reference year 2018), which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2015–19)**: kawakawa are caught mainly by gillnets (~50%), purse seiners (including coastal ones, ~28%) and handlines and trolling (~13%) (**Fig. 1**).
- **Main fleets (average catches 2015–19)**: Catches are highly concentrated: Indonesia, India, and I.R. Iran account for ~75% of catches in recent years.

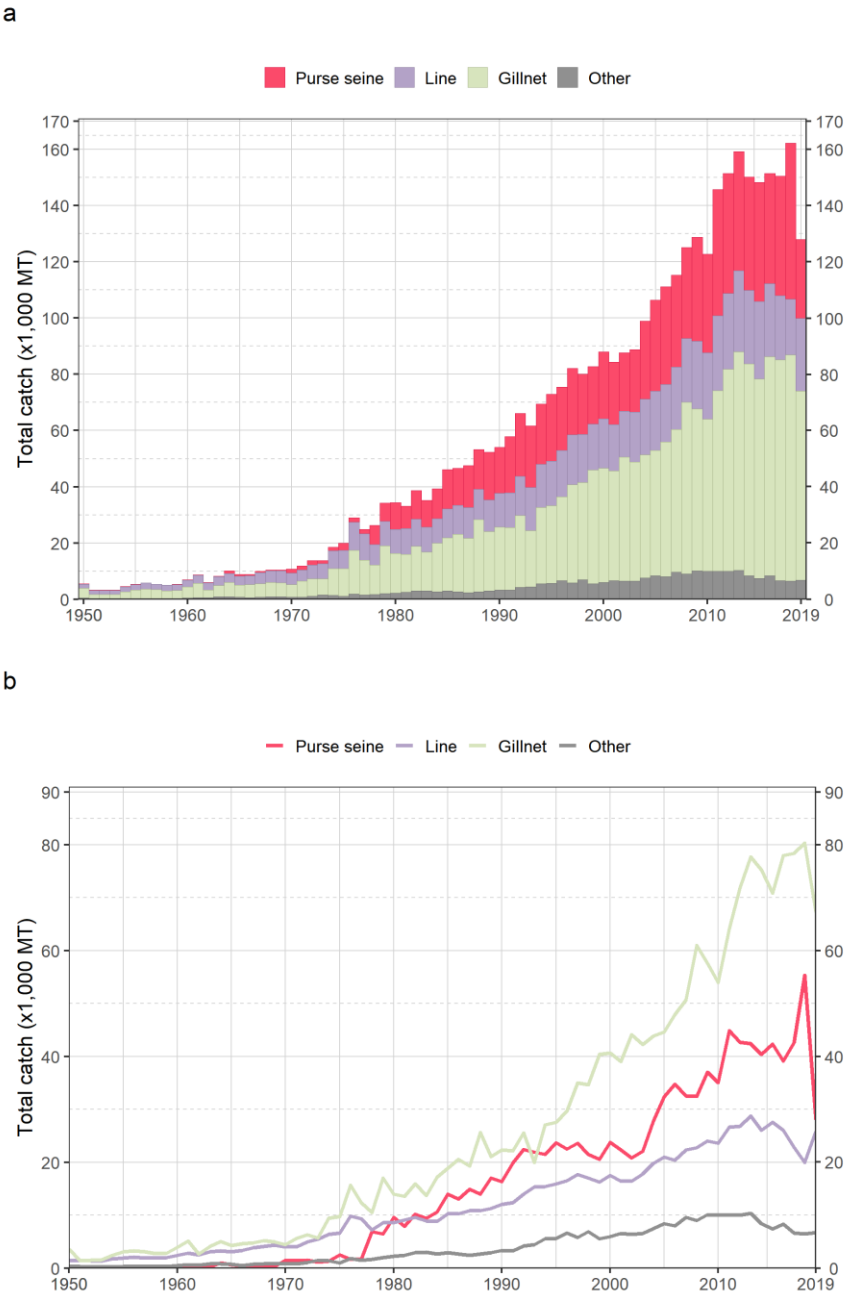


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for kawakawa during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining fishing gears

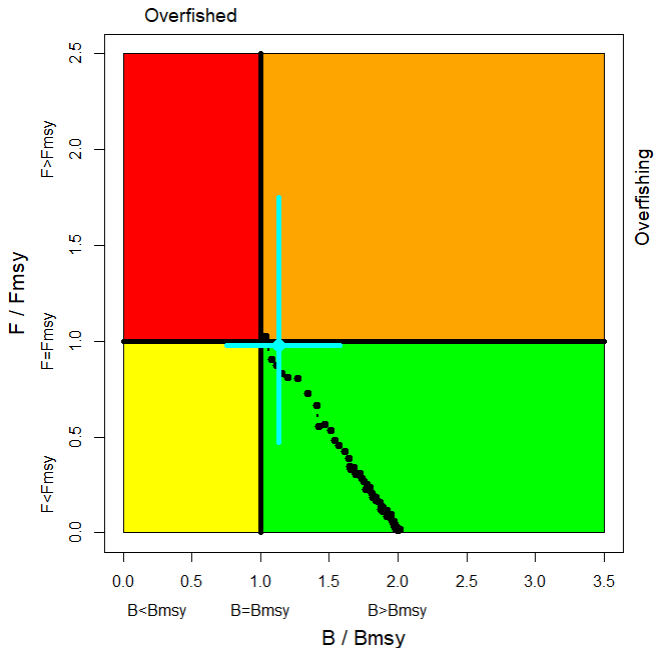


Fig. 2. OCOM Indian Ocean assessment Kobe plot for kawakawa. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018 (median and 80% confidence interval).

APPENDIX 20
EXECUTIVE SUMMARY: LONGTAIL TUNA

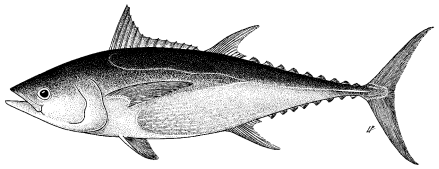


Table 1. Status of longtail tuna (*Thunnus tonggol*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination
Indian Ocean	Catch 2019[2] (MT) Average catch 2015–2019 (MT)	107,088 133,872	76%
	MSY (MT) (80% CI) F_{MSY} (80% CI) B_{MSY} (MT) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	128,750 (99,902 – 151,357) 0.32 (0.15 – 0.66) 395,460 (129,240 – 751,316) 1.52 (0.751 – 2.87) 0.69 (0.45 – 1.21)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2019 catches estimated or partially estimated by IOTC Secretariat: 26%

Colour key	Stock overfished ($SB_{year}/SB_{MSY}< 1$)	Stock not overfished ($SB_{year}/SB_{MSY}\geq 1$)
Stock subject to overfishing ($F_{year}/F_{MSY}> 1$)	76%	2%
Stock not subject to overfishing ($F_{year}/F_{MSY}\leq 1$)	2%	20%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new assessment was carried out in 2020 using the Optimised Catch-Only Method (OCOM). Analysis using the OCOM indicates that the stock is being exploited at a rate that exceeded F_{MSY} in recent years and that the stock appears to be below B_{MSY} and above F_{MSY} (76% of plausible models runs) (**Fig. 2**). Catches were above MSY between 2010 and 2014, however since 2015 catches have marginally decreased (**Fig. 1**) and were below estimated MSY in 2018. The F_{2018}/F_{MSY} ratio is slightly higher than previous estimates. The estimate of the B_{2018}/B_{MSY} ratio (0.94) was slightly lower than in previous years, reflecting declining abundance. An assessment using a biomass dynamic model incorporating Gillnet CPUE indices was also undertaken in 2020 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 the total catches of longtail tuna 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 should be focused 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.).

Management advice. The catch in 2018 was just below the estimated MSY but the exploitation rate has been increasing over the last few years, as a result of the declining abundance. Despite the substantial uncertainties, this suggests that the stock is very close to being fished at MSY levels and that higher catches may not be sustained. A precautionary approach to management is recommended.

The following should be also noted:

- The Maximum Sustainable Yield estimate of around 146,000 MT was exceeded between 2011 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, 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 should be focused on collating catch per unit effort (CPUE) time series for the main fleets (I.R. Iran, Indonesia, Pakistan, Oman and India), size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).
- 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 2019 catches (reference year 2018) 28% 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 to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2015–19)**: Longtail tuna are caught mainly using gillnets (~73% of catches) and, to a lesser extent, coastal purse seine nets (~7%) and handline and trolling (~10%) (**Fig. 1**).
- **Main fleets (average catches 2015–19)**: 43% of the catches of longtail in the Indian Ocean are accounted for by I.R. Iran, followed by Indonesia (~18%), Oman (~12%) and Pakistan (~12%).

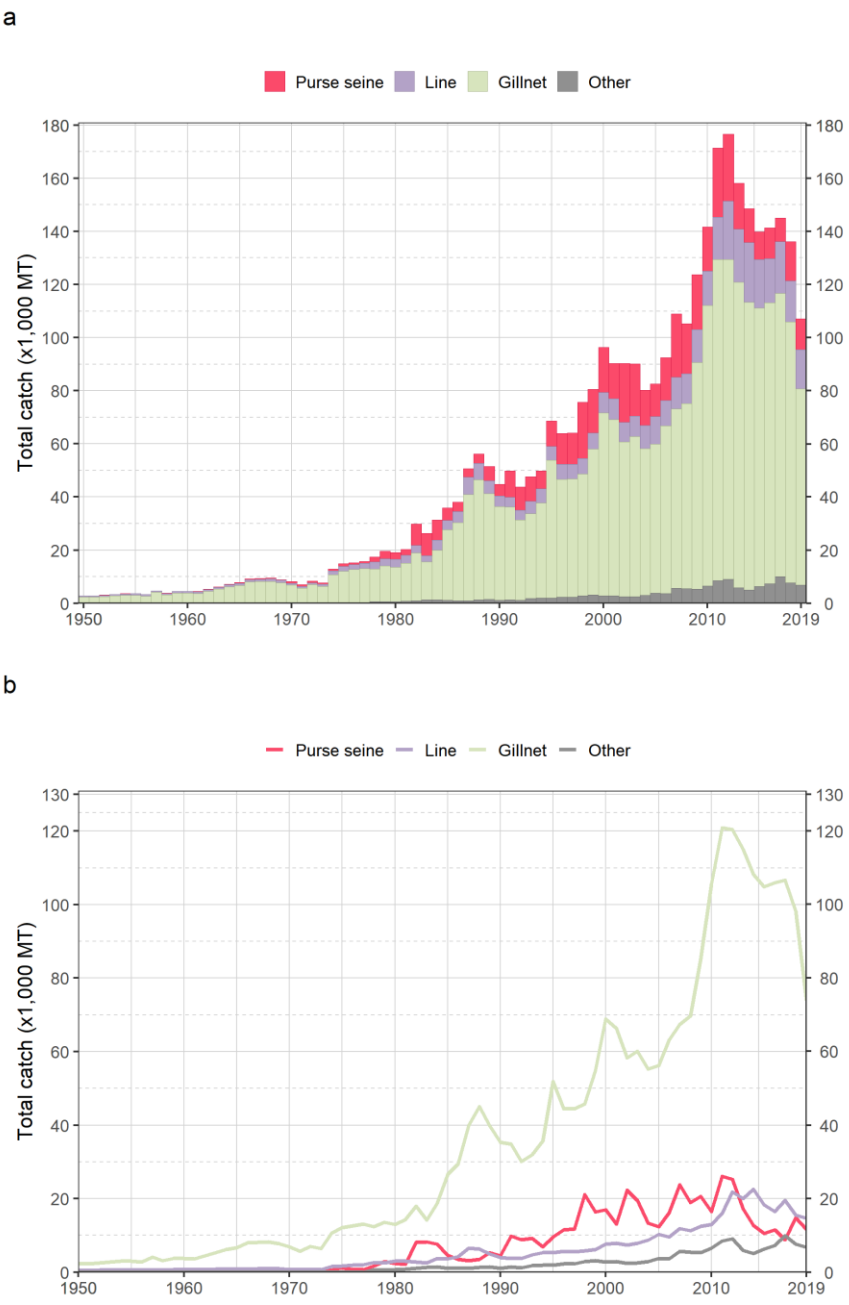


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for longtail tuna during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining fishing gears

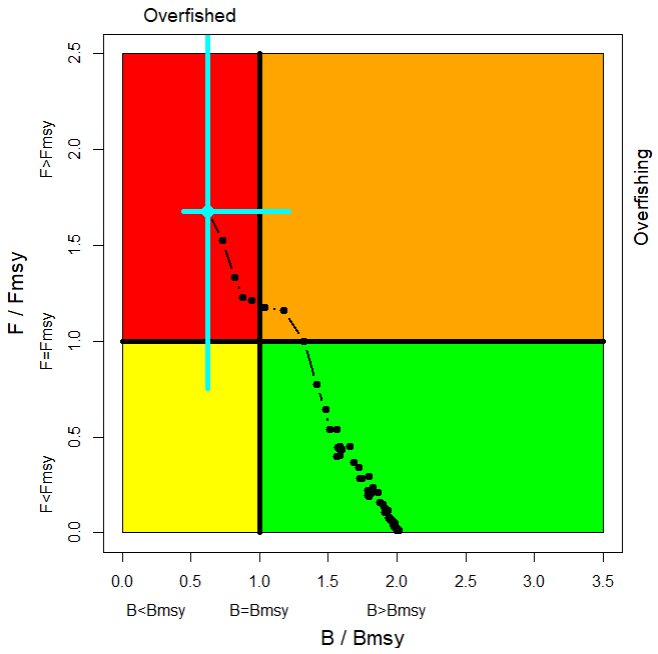


Fig. 2. Longtail tuna OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018 (median and 80% confidence interval).

APPENDIX 21
EXECUTIVE SUMMARY: INDO-PACIFIC KING MACKEREL

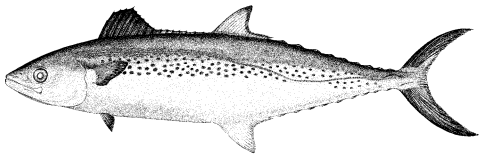


Table 1. Status of Indo-Pacific king mackerel (*Scomberomorus guttatus*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination
Indian Ocean	Catch 2019[2] (MT)	42,488	
	Average catch 2015-2019 (MT)	44,833	
	MSY (1,000 MT)	Unknown	
	F_{MSY}	Unknown	
	B_{MSY} (1,000 MT)	Unknown	
	$F_{current}/F_{MSY}$	Unknown	
	$B_{current}/B_{MSY}$	Unknown	
	$B_{current}/B_0$	Unknown	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2019 catch estimated or partially estimated by IOTC Secretariat: 39%

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 new stock assessment for Indo-Pacific king mackerel was carried out in 2019, thus, the stock status is determined on the basis of the 2016 assessment when a preliminary assessment was undertaken using catch-only methods techniques (Catch-MSY and OCOM). 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 (37% estimated) for this species, combined with the highly variable and uncertain estimates of growth parameters used to estimate model priors, warrant caution in interpreting the model results for Indo-Pacific king mackerel. Given that no new assessment was undertaken in 2020, the WPNT considered that stock status in relation to the Commission's B_{MSY} and F_{MSY} target reference points remains **unknown** (**Table 1**).

Outlook. Total annual catches for Indo-Pacific king mackerel have increased steadily over time, reaching a peak of 51,600 MT in 2009 and have since fluctuated between around 40,000 MT and 48,000 MT. 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 should be focused 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.).

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 between 2009 and 2011 estimated at the time of the assessment (46,787 MT). 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. 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 should be focused 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.).
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Data collection and reporting urgently needed 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 2019 catches (reference year 2018) 34% 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 to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gears (average catches 2015-19)**: Indo-Pacific King mackerel are caught mainly by gillnets (~66%), however significant numbers are also caught by trawling (~18%) and trolling (7%) (**Fig. 1**).
- **Main fleets (average catches 2015–19)**: Almost two-thirds of catches are accounted for by fisheries in India and Indonesia; with important catches also reported by I.R. Iran (~20%).

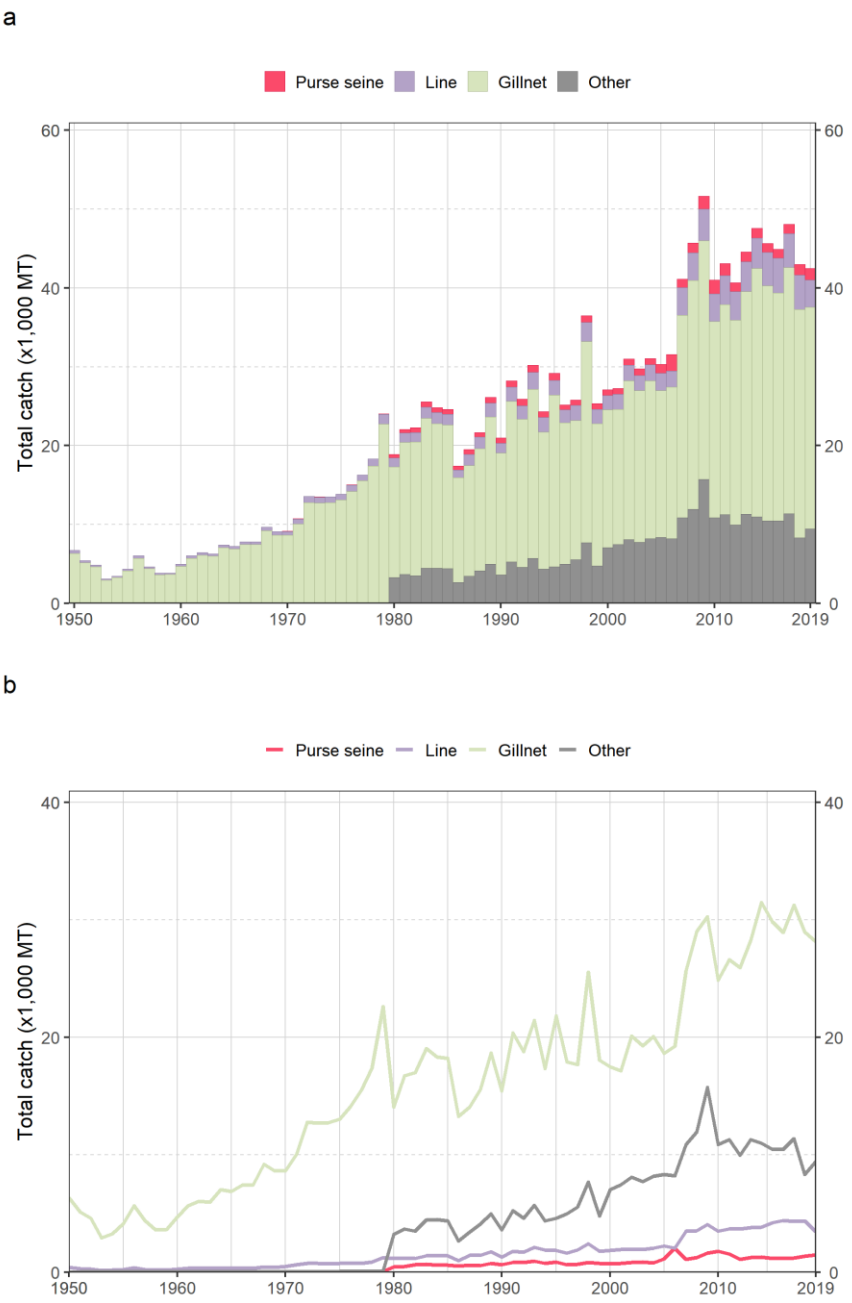


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for Indo-Pacific king mackerel during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining fishing gears

APPENDIX 22
EXECUTIVE SUMMARY: NARROW-BARRED SPANISH MACKEREL

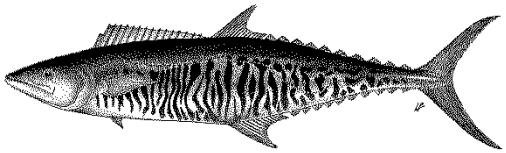


Table 1. Status of narrow-barred Spanish mackerel (*Scomberomorus commerson*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination[3]
Indian Ocean	Catch 2019[2] (MT) Average catch 2015-2019 (MT)	152,574 170,298	73%
	MSY (MT) (80% CI) F_{MSY} (80% CI) B_{MSY} (MT) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	157,760 (132,140–187,190) 0.49 (0.25–0.87) 323,500 (196,260–592,530) 1.24 (0.65–2.13) 0.80 (0.54–1.27)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2019 catch estimated or partially estimated by IOTC Secretariat: 57%
[3] The stock status refers to the most recent years' data used in the assessment conducted in 2020. i.e. 2018

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)	73%	3%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	3%	22%
Not assessed/Uncertain		

The percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new assessment was carried out in 2020 using the Optimised Catch-Only Method (OCOM). The OCOM model 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[4]. 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 for 2014-2018 are well above the current MSY estimate of 131,000 MT (**Fig. 1**).

Outlook. There is considerable uncertainty about the estimate of total catches. The continued 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 should be focused 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.).

Management advice. The catch in 2018 was just below the estimated MSY and the available Gillnet CPUE show a somewhat increasing trend in recent years although the reliability of the Index as abundance indices remains

[4] IOTC-2013-WPNT03-27

unknown. Despite the substantial uncertainties, the stock is probably very close to being fished at MSY levels and that higher catches may not be sustained.

The following should also be noted:

- Maximum Sustainable Yield for the Indian Ocean stock was estimated at 157,760 MT, with catches for 2018 (154,785 MT) not 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, 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 should be focused 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.).
- 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 2019 catches (reference year 2018) 55% 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 to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gears (average catches 2015-19)**: Narrow-barred Spanish mackerel are caught mainly using gillnet (~63%), however significant numbers are also caught using troll lines (~9.3%) and trawling (~8.9%) (**Fig. 1**).
- **Main fleets (average catches 2015-19)**: Fisheries in Indonesia, India, I.R. Iran and Pakistan account for around two-thirds of catches of narrow-barred Spanish mackerel, while the species is also targeted throughout the Indian Ocean by artisanal and sports / recreational fisheries.

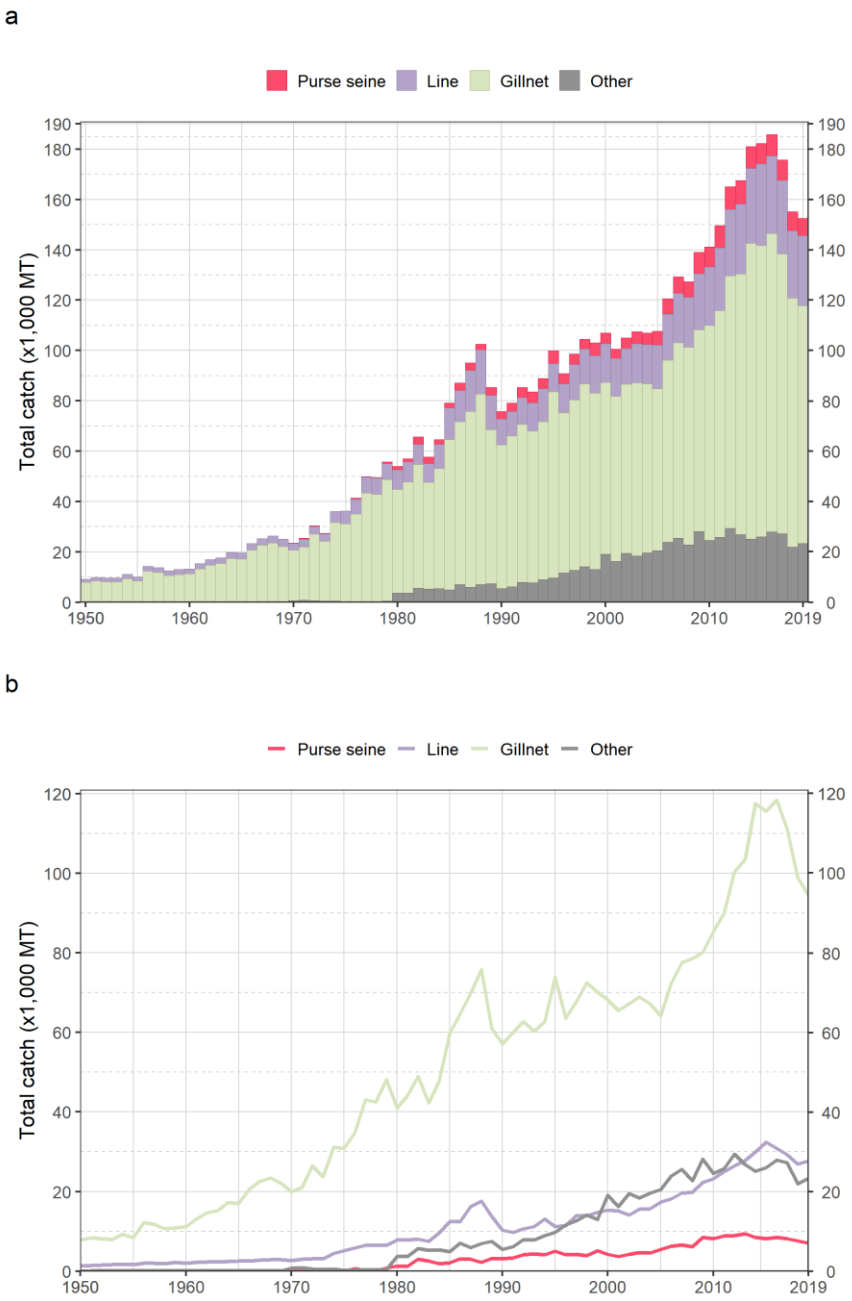


Fig. 1. Annual time series of (a) cumulative and (b) individual nominal catches (MT) by gear group for narrow-barred Spanish mackerel during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining fishing gears

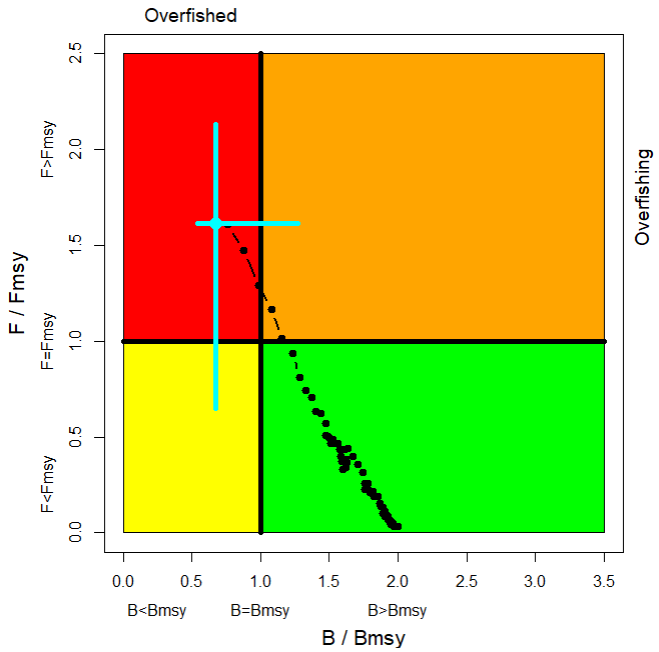


Fig. 2. Narrow-barred Spanish Mackerel OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018 (median and 80% confidence interval)

APPENDIX 23
EXECUTIVE SUMMARY: BLUE SHARK

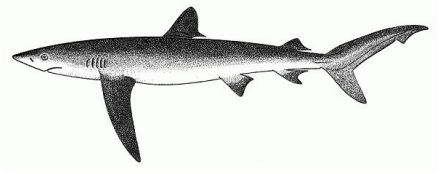


Table 2. Status of blue shark (*Prionace glauca*) in the Indian Ocean

Area	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2019 (MT)	22,719	72.6%
	Estimated catch 2015 (MT)	54,735	
	Not elsewhere included (nei) sharks[2] 2019 (MT)	35,964 t	
	Average reported catch 2015-19 (MT)	26,187	
	Average estimated catch 2011–15 (MT)	54,993	
	Ave. not elsewhere included (nei) sharks[2] 2015-19 (MT)	39,478 t	
	MSY (1,000 MT) (80% CI)[3]	33.0 (29.5 - 36.6)	
	F_{MSY} (80% CI)[3]	0.30 (0.30 - 0.31)	
	SB_{MSY} (1,000 MT) (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 are defined as the 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 ($SB_{2015}/SB_{MSY}< 1$)	Stock not overfished ($SB_{2015}/SB_{MSY}\geq 1$)
Stock subject to overfishing($F_{2015}/F_{MSY}> 1$)	0%	27.4%
Stock not subject to overfishing ($F_{2015}/F_{MSY}\leq 1$)	0%	72.6%
Not assessed/Uncertain		

Table 3. 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	–	–

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 Red List 2020, Stevens 2009

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment for blue sharks was carried out in 2020, thus, the stock status is determined on the basis of the 2017 assessment. 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 2**). 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 2018 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 3**). 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 – they 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 2**).

Outlook. Increasing effort could result in declines in biomass. The Kobe II Strategy Matrix (**Table 4**) 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 was 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 4**). If the catches are reduced at least 10%, the probability of maintaining spawning biomass above MSY reference levels ($SB>SB_{MSY}$) over the next 8 years will be increased (**Table 4).** 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** (2014–18): Coastal longline; longline (deep-freezing); longline targeting swordfish.
- **Main fleets** (2014–18): Indonesia; Taiwan,China; EU,Spain; EU,Portugal; Japan, Sri Lanka, Seychelles.

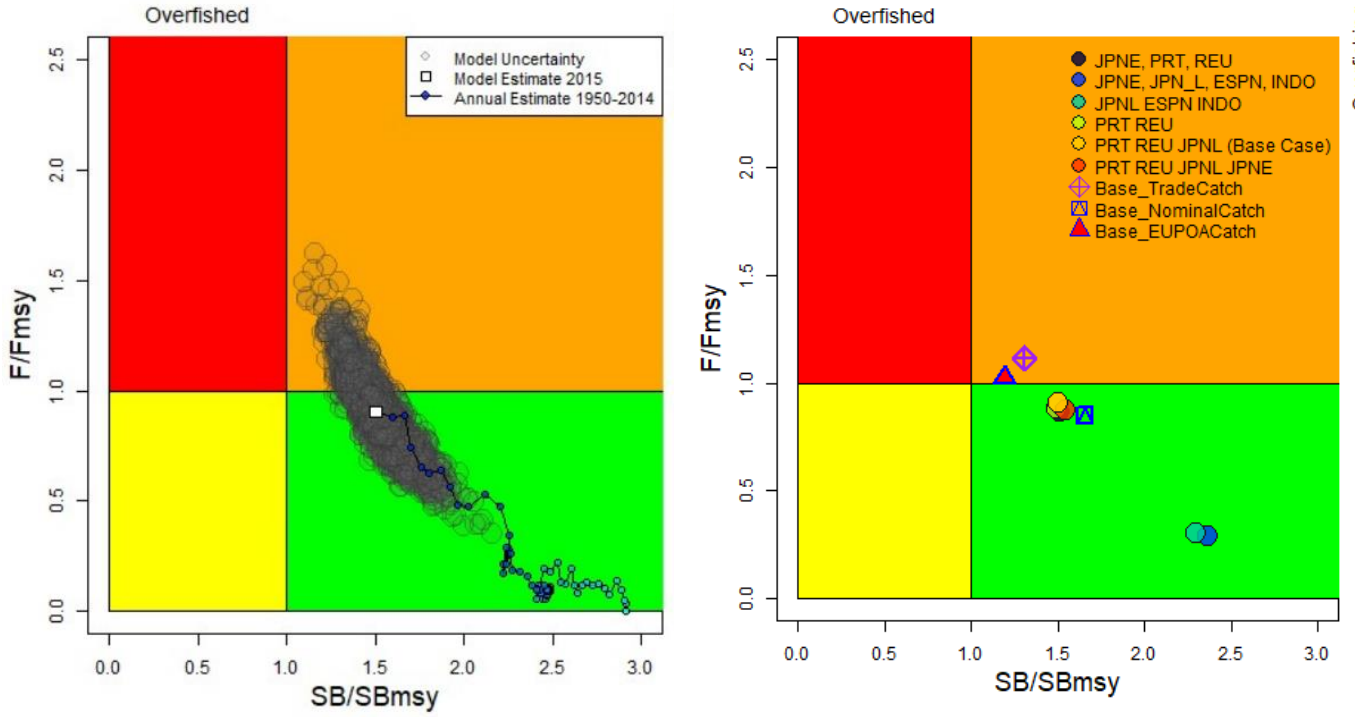


Fig. 1. Blue shark: Aggregated Indian Ocean stock assessment Kobe plot for the 2017 estimate based on the base case model and a range of sensitivity models explored with several catch reconstructions and fits to CPUE series. (Left panel: base case model with trajectory and MCMC uncertainties in the terminal year; Right panel: terminal year estimates of the sensitivity model runs). All models shown are run using SS3 - Stock Synthesis III

Table 4. 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* (54,735 MT), ± 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 exceeding 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)
$SB_{2018} < SB_{MSY}$	0%	0%	0%	0%	0%	0%	1%	1%	3%
$F_{2018} > F_{MSY}$	0%	1%	7%	25%	49%	69%	83%	91%	95%
$SB_{2025} < SB_{MSY}$	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)

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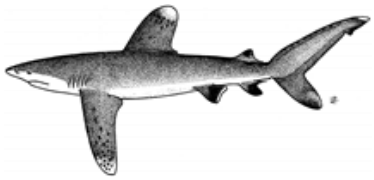
APPENDIX 24
EXECUTIVE SUMMARY: OCEANIC WHITETIP SHARK



CITES APPENDIX II species

Table 5. Oceanic whitetip shark: Status of oceanic whitetip shark (*Carcharhinus longimanus*) in the Indian Ocean.

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2019	32 t	
	Not elsewhere included (nei) sharks[2] 2019	35,964 t	
	Average reported catch 2015-19	169 t	
	Av. not elsewhere included 2015-2019 (nei) sharks[2]	39,478 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 6. 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*	Critically 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 Red List 2020, Baum et al. 2006

CITES - In March 2013, CITES agreed to include oceanic whitetip shark to Appendix II to provide further protections prohibiting the international trade; which will become effective on September 14, 2014.

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty about the relationship between abundance, standardised CPUE series and total catches over the past decade (**Table 5**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 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 (Murua *et al.* 2018). Oceanic whitetip shark received a medium vulnerability ranking (No. 9) in the ERA rank for longline gear because it was estimated as one of the least productive

shark species, but was only characterised by a medium susceptibility to longline gear. Oceanic whitetip shark was estimated as being the 11th most vulnerable shark species to purse seine gear, as it was characterised as having a relatively low productive rate, and medium susceptibility to the gear. The current IUCN threat status of 'Critically Endangered' applies to oceanic whitetip sharks globally (**Table 6**). 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 relatively 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 5**).

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 18/07), 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. Given that some CPCs are still reporting oceanic whitetip shark as landed catch, there is a need to strengthen mechanisms to ensure CPCs comply with Resolution 13/06.

The following key points should be also noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2014-18): Troll line; Gillnet; offshore gillnet.
- **Main fleets** (2014-2018): Comoros; I.R. Iran; Sri Lanka; Indonesia; and India;; (Reported as discarded/released alive by China, Korea, France, Australia, South Africa, Sri Lanka, Japan).

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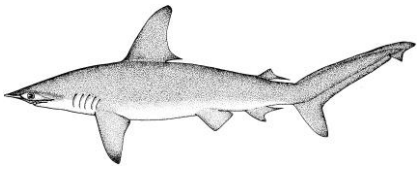
APPENDIX 25
EXECUTIVE SUMMARY: SCALLOPED HAMMERHEAD SHARK



CITES APPENDIX II species

Table 7. Status of scalloped hammerhead shark (*Sphyrna lewini*) in the Indian Ocean.

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2019 Not elsewhere included (nei) sharks[2] 2019 Average reported catch 2015-19 Av. not elsewhere included 2015-2019 (nei) sharks[2]	51 t 21,899 t 67 t 38,190 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 8. 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 shark	*Sphyrna lewini*	Critically 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 Red List 2020, Baum 2007

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. The current IUCN threat status of 'Critically Endangered' applies to scalloped hammerhead sharks globally but specifically for the western Indian Ocean the status is 'Endangered' (**Table 8**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 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 (Murua *et al.* 2018). Scalloped hammerhead shark received a low vulnerability ranking (No. 17) 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 twelfth most vulnerable shark species in the ERA

ranking for purse seine gear, but with lower levels of vulnerability compared to longline gear, because the susceptibility was lower for purse seine gear. There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. Scalloped hammerhead sharks are commonly taken by a range of fisheries in the Indian Ocean. They are extremely vulnerable to gillnet fisheries. Furthermore, pups occupy shallow coastal nursery grounds, often heavily exploited by inshore fisheries. Because of their life history characteristics – they are relatively long lived (over 30 years), and have relativity few offspring (<31 pups each year), the scalloped hammerhead shark is vulnerable to overfishing. There is no quantitative stock assessment or basic fishery indicators currently available for scalloped hammerhead shark in the Indian Ocean therefore the stock status is unknown (**Table 7**).

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 scalloped hammerhead sharks. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), 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** (2014-2018): Ringnet; Gillnet; longline-coastal; longline (fresh) and offshore gillnet.
- **Main fleets** (2014-18): Sri Lanka; Kenya; Seychelles; NEI-Fresh (report as released alive/discarded by EU-France, South Africa, Indonesia, Japan).

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APPENDIX 26
EXECUTIVE SUMMARY: SHORTFIN MAKO SHARK

Table 9. Shortfin mako shark: Status of shortfin mako shark (*Isurus oxyrinchus*) in the Indian Ocean.

Area[1]	Indicators		2020 stock status determination
Indian Ocean	Reported catch 2019	1,087 t	
	Not elsewhere included (nei) sharks[2] 2019	37,773 t	
	Average reported catch 2015-19	1,789 t	
	Av. not elsewhere included (nei) sharks[2] 2015-19	41,367 t	
	MSY (1,000 t) (80% CI)	unknown	
	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)		

[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 10. 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*	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 Red List 2020, 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 9**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 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 (Murua *et al.* 2018). 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 fourth 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 ‘‘Endangered’ applies to shortfin mako sharks globally (**Table 10**). Trends in the Japanese standardised

CPUE series from its longline fleet has declined from 1999 to 2004, but has remained relatively stable since 2005. Conversely, trends in EU,Portugal longline standardised CPUE series have been increasing since 2008 as has the trends in the EU,Spain and Taiwanese longline series (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. Because of their life history characteristics – they are relatively long lived (over 30 years), females mature at 18–21 years, and have relativity few offspring (<25 pups every two or three years) - the shortfin mako shark is vulnerable to overfishing. Although an attempt was made to assess the shortfin mako stock in 2020, there is no quantitative stock assessment currently available for shortfin mako shark in the Indian Ocean. Therefore, the stock status is **unknown**. This highlights the need for further work on data improvement and provision of abundance indices as well as utilizing complimentary approaches (e.g. genetic tools) to inform the trends in abundance of the stock.

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 global catch and effort on shortfin mako shark has declined in the southern and eastern areas, and may have resulted in localised depletion there. It should be noted that subsequent to the past assessment, shortfin mako has been placed on CITES Appendix II and therefore this may influence the landings in the future.

Management advice. In the absence of a stock assessment and noting conflicting information, the Commission should take a cautious approach by implementing management actions that reduce fishing mortality on shortfin mako sharks. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), 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** (2015-19): Longline targeting swordfish; longline (fresh); longline (targeting sharks); gillnet.
- **Main fleets** (2015-19): EU,Spain; South Africa; EU,Portugal; Japan, I.R. Iran, China, Sri Lanka, (Reported as discarded/released alive: Australia, EU,France, Indonesia, Japan, Korea, South Africa).

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APPENDIX 27
EXECUTIVE SUMMARY: SILKY SHARK

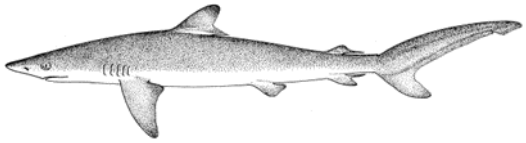

Table 11. Silky shark: Status of silky shark (*Carcharhinus falciformis*) in the Indian Ocean.

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2019 Not elsewhere included (nei) sharks[2] 2019 Average reported catch 2015-19 Av. not elsewhere included (nei) sharks[2] 2015-19	2,094 t 20,717 t 2,241 t 36,248 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 12. 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*	Vulnerable	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 Red List 2020

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 11**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 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 (Murua *et al.* 2018). Silky shark received a high vulnerability ranking (No. 2) 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 fifth 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 but globally the status is 'Vulnerable' (**Table 12**). There is a paucity of information available on this species but several studies have been carried out for this species in the recent years. CPUE derived from longline fishery observations indicated a decrease from 2009 to 2011 with a stable pattern onward. A preliminary stock assessment was run in 2018 but could not be updated in 2019. This assessment is extremely uncertain, however, and so the population status of silky sharks in the Indian Ocean is considered uncertain. Silky sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (over 20 years), mature relatively late (at 6–12 years), and have relativity few offspring (<20 pups every two years), the silky shark 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 18/07), 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** (2014-18): Gillnet; offshore gillnet; longline-coastal; longline (fresh), , longline
- **Main fleets** (2014-18): I.R. Iran; Sri Lanka; Taiwan,China; Pakistan; .

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APPENDIX 28
EXECUTIVE SUMMARY: BIGEYE THRESHER SHARK

Table 13. Bigeye thresher shark: Status bigeye thresher shark (*Alopias superciliosus*) in the Indian Ocean.

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2019	0 t	
	Not elsewhere included (nei) sharks[2] 2019	24,043 t	
	Average reported catch 2015-19	<1 t	
	Av. not elsewhere included (nei) sharks[2] 2015-19	40,006 t	
	MSY (1,000 t) (80% CI)	unknown	
	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)		

[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 14. 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 Red List 2020, 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 13**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 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 (Murua *et al.* 2018). Bigeye thresher shark received a high vulnerability ranking (No. 4) 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 14**). There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. Bigeye thresher sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (+20 years), mature at 3–9 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 live 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 18/07), 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*[5].

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2014–18): No report after 2012. (reported previously as discard from gillnet and longline).
- **Main reporting fleets** (2014–18): India; (reported as discarded/released alive by South Africa, Sri Lanka, Japan, Korea, EU,France, Indonesia).

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[5] 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 29
EXECUTIVE SUMMARY: PELAGIC THRESHER SHARK

Table 15. Pelagic thresher shark: Status pelagic thresher shark (*Alopias pelagicus*) in the Indian Ocean.

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2019	209 t	
	Not elsewhere included (nei) sharks[2] 2019	24,043 t	
	Average reported catch 2015-19	335 t	
	Av. not elsewhere included (nei) sharks[2] 2015-19	40,006 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 16. 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*	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 Red List 2020, 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 15**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 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 (Murua *et al.* 2018). Pelagic thresher shark received a medium vulnerability ranking (No. 12) in the ERA for longline gear because it was characterised as one of the least productive shark species, and with a medium susceptibility to longline gear. Due to its low productivity, pelagic thresher shark has a high vulnerability ranking (No. 2) to purse seine gear due to its high availability for this particular gear. The current IUCN threat status of 'Endangered' applies to pelagic thresher shark globally (**Table 16**). There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. Pelagic thresher sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (+ 20 years), mature at 8–9 years, and have few offspring (2 pups every

year) - the pelagic thresher shark is vulnerable to overfishing. There is no quantitative stock assessment and limited basic fishery indicators 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 18/07), 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*[6].

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2014-18): Gillnet (reported as discard/ released from gillnet and longline).
- **Main fleets** (2014-18): Pakistan; (reported as discarded/released alive by Japan, Korea, Sri Lanka, South Africa, Indonesia).

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[6]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 30
EXECUTIVE SUMMARY: MARINE TURTLES

Table 17. 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[7]
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 2020, The IUCN Red List of Threatened species. <www.iucnredlist.org>. Downloaded on 16 September 2020

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 17**. It is important to note that a number of international global environmental accords (e.g. Convention on Migratory Species (CMS), Convention on Biological Diversity (CBD), as well as numerous fisheries agreements obligate States to provide protection for these species. In particular, there are now 35 Signatories to the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA MoU). Of the 35 Signatories to the IOSEA MoU, 23 are also members of the IOTC. While the status of marine turtles is affected by a range of factors such as degradation of marine turtle natural habitats and targeted harvesting of eggs and turtles, the level of mortality of marine turtles due to capture by gillnets is likely to be substantial as shown by the Ecological Risk Assessment (ERA) presented in 2018 (Williams et al., 2018). Stock assessments of all species of marine turtles in the Indian Ocean are limited due to data insufficiencies as well as limited data quality (Wallace et al., 2011). Bycatch and mortality from gillnet fisheries have greater population-level impacts on marine turtles relative to other gear types, such as longline, purse seine and trawl fisheries in the Indian Ocean (Wallace et al., 2013). Population levels of impacts of leatherback turtles caught in longline gear in the Southwest Indian Ocean were also identified as a conservation priority.

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. So

[7] IUCN, 2020. The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

far, reporting of sea turtle interactions are not described at the species level. It is recommended that CPCs now declare interactions indicating the sea turtle species. Guides for species identification are available at http://iotc.org/science/species-identification-cards. 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:

1. The available evidence indicates considerable risk to marine turtles in the Indian Ocean.
2. Given the high mortality rates associated with marine turtle interactions with gillnet fisheries and the increasing use of gillnets in the Indian Ocean (Aranda, 2017) there is a need to both assess and mitigate impacts on threatened and endangered marine turtle populations.
3. 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.
4. Current reported interactions are known to be a severe underestimate.
5. The Ecological Risk Assessment (Nel et al., 2013) 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[7]. The ERA 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.
6. 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.
7. Efforts should be undertaken to encourage CPCs to investigate means to reduce marine turtle bycatch and mortality in IOTC fisheries.
8. That appropriate mechanisms are developed by the Compliance Committee to ensure CPCs comply with their data collection and reporting requirements for marine turtles.

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APPENDIX 31
EXECUTIVE SUMMARY: SEABIRDS

Table 18. 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[8]
Albatross		
Atlantic Yellow-nosed Albatross	*Thalassarche chlororhynchos*	Endangered
Black-browed albatross	*Thalassarche melanophris*	Least Concern
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*	Endangered
Tristan albatross	*Diomedea dabbenena*	Critically Endangered
Wandering albatross	*Diomedea 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*	Endangered
Flesh-footed shearwater	*Puffinus carneipes*	Near Threatened

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 (IOTC-2016-SC19-INF02). 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 18**. It is important to note that the IUCN threat status for all birds is currently being re-assessed; this process is expected to be completed by the end of 2016. A number of international global environmental accords (e.g. Convention on Migratory Species (CMS), the Agreement on the Conservation of Albatrosses and Petrels (ACAP), Convention on Biological Diversity (CBD)), as well as numerous fisheries agreements obligate States to provide protection for these species. While the status of seabirds is affected by a range of factors such as degradation of nesting habitats and targeted harvesting of eggs, for albatrosses and large petrels, fisheries bycatch is generally considered to be the primary threat. The level of mortality of seabirds due to fishing gear in the Indian Ocean is poorly known, although where there has been rigorous assessment of impacts in areas south of 25 degrees (e.g. in

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

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 32
EXECUTIVE SUMMARY: CETACEANS

Table 19. 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*	LC	-
Balaenopteridae	Common minke whale	*Balaenoptera acutorostrata*	LC	-
	Antarctic minke whale	*Balaenoptera bonaerensis*	NT	-
	Sei whale	*Balaenoptera borealis*	EN	PS
	Bryde's whale	*Balaenoptera edeni/brydei*	LC	-
	Blue whale	*Balaenoptera musculus*	EN	-
	Fin whale	*Balaenoptera physalus*	VU	-
	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*	LC	GN
	Dwarf sperm whale	*Kogia sima*	LC	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 bowdoini*	DD	-
	Blainville's beaked whale	*Mesoplodon densirostris*	DD	-
	Gray's beaked whale	*Mesoplodon grayi*	DD	-
	Hector's beaked whale	*Mesoplodon hectori*	DD	-
	Deraniyagala's beaked whale	*Mesoplodon hotaula*	DD	-
	Strap-toothed whale	*Mesoplodon layardii*	DD	-
	True's beaked whale	*Mesoplodon mirus*	DD	-
	Spade-toothed whale	*Mesoplodon traversii*	DD	-
	Shepherd's beaked Whale	*Tasmacetus 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*	LC	GN
	Short-finned pilot whale	*Globicephala macrorhynchus*	LC	LL, GN
	Long-finned pilot whale	*Globicephala melas*	LC	-
	Risso's dolphin	*Grampus griseus*	LC	LL, GN

Delphinidae	Fraser's dolphin	*Lagenodelphis hosei*	LC	-
	Irrawaddy dolphin	*Orcaella brevirostris*	EN	GN
	Australian snubfin dolphin	*Orcaella heinsohni*	VU	GN
	Killer whale	*Orcinus orca*	DD	LL, GN
	Melon-headed whale	*Peponocephala electra*	LC	LL, GN
	False killer whale	*Pseudorca crassidens*	NT	LL, GN
	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*	LC	-
	Spinner dolphin	*Stenella longirostris*	LC	GN
	Rough-toothed dolphin	*Steno bredanensis*	LC	GN
	Indo-Pacific bottlenose dolphin	*Tursiops aduncus*	NT	GN
	Bottlenose dolphin	*Tursiops truncatus*	LC	LL, GN
Phocoenidae	Indo-Pacific finless porpoise	*Neophocaena phocaenoides*	VU	GN

* The assessment of the status level in IUCN is independent of IOTC processes
** Published bycatch records only (reference at the end of the document)
*** Arabian Sea population: EN
The IUCN Red List of Threatened species. <www.iucnredlist.org>.
Downloaded on 16 September 2020.

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. The current[9] 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 19**. 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 (Anderson, 2014). Many reports (e.g. Sabarros et al., 2013) also suggest some level of cetacean mortality for species involved in depredation of pelagic longlines, 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 (e.g. Escalle et al., 2015), 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

[9] September 2020

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 (Anderson, 2014).
- 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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APPENDIX 33
STATUS OF YELLOWFIN TUNA CATCHES PURSUANT TO RESOLUTION 19/01

Status of YFT catch reductions for purse seine fleets

Purse seine fleets		Reduction	2014	2015	2016	2017	2018	2019	Difference with baseline	
									Absolute	%
Subject to Res. 19/01	EU	15%	91405	86149	87075	86893	78148	69479	-21926	-24%
	KOR		8852	7509	10347	6362	5415	8730	-122	-1%
	SYC		23463	39072	40014	41694	35023	33006	-6066	-16%
	MUS	7.5%	4844	5448	7404	7681	11322	12290	**1817**	**33%**
	Sub-tot		**128564**	**138178**	**144841**	**142630**	**129908**	**123505**	**-27147**	**-18%**
	IDN		5598	5493	5214	5214	9564	9775	**4177**	75%
	IND		98	76	84	63	120	124	25	26%
	IRN		4832	3842	3465	1764	3898	3361	**-1471**	-30%
	JPN		433	338	422	712	407	24	-409	-94%
	KEN					73				
	LKA		2627	3532	1966	5505	2891	1909	-718	-27%
	MOZ				126					
	PHL					73				
	Sub-tot		**13588**	**13281**	**11278**	**13404**	**16880**	**15192**	**1604**	**12%**
All purse seine fleets			**142152**	**151459**	**156119**	**156034**	**146788**	**138697**	**-25543**	**-16%**

IDN	Includes coastal (small-scale) purse seiners for 2014-2019 and industrial purse seiners for 2018-2019
KEN	Includes ringnet and offshore ringnets
LKA	Includes ringnet and offshore ringnets
MOZ	Includes coastal (small-scale) purse seiners for 2016
SYC	Baseline corresponds to catches reported for 2015 (see Res. 17/01 and Res. 19/01 para. 9)
MUS	Baseline corresponds to catches reported for 2018 (see Res. 19/01 para. 10)

Status of YFT catch reductions for longline fleets

Longline fleets		Reduction	2014	2015	2016	2017	2018	2019	Difference with baseline	
									Absolute	%
Subject to Res. 19/01	TWN	10%	12285	13921	16958	9115	10845	9427	-2858	-23%
	LKA		8625	5933	3939	6448	8554	10746	**2121**	**25%**
	Sub-tot		**20910**	**19855**	**20896**	**15563**	**19399**	**20173**	**-737**	**-4%**
Not subject to Res. 19/01	AUS	N/A	19	73	66	65	38	44	25	131%
	CHN		1078	1793	1812	2962	4641	3212	**2135**	198%
	EU		894	732	651	369	331	361	-532	-60%
	IDN		4009	5077	2826	2353	1501	2602	**-1408**	-35%
	IND		327	669	106	6	7		-327	-100%
	JPN		3639	3140	2967	3291	2975	2560	**-1080**	-30%
	KEN						116		0	0%
	KOR		1557	1674	1374	1802	1575	2060	503	32%
	MDG		59	72	61	28	29	40	-20	-33%
	MDV		120	63	286	220	106	36	-85	-70%
	MOZ		1	56	21	89	63	69	68	4868%
	MUS		15	32	94	266	259	325	310	2069%
	MYS		77	144	156	384	446	428	350	453%
	OMN		28	205	135	110	177	297	269	971%
	PHL		69						-69	-100%
	SYC		1616	2395	3247	4313	5678	6984	**5368**	332%
	THA		187	109					-187	-100%
	TZA		155	108	109				-155	-100%
	ZAF		83	182	183	247	331	389	306	369%
	Sub-tot		**13935**	**16525**	**14094**	**16504**	**18273**	**19406**	**5471**	**39%**
All longline fleets			**34845**	**36380**	**34991**	**32067**	**37672**	**39579**	**4734**	**14%**

Status of YFT catch reductions for gillnet fleets

Gillnet fleets		Reduction	2014	2015	2016	2017	2018	2019	Difference with baseline	
									Absolute	%
Subject to Res. 19/01	IRN	10%	24401	26780	31079	37193	35534	44024	19623	80%
	Sub-tot		24401	26780	31079	37193	35534	44024	19623	80%
Not subject to Res. 19/01	AUS	N/A	0	0	1	1	1	1	1	389%
	COM		16	117	905	547	135			
	IDN		341	334	317	317	252	241	-99	-29%
	IND		5153	3974	4392	3297	13717	6801	1648	32%
	IRN		16925	11632	4031	8358	6537	1274	-15651	-92%
	KEN		54	82	82	157	973	982	928	1724%
	LKA		11246	8559	5469	3142	1479	2024	-9222	-82%
	OMN		2268	8145	6914	9691	11332	11516	9248	408%
	PAK		16441	18817	25560	27784	18384	9358	-7083	-43%
	TZA		3210	3814	3814	3814	3814	3814	603	19%
	YEM		180	119	105	99	87	48	-133	-74%
	Sub-tot		55835	55594	51589	57205	56710	36060	-19775	-35%
All gillnet fleets			80236	82374	82669	94398	92243	80084	-152	0%

YEM Data from FAO, re-estimated by the IOTC Secretariat

Status of YFT catch reductions for fleets using other gears

Other fleets		Reduction	2014	2015	2016	2017	2018	2019	Difference with baseline	
									Absolute	%
Subject to Res. 19/01	MDV BB	5%	11416	9757	5282	10810	10749	10165	-1250	-11%
	MDV HL		17831	21399	26165	18017	16704	15918	-1913	-11%
	Sub-tot		29246	31157	31447	28827	27453	26083	-3163	-11%
Not subject to Res. 19/01	AUS	N/A	0	0	0	1	0	1	1	177%
	COM		1383	1630	4679	4259	3059		-1383	-100%
	EU		291	361	564	445	407	362	71	25%
	GBRT		2	2	2	3	4	3	1	78%
	IDN		15327	15041	14278	14278	11319	10855	-4472	-29%
	IND		27849	12440	14662	10566	23644	26616	-1233	-4%
	IRN		57	345	6535	8806	12682	9385	9328	16263%
	KEN		17	27	27	174	2503	2481	2464	14117%
	LKA		15280	14647	22361	22883	26892	30076	14796	97%
	MDG		675	675	675	675	675	675	0	0%
	MDV BB		7065	6039	3269	6690	6870	7075	10	0%
	MDV HL		12416	14901	18219	12546	12256	11015	-1401	-11%
	MOZ		4	13	27	80	93	93	89	2219%
	MUS		50	50	87	69	75	69	19	39%
	OMN		4912	6833	13935	9698	17329	25219	20307	413%
	SYC		0	0	0	57	43	9	8	2146%
	TZA		76	90	90	90	90	90	14	19%
	YEM		29000	24398	21148	17962	17989	18063	-10937	-38%
	ZAF		0							
	Sub-tot		114405	97492	120557	109280	135931	142090	27684	24%
All other fleets			143652	128649	152004	138107	163384	168172	24521	17%

NOTE: The fraction of MDV BB and HL catches subject to 19/01 for 2015-2017 has been estimated using proportions from 2014
MDV provided the breakdown for 2014 and again starting from 2018

IRN Includes catches for the coastal longline fleet that started developing from 2016

MDG Data repeated from 2014 due to lack of reporting

YEM Data from FAO, re-estimated by the IOTC Secretariat

APPENDIX 34
PROGRESS MADE ON THE RECOMMENDATIONS OF SC22

SC22 Report	SC recommendations	Update/Progress
SC22.08 Para. 17	***Science Related Activities of the IOTC Secretariat In 2019*** The SC **NOTED** the recent departure of two scientific staff at the Secretariat and **ACKNOWLEDGED** that the Secretariat is in the process of recruiting two replacement staff members. Notwithstanding this replacement of staff, the SC **RECALLED** that in 2018 the Commission deferred the recruitment of a P4 officer for the IOTC Data and Science Section until 2020. Given the increased workload of the Secretariat, the SC **RECOMMENDED** that the Commission confirm the reinstatement of this position at its next meeting, so it can be advertised and filled as soon as possible	**Update**: In 2019 the Commission deferred the recruitment of the Scientific Coordinator until 2021 in response to concerns regarding the financial impact that filling this position would have on annual contributions. The main role of the Scientific Coordinator would be to manage the research projects being implemented by the Secretariat. However, as this largely involves dealing with administrative and contract matters (compared to dealing with technical matters), it has been found that IOTC's projects can be delivered by the Secretariat's existing science team, with increased input from the Administrative Officer. The Secretariat therefore proposed that the recruitment of a Scientific Coordinator is again deferred
SC22.09 Para. 23 SC22.10 Para. 24	***National Reports from CPCs*** Noting that the Commission, at its 15th Session (in 2011), 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 2019, 23 reports were provided by CPCs (26 in 2018, 23 in 2017, 23 in 2016, 26 in 2015) (Table 2). The SC **RECOMMENDED** that the Compliance Committee and Commission note the lack of compliance by 9 Contracting Parties (Members) and 2 Cooperating Non-Contracting Party (CNCPs) that did not submit a National Report to the Scientific Committee in 2019, noting that the Commission agreed that the submission of the annual reports to the Scientific Committee is mandatory	**Update:** Ongoing. CPCs are encouraged to provide national reports whether or not they are attending the SC meeting and that the provision of national reports is a mandatory requirement for all CPCs **Update:** The SC chair presented the report of the S22 to the Commission in November 2020. The Commission noted this issue with concern although the official report was not available at the time of drafting this document.
SC22.11 Para. 42	***Report of the 17th Session of the Working Party on Billfish (WPB17)*** The SC reiterated its previous **RECOMMENDATION** that on the next revision of the IOTC Agreement, that short bill spearfish (*Tetrapturus angustirostris*) be included as an IOTC species.	**Update:** No progress
SC22.12 Para. 47	***Revision of catch levels of Marlins under Resolution 18/05*** The SC **NOTED** that catches in recent years for Black Marlin, Blue Marlin, Striped Marlin and Indo-Pacific Sailfish have all exceeded the catch limits set by Resolution 18/05, and that current catch trends for all four species show no signs of decline in line with meeting the catch limits by 2020. As such, the SC urgently reiterates its **RECOMMENDATION** that measures are agreed to	**Update:** The Commission discussed the stock status of the tuna and tuna-like species and noted the need to take action to prevent further declines in stock status. No new CMMs were discussed or adopted at the meeting.

	reduce current catches to the limits set for all four species covered by Resolution 18/05 as per the management advice given in the Executive Summaries.	
SC22.13 Para. 54	***Report of the 15th session of the working party on ecosystems and bycatch (WPEB15)*** ***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*** 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 5, recalling that the IPOA-Seabirds and IPOA-Sharks were adopted by the FAO in 1999 and 2000, respectively, and recommended the development of NPOAs.	**Update**: Ongoing
SC22.14 Para. 55	***Resolution 17/05 and the conservation of sharks in IOTC fisheries*** The SC **ENDORSED** the advice of the WPEB regarding the need to improve data collection and reporting for shark species. To this end, the SC **RECOMMENDED** that several initiatives be implemented, including: (i) holding regional workshops to improve shark species identification, shark data sampling and collection (fisheries and biological) and IOTC data reporting requirements; (ii) data mining to fill historical data gaps; (iii) developing alternative tools to improve species identification (e.g. genetic analyses, machine learning, and artificial intelligence)	**Update**: Ongoing
SC22.15 Para. 76	***Report of the 21st Session of the Working Party on Tropical Tunas (WPTT21)*** ***Review of the statistical data available for skipjack tuna*** The SC **NOTED** that total catches in 2018 (607,701 t) were 30% higher than the catch limit generated by the Harvest Control Rule (470,029 t) which applies to the years 2018–2020, and that catches have increased over the past 3 years. The SC reiterated its **RECOMMENDATION** that the Commission urgently consider the need to monitor catches of skipjack in the 2019–2020 period to ensure catches do not exceed the limit.	**Update:** The Commission noted the high catches of Skipjack in the IO and that these have surpassed the levels advised by the HCR.
SC22.16 Para. 80	***Report of the 7th Session of the Working Party on Temperate Tunas (WPTmT07)*** ***Albacore Tuna stock assessment***	**Update:** Ongoing.

	The SC **NOTED** that the 2020 and draft 2021 calendars of working party meetings were approved by the Commission in June 2019, and the WPTmT is not scheduled to meet in either of these years. The SC **NOTED** the request by the chairs of the WPTmTs to hold an assessment meeting in April 2020 but **AGREED** that this would not be appropriate as the SC would not have an opportunity to review the WPTmT outputs prior to the Commission meeting in June 2020. The SC **AGREED** that it would be beneficial to hold an assessment preparatory meeting in 2020 or 2021; and to this end, the SC **RECOMMENDED** that the Commission consider approving an assessment preparatory meeting for the WPTmT in either of these years	
SC22.17 Para. 97	***Report of the 15th Session of the Working Party on Data Collection and Statistics (WPDCS15)*** **NOTING** that the WPDCS highlighted several issues still affecting the quality of the information available for stock assessment purposes of tropical tunas, the SC **RECOMMENDED** that a data preparatory meeting be held prior to the Working Party on Tropical Tunas.	**Update**: A data preparatory meeting was held for the WPTT in 2020.
SC22.18 Para. 104	***Invited Expert(s) at the WP meetings*** 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.	**Update**: Ongoing. The Commission has provided budget for invited experts for 2020 and 2021.
SC22.19 Para. 105	***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**: No Progress
SC22.20 Para. 106	***IOTC species identification guides: Tuna and tuna-like species*** 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.	**Update**: Ongoing. Budget has been made available through the IOTC main budget and an EU grant to continue the printing of ID cards,
SC22.21 Para. 107	***General - Chairpersons and Vice-Chairpersons of the SC and its subsidiary bodies*** 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 7.	**Update:** Completed

SC22.22 Para. 127	***Implementation of the Regional Observer Scheme*** The SC **ACKNOWLEDGED** that estimation of ROS coverage for the purse seine fleets is adversely impacted by the lack of uniformity in reporting effort data to the IOTC Secretariat, and **AGREED** that this information, which is particularly useful to assess the performance of Resolution 11/04, should be further standardized. As such, the SC **RECOMMENDED** that all purse seine fleets reporting effort as fishing hours or fishing days begin to submit this information as 'number of sets' instead, in particular when fulfilling the reporting requirements of Resolution 15/02.	**Update:** The Commission noted that this requirement is already encapsulated in Resolutions 15/01 and 15/02 and that the recommendation is redundant. The Commission urged members to conform with these 2 Resolutions.
SC22.23 Para. 133	***General - Progress on the implementation of the recommendations of the performance review panel*** The SC **RECOMMENDED** that the Commission note the updates on progress regarding Resolution 16/03.	**Update:** Completed.
SC22.24 Para. 150	***General - Consultants*** Noting the highly beneficial and relevant work done by IOTC stock assessment consultants 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.	**Update:** Ongoing. Several consultants were contracted in 2019.

APPENDIX 35A
WORKING PARTY ON NERITIC TUNAS PROGRAM OF WORK (2021 – 2025)

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

Topic in order of priority	Sub-topic and project	Timing				
		2021	2022	2023	2024	2025
1. 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.					
	➢ Sri Lanka (priority species: Frigate tuna, Kawakawa, bullet tuna)					
	➢ Indonesia (priority species: Kawakawa, Bullet tuna, Frigate tuna)					
	➢ Pakistan (priority species: Longtail tuna, Kawakawa, narrow-barred Spanish mackerel)					
	➢ Iran gillnet CPUEs for all species					
	Capacity building support for CPCs to develop standardised CPUEs for their fisheries					
2. Stock assessment / Stock indicators	Explore alternative assessment approaches and develop improvements where necessary based on the data available to determine stock status for longtail tuna, kawakawa and Spanish mackerel					

	• 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. • Exploration of priors and how these can be quantifiably and transparently developed • Take into consideration the outputs of genetic studies to investigate stock structure and regional differences in populations Improve the presentation of management advice from different assessment approaches to better represent the uncertainty and improve communication between scientists and managers in the IOTC.					
3. Data mining and collation	Collate and characterize 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. 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) Re-estimation of historic catches for assessment purposes (taking into account updated identification of uncertainties and knowledge of the history of the fisheries) • (Data support missions to priority countries: India, Oman, Pakistan)					

APPENDIX 35B
WORKING PARTY ON TEMPERATE TUNAS PROGRAM OF WORK (2020 – 2024)

Table 1. Priority topics for obtaining the information necessary to develop stock status indicators for albacore in the Indian Ocean (2020-2024). As there was no meeting in 2020, this table is unchanged from 2019.

Topic	Sub-topic and project	Priority	Est. budget and/or potential source	Timing				
				2020	2021	2022	2023	2024
1. Stock structure (connectivity and diversity)	1.1 Genetic research to determine the connectivity of albacore throughout its distribution and the effective population size.	Low (5)	1.3 m Euro: European Union					
2. Biological information (parameters for stock assessment)	2.1 Biological research (collaborative research to improve understanding of spatio-temporal patterns in age and growth and reproductive parameters)	High (1)	TBD					
	2.1.1 Age and growth studies: Uncertainty about the growth curve is a primary source of uncertainty in the stock assessment. A preliminary growth curve was developed in 2019, but there is substantial work to be done to ensure that growth curves include data from smaller size classes, and that spatio-temporal patterns in growth are quantified for use in the stock assessment. Collaborative sampling programs, involving a combination of observer- and port-based sampling, are required to ensure that adequate samples are collected.		TBD					
	2..1.2 Quantitative biological studies are necessary for albacore throughout its range to determine spatio-temporal patterns in		TBD					

		key reproductive parameters including sex ratio; female length- and age-at-maturity; spawning location, periodicity and frequency; batch fecundity at length and age; spawning fraction and overall reproductive potential, to inform future stock assessments.							
2	CPUE standardisation	3.1 Continue the development of standardized CPUE series for each albacore fishery for the Indian Ocean, with the aim of developing appropriate CPUE series for stock assessment purposes.	High (2)	CPUE Workshop (TBD)					
		3.1.1 Spatio-temporal structure and target changes need to be considered carefully, as fish density and targeting practices can vary in ways that affect CPUE indices. Developments may include changes to fishery spatial structure, new approaches for area weighting, time-area interactions in the model, and/or indices using VAST.		CPCs directly					
3	Size frequency data	5.1 Further investigate the size information provided by CPCs in order to better understand the stock dynamics and inputs into the assessment models. This is particularly necessary for the purse seine data.	High (3)	TBD					
5	Management strategy evaluation	6.1 Continue to collaborate with the WPM on input to the Management Strategy Evaluation (MSE) process.	High (4)	TBD					

APPENDIX 35C
WORKING PARTY ON BILLFISH PROGRAM OF WORK (2021 – 2025)

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

Topic in order of priority	Sub-topic and project	Timing				
		2021	2022	2023	2024	2025
1. Stock structure (connectivity and diversity)	Continue work on determining stock structure of Swordfish, using complimentary data sources, including genetic and microchemistry information as well as other relevant sources/studies.					
2. Biological and ecological information (incl. parameters for stock assessment and provide answers to the Commission)	Reproductive biology study CPCs to conduct reproductive biology studies, which are necessary for billfish throughout its range to determine key biological parameters including length-at-maturity, age-at-maturity and fecundity-at-age, which will be fed into future stock assessments, as well as provide advice to the Commission on the established Minimum Retention Sizes (Res 18-05, paragraphs 5 and 14c). (Priority: marlins and sailfish). Propose to have a two-day workshop to discuss the standard of billfish maturity staging intersessionally prior to the next WPB. Funding are needed to support the workshop participation of CPCs and expert(s) on billfish reproduction (expecting to have confirmation from the host organization).					
3. Stock structure (connectivity and diversity)	Tagging research (PSAT tags) to determine connectivity, movement rates and mortality estimates of billfish (Priority species: swordfish). Similar projects have been partially funded by EU, with a focus on epipelagic species. More tags are needed for swordfish.					
Other Future Research Requirements (not in order of priority)						
1. Biological and ecological information (incl. parameters for stock assessment and provide answers to the Commission)	1.1 Age and growth research 1.1.1 CPCs to provide further research 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, port sampling or other research programs. (Priority: all billfishes: swordfish, marlins and sailfish)					

	1.2 Spawning time and locations	
	1.2.1 Collect gonad samples from billfish to confirm the spawning time and location of the spawning area that are presently hypothesized for each billfish species. This will also provide advice to the Commission on the request for alternative management measures (Res. 18-05, paragraph 6). Partially supported by EU, on-going support and collaboration from CPCs are required.	
2. Historical data review	2.1 Changes in fleet dynamics	
	2.1.1 Continue the work with coastal countries to address recent changes and/or increases of marlins catches especially in some coastal fleets. 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 and very high increases in some species (e.g., black marlin mainly due to very high catches reported by India in recent years). The possibility of producing alternative catch histories should also be explored. Priority countries: India, Pakistan, Iran, I.R., Indonesia.	
	2.2 Species identification	
	2.2.1 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. Consider the application of DNA-Barcoding technology for billfish species identification.	
	2.3 Tagging data recovery from alternate sources (e.g. Billfish foundation) to supplement IOTC tagging database information.	
3. Observer Training to improve data collection for billfish (and other) species	3.1 Training for observers with respect to billfish species identification, various length measurements and biological sampling (gonads, spines and otoliths).	
4. CPUE standardization	4.1 Develop and/or revise standardized CPUE series for each billfish species and major fisheries/fleets for the Indian Ocean.	

	4.1.1 Swordfish: Priority LL fleets: Taiwan,China, EU(Spain, Portugal, France), Japan, Indonesia, South African					
	4.1.2 Striped marlin: Priority fleets: Japan, Taiwan,China					
	4.1.3 Black marlin: Priority fleets: Longline: Taiwan,China; Gillnet: I.R. Iran, Sri Lanka, Indonesia					
	4.1.4 Blue marlin: Priority fleets: Japan, Taiwan,China, Indonesia					
	4.1.5 I.P. Sailfish: Priority fleets: Priority gillnet fleets: I.R. Iran and Sri Lanka; Priority longline fleets: EU(Spain, Portugal, France), Japan, Indonesia;					
	4.1.6 Joint analysis of operational catch and effort data from Indian Ocean longline fleets as recommended by WPM					
5. Stock assessment / Stock indicators	5.1 Workshops on techniques for assessment including CPUE estimations for billfish species in 2021 and 2022. Priority fleets: Gillnet fisheries					
6. Target and Limit reference points	6.1 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.					
7. Management measure options	7.1 To advise the Commission, on potential management measures having been examined through the Management Strategy Evaluation (MSE) process.					
	7.1.1 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.					

APPENDIX 35D
WORKING PARTY ON ECOSYSTEMS AND BYCATCH PROGRAM OF WORK (2021 – 2025)

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

Topic in order of priority	**Sub-topic and project**	Timing				
		2021	2022	2023	2024	2025
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. This may include Next Generation Sequencing (NGS), Nuclear markers (i.e. microsatellite) as well as other components of close-kin mark recapture studies (CKMR).					
2. Connectivity, movements, habitat use and post release mortality	Electronic tags (PSATs, SPOT, Splash MiniPAT) to assess the efficiency of management resolutions on non-retention species (BSH in LL, marine turtles and rays in GIL and PS, whale sharks) and to determine connectivity, movement rates and mortality estimates.					
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))					
	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. Research started in Sri Lanka. Could look at IOTC priority species					
	3.3 Reproduction research Priority species: blue shark (BSH), shortfin mako shark (SMA) and oceanic whitetip shark (OCS), and silky shark (FAL)					
	3.4 Ecological Risk Assessment (cetaceans)					

Other Future Research Requirements (not in order of priority)

Topic	Sub-topic and project	2021	2022	2023	2024	2025
1. Fisheries data collection	1.1 Historical data mining for the key species and IOTC fleets (e.g. as artisanal gillnet and longline coastal fisheries) including (Workshops – leader?):					
	1.1.1 Capacity building of fisheries observers (including the provision of ID guides, training, etc. Fishing gear guides from SPC)					
	1.1.2 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					
	1.2 Implementation of the Pilot Project (Resolution 16/04) for the Regional Observer Scheme					

	1.2.1 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)					
	1.2.2 Development of a Regional Observer database and population with historic observer data					
	1.2.3 Development, piloting and implementation of an electronic reporting tool to facilitate data reporting					
	1.2.4 Development and trial of Electronic Monitoring Systems for gillnet fleets					
	1.2.5 Port sampling protocols for artisanal fisheries					
	1.3 Review the status of manta and mobula rays and their interaction with IOTC fisheries. Evaluation of data availability and data gaps. Include ID guide revision and translation. ID guides to be updated with help of CPC scientists					
4. Bycatch mitigation measures	Develop studies on bycatch mitigation measures (operational, technological aspects and best practices)					
	4.1 Sharks a) Harmonise and finalise guidelines and protocols for safe handling and release of sharks and rays caught on longlines and gillnets fisheries					
	4.2 Sea turtles 4.2.1 Res. 12/04 (para. 11) Part I. The IOTC Scientific Committee shall request the IOTC Working Party on Ecosystems and Bycatch to:					
	a) Develop recommendations on appropriate mitigation measures for gillnet, longline and purse seine fisheries in the IOTC area; [mostly completed for LL and PS]					
	b) Develop regional standards covering data collection, data exchange and training					

	4.2.2 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.					
	4.2.3 Regional workshop to review the effectiveness of marine turtle mitigation measures					
	4.3 Seabirds 4.3.1 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.					
	4.3.2 Bycatch assessment for seabirds taking into account the information from the various ongoing initiatives in the IO and adjacent oceans					
	4.3.3 Study on cryptic mortality of seabirds in tuna LL fisheries.					

	4.3.4 Post release survival rates for seabirds and review of safe release techniques.					
	4.4 Cetaceans 4.4.1 Collate all data available on bycatch of key species interacting with all tuna fisheries in the IOTC area (tuna drift gillnets, longlines, purse seines)					
	4.4.2 Collaborate with other organisations on the assessment of marine mammal abundance and collect data on marine mammal bycatch interactions with gillnets across the IOTC region					
	4.4.3 Testing mitigation methods for cetacean bycatch in tuna drift gillnet fisheries					
	4.4.4. Intersessional meeting to discuss cetacean guidelines, ERA, Data gaps.					
5. CPUE standardisation / Stock Assessment / Other indicators	5.1 Develop standardised CPUE series for each key shark species and fishery in the Indian Ocean					
	5.1.1 Development of CPUE guidelines for standardisation of CPC data.					
	5.1.2 Blue shark: Priority fleets: TWN,CHN LL, EU,Spain LL, Japan LL; Indonesia LL; EU,Portugal LL					
	5.1.3 Shortfin mako shark: Priority fleets: Longline and Gillnet fleets					

	5.1.4 Oceanic whitetip shark: Priority fleets: Longline fleets; purse seine fleets					
	5.1.5 Silky shark: Priority fleets: Purse seine fleets					
	5.2 Joint CPUE standardization across the main LL fleets for silky shark, using detailed operational data					
	5.3 Stock assessment and other indicators					
6. Bycatch and discards	6.1 Review proposal on retention of non-targeted species					
	6.1.1 The Commission requested that the Scientific Committee review proposal IOTC–2014– S18–PropL Rev_1, and to make recommendations on the benefits of retaining non-targeted species catches, other than those prohibited via IOTC Resolutions, for consideration at the 19th Session of the Commission. (S18 Report, para. 143). Noting the lack of expertise and resources at the WPEB and the short timeframe to fulfil this task, the SC RECOMMENDED that a consultant be hired to conduct this work and present the results at the next WPEB meeting. The following tasks, necessary to address this issue, should be considered for the terms of reference, taking into account all species that are usually discarded on all major gears (i.e., purse-seines, longlines and gillnets), and fisheries that take place on the high seas and in coastal countries EEZs:					
	i) Estimate species-specific quantities of discards to assess the importance and potential of this new product supply, integrating data available at the Secretariat from the regional observer programs,					

	ii) Assess the species-specific percentage of discards that is captured dead versus alive, as well as the post-release mortality of species that are discarded alive, in order to estimate what will be the added fishing mortality to the populations, based on the best current information, iii) Assess the feasibility of full retention, taking into account the specificities of the fleets that operate with different gears and their fishing practices (e.g., transhipment, 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.					
7. Ecosystems	10.1 Develop a plan for Ecosystem Approach to Fisheries (EAF) approaches in the IOTC, in conjunction with the Common Oceans Tuna Project.					
	7.1.2 Workshop for CPCs on continuing efforts to the development of an EAF including delineation of candidate eco regions within IOTC.					
	7.1.3 Practical Implementation of EBFM with the development and testing of ecosystem report cards.					

7.1.4 Evaluation of EBFM plan in IOTC area of competence by the WPEB to review its elements components and make any corrective measures.					
7.2 Assessing the impacts of climate change and socio-economic factors on IOTC fisheries					
7.3 Evaluate alternative approaches to ERAs to assess ecological risk					
7.4 Progress on Climate webpage on IOTC website and liaise with WPDCS for technical implementation					

APPENDIX 35E
WORKING PARTY ON TROPICAL TUNAS PROGRAM OF WORK (2021 – 2025)

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

Topic in order of priority	Sub-topic and project	TIMING				
		2021	2022	2023	2024	2025
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), ii. Tagging data: Further analysis of the tag release/recovery data set. iii. Organisation of expert group to investigate tagging mortality iv. Re-estimation of M using updated tagging data.					
Fisheries Independent Monitoring	i. Scoping study to investigate 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). It would be valuable to conduct a scoping exercise to evaluate the applicability to the tropical tuna species					
CPUE standardisation	Develop standardised CPUE series for each tropical tuna fleet/fishery for the Indian Ocean					

Other Future Research Requirements (not in order of priority)						
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.					
	1.1.1 Population genetic analyses to decipher intraspecific connectivity, levels of gene flow, genetic divergence and effective population sizes based on genome-wide distributed Single Nucleotide Polymorphisms (SNPs).					
	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).					
		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.					
2.	Biological and ecological information (incl. parameters for stock assessment)	2.1 Biological sampling					
		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.					
		2.1.2 Collect gonad samples from tropical tunas to confirm the spawning periods and location of the spawning area that are presently hypothesized for each tropical tuna species.					
3.	Historical data review	3.1 Changes in fleet dynamics need to be documented by fleet					
		3.1.1 Provide an evaluation of fleet-specific fishery impacts on the stock of bigeye tuna, skipjack tuna and yellowfin tuna. Project potential impact of realizing fleet development plans on the status of tropical tunas based upon most recent stock assessments.					
4	CPUE standardisation	4.1 Develop standardised CPUE series for each tropical tuna fleet/fishery for the Indian Ocean					

	4.1.1 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					
	4.1.2 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.					
	4.1.3 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.					
	4.1.4 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.					
	Bigeye tuna: High priority fleets					
	Skipjack tuna: High priority fleets					
	Yellowfin tuna: High priority fleets					
	4.1.5 Gillnet CPUE standardization including further investigate and use of gillnet CPUE series from Sri Lankan gillnet fishery					
	4.1.6 Workshops to assist in standardising CPUEs for tropical tuna fleets					
	4.2 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 IOTC-2017-WPTT19-R).					
	4.3 Investigate the potential to use the Indian longline survey as a fishery-independent index of abundance for tropical tunas.					
5 Stock assessment / stock indicators	5.1 Develop and compare multiple assessment approaches to determine stock status for tropical tunas 5.2 Scoping of ongoing age composition data collection for stock assessment					

		5.3 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 IOTC-2017-WPTT19-R).					
6	Fishery independent monitoring	6.1 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: ii. Acoustic FAD monitoring, with the objective of deriving abundance indices based on the biomass estimates provided by echo-sounder buoys attached to FADs iii. Longline-based surveys (expanding on the Indian model) or “sentinel surveys” in which a small number of commercial sets follow a standardised scientific protocol iv. Aerial surveys, potentially using remotely operated or autonomous drones v. Studies (research) on flux of tuna around anchored FAD arrays to understand standing stock and independent estimates of the stock abundance. vi. Scoping study to investigate 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 vii. Investigate the possibility of conducting ongoing ad hoc, low level tagging in the region					
7	Target and Limit reference points	7.1 To advise the Commission, on Target Reference Points (TRPs) and Limit Reference Points (LRPs). Used when assessing tropical tuna stock status and when establishing the Kobe plot and Kobe matrices					

APPENDIX 35F
WORKING PARTY ON DATA COLLECTION AND STATISTICS PROGRAM OF WORK (2021 – 2025)

Table 1. Priority topics for obtaining the information necessary to deliver the necessary advice to the Commission.

Topic	Sub-topic and project	Priority ranking	Timing				
			2021	2022	2023	2024	2025
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:	3					
	• Coastal fisheries of Indonesia						
	• Coastal fisheries of Kenya						
	• Coastal fisheries of Somalia						
	• Coastal fisheries of Pakistan						
	• Coastal fisheries of Sri Lanka						
	• Coastal fisheries of I.R. Iran						
2. Compliance with IOTC Data Requirements	2.1 Data support missions						
	2.1.1 Drafting 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:						
	• Indonesia						
	• Pakistan						
	• India						

		• Sri Lanka						
		• Somalia						
3.	IOTC Data access	**3.1** Improving discoverability of IOTC scientific assets through standard metadata and DOIs						
4.	ROS – Support for the implementation of the IOTC Regional Observer Scheme	**4.1** ROS tools						
		4.1.1 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						
		4.2 ROS Regional Database						
		4.2.1 Incorporate all historical observer data currently available in other proprietary data formats (e.g. ObServe, ICCAT ST09 and other custom observer forms)						
		4.2.2 Implement dissemination best-practices for all data collected by the ROS Regional Database						
		4.3 ROS Electronic Monitoring Systems						
		4.3.1 Implement pilot EMS system on gillnet / coastal longline vessels for fleets insufficiently covered by on-board observers possibly by providing support through remote meetings until travel bans are lifted						
		4.3.2 Ad-hoc Working Group on EMS programme standards, including workshops (in person / virtual, depending on the case)	1					
		4.4 Evaluate the combination of alternative data collection systems and protocols for the collection of scientific observer data for artisanal and coastal fisheries, with an initial expert workshop (in person / virtual, depending on the case) to develop protocols and guidelines for minimum data collection requirements in small-scale, artisanal and coastal fisheries.	2					

APPENDIX 35G
WORKING PARTY ON METHODS PROGRAM OF WORK (2021 – 2025)

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	Timing				
		2021	2022	2023	2024	2025
1. Management Strategy Evaluation	Continuation of Management Strategy Evaluation for Albacore, Skipjack, Yellowfin, Bigeye tunas as well as Swordfish					
Future Research Requirements (not in order of priority)						
Management Strategy Evaluation	1.1 Albacore					
	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 (2022 or date TBD)					
	1.1.5 Evaluation of new set of Management Procedures (if required)					
	1.2 Skipjack tuna					
	1.2.1 Revision and adaptation of framework for simulation evaluations of MPs. Moving from HCR to fully specified MP.					
	1.2.2 Develop revised production model for inclusion in simulation framework					
	1.2.3 Condition OM on updated assessment model from 2020.					

	1.2.4 Revision of Management Procedures and Indicators after presentation of initial set to TCMP and Commission					
	1.3 Bigeye tuna					
	1.3.1 Update OM & present preliminary MP results to TCMP, WPTT/WPM review of new OM					
	1.3.2 External peer review (2021 or date TBC)					
	1.3.3 Present revised MP results to TCMP with target adoption date of 2022					
	1.3.4 Additional iterations if required					
	1.4 Yellowfin tuna					
	1.4.1 Update OM & present preliminary MP results to TCMP, WPTT/WPM review of new OM					
	1.4.2 External peer review (2020 or date TBD)					
	1.4.3 Present revised MP results to TCMP with target adoption date of 2021; iteratively update development if required)					
	1.4.4 additional iterations if required					
	1.5 Swordfish					
	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					
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*)					
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)					

APPENDIX 36
SCHEDULE OF STOCK ASSESSMENTS FOR IOTC SPECIES AND SPECIES OF INTEREST FROM 2020–2025, AND FOR OTHER WORKING PARTY PRIORITIES

Working Party on Neritic Tunas					
Species	**2021***	**2022****	**2023***	**2024****	**2025***
Bullet tuna	**Assessment**	Data preparation	Data preparation	**Assessment**	Data preparation
Frigate tuna	**Assessment**	Data preparation	Data preparation	**Assessment**	Data preparation
Indo-Pacific king mackerel	**Assessment**	Data preparation	Data preparation	**Assessment**	Data preparation
Kawakawa	Data preparation	Data preparation	**Assessment**	Data preparation	Data preparation
Longtail tuna	Data preparation	Data preparation	**Assessment**	Data preparation	Data preparation
Narrow-barred Spanish mackerel	Data preparation	Data preparation	**Assessment**	Data preparation	Data preparation

* Including data-limited stock assessment methods;
** Including species-specific catches, CPUE, biological information and size distribution as well as identification of data gaps and discussion of improvements to the assessments (stock structure);
Note: the assessment schedule may be changed dependent on the annual review of fishery indicators, or SC and Commission requests

Working Party on Billfish					
Species	**2021**	**2022**	**2023**	**2024**	**2025**
Black marlin	**Full assessment**			**Full assessment**	
Blue marlin		**Full assessment**			**Full assessment**
Striped marlin	**Full assessment**			**Full assessment**	
Swordfish		**Indicators****	**Full assessment**		**Indicators****
Indo-Pacific sailfish		**Full assessment***			**Full assessment***

* Including data poor stock assessment methods; Note: the assessment schedule may be changed depending on the annual review of fishery indicators, or SC and Commission requests.
** Including biological parameters, standardized CPUE, and other fishery trends

Working Party on Tropical Tunas					
Species	**2021**	**2022**	**2023**	**2024**	**2025**
Bigeye tuna	Indicators	**Data preparatory meeting** **Full assessment**	Indicators	Indicators	**Data preparatory meeting** **Full assessment**
Skipjack tuna	Indicators	Indicators	**Data preparatory meeting** **Full assessment**	Indicators	Indicators
Yellowfin tuna	**Data preparatory meeting** **Full assessment**	Indicators	Indicators	**Data preparatory meeting** **Full assessment**	Indicators
Working Party on Ecosystems and Bycatch					
Species	**2021**	**2022**	**2023**	**2024**	**2025**
Blue shark	Data preparatory meeting Full assessment	-	–	–	Data preparatory meeting Full assessment
Oceanic whitetip shark	–	Indicator analysis	–	Data preparation	Indicator analysis
Scalloped hammerhead shark	–	Assessment*	–	–	–
Shortfin mako shark	–	–		Data preparation Full assessment	–
Silky shark	Data preparatory meeting Assessment*;	-	–	Assessment*;	–
Bigeye thresher shark	–	Assessment*		–	–
Pelagic thresher shark	–	Assessment*		–	–
Porbeagle shark	–	–	Assessment*	–	–
Mobulid Rays				Interactions/ Indicators	–
Marine turtles	–	–	Indicators	–	–

Seabirds	–	Review of mitigation measures in Res. 12/06	–	–	–
Marine Mammals	Review of mitigation measures in Res. 12/13/04	–	–	–	Review of mitigation measures
Ecosystem Based Fisheries Management (EBFM) approaches	ongoing	ongoing	ongoing	ongoing	ongoing

*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	**2020**	**2021**	**2022**	**2023**	**2024**
Albacore		Review of previous assessment and preparation for next assessment	**Data preparatory meeting** **Full assessment**	–	–

APPENDIX 37
SCHEDULE OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE MEETINGS
(2021 and 2022)

	2021			2022		
Meeting	**No.**	**Date**	***Location**	**No.**	**Date**	***Location**
Working Party on **Ecosystems and Bycatch** (WPEB) BSH Data Preparatory Meeting	17th	12-14 April	TBC	18th	NA	NA
Working Party on **Temperate Tunas**	08th	8 - 10 November (TBC)	TBC	9th	TBC	TBC
Working Party on **Tropical Tunas (Data Preparatory meeting)**	23rd	10-14 May	TBC	24th	TBC	TBC
Working Party on **Neritic Tunas**	11th	5-9 July	TBC	12th	TBC	TBC
Working Party on **Ecosystems and Bycatch** (WPEB)	17th	6-10 September (5d)	TBC	18th	TBC	TBC
Working Party on **Billfish** (WPB)	19th	13-16 September (4d)	TBC	20th	TBC	TBC
Ad hoc Working Group on FADs (WGFAD)	2nd	4-6 October	TBC	3rd	TBC	TBC
Working Party on **Methods**	12th	18-20 October (3d)	TBC	13th	October (3d)	TBC
Working Party on **Tropical Tunas** (Assessment meeting)	23rd	21-26 October (6d)	TBC	24th	October (6d)	TBC
Working Party on **Data Collection and Statistics**	17th	1-3 December (3d)	TBC	18th	November (3d)	TBC
Scientific Committee	24th	6-10 December (5d)	TBC	25th	December (5d)	TBC

*Due to the Covid-19 crisis and the cancellation of physical meetings for the foreseeable future, offers to host meetings in 2021 were not requested or accepted. Should the situation change, the Secretariat will work with Member countries to determine hosting of these meetings.

APPENDIX 38
CONSOLIDATED SET OF RECOMMENDATIONS OF THE 23RD SESSION OF THE SCIENTIFIC COMMITTEE (7 – 11 DECEMBER 2020) TO THE COMMISSION

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

Tuna – Highly migratory species

SC23.01 (para. 130) 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 2020 (Fig. 1):

- Albacore (*Thunnus alalunga*) – Appendix 8
- Bigeye tuna (*Thunnus obesus*) – Appendix 9
- Skipjack tuna (*Katsuwonus pelamis*) – Appendix 10
- Yellowfin tuna (*Thunnus albacares*) – Appendix 11

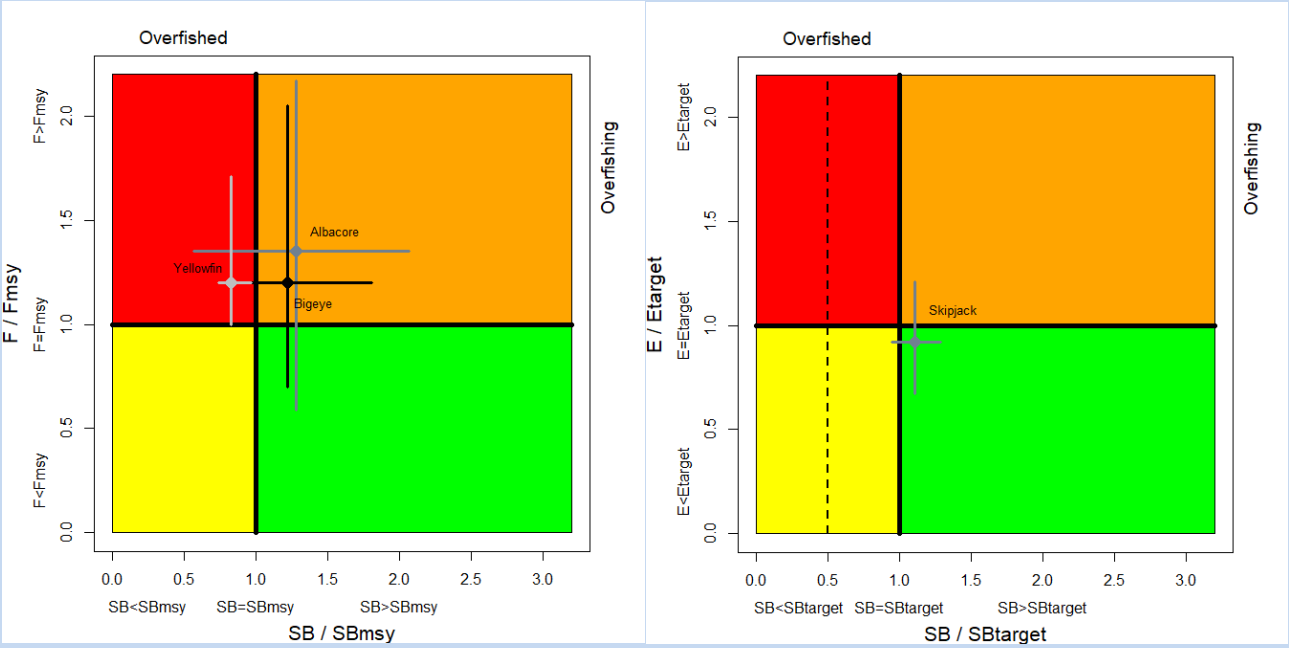

Fig. 1. (Left) Combined Kobe plot for bigeye tuna (black: status in 2018, based on the assessment conducted in 2019), and yellowfin tuna (light grey: 2017, with assessment conducted in 2018) and albacore (dark grey: 2017 with assessment conducted in 2019) showing the estimates of current spawning biomass (SB) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality. (Right) Kobe plot for skipjack tuna (assessment conducted in 2020) showing the estimates of the current stock status (The dashed line indicates the limit reference point at 20%SB0 while SBtarget=0.4 SB0). Cross bars illustrate the range of uncertainty from the model runs with an 80% CI (95% CI for albacore).

Billfish

SC23.02 (para. 133) 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 2020 (Fig. 3):

- Swordfish (*Xiphias gladius*) – Appendix 12
- Black marlin (*Makaira indica*) – Appendix 13
- Blue marlin (*Makaira nigricans*) – Appendix 14
- Striped marlin (*Tetrapturus audax*) – Appendix 15
- Indo-Pacific sailfish (*Istiophorus platypterus*) – Appendix 16

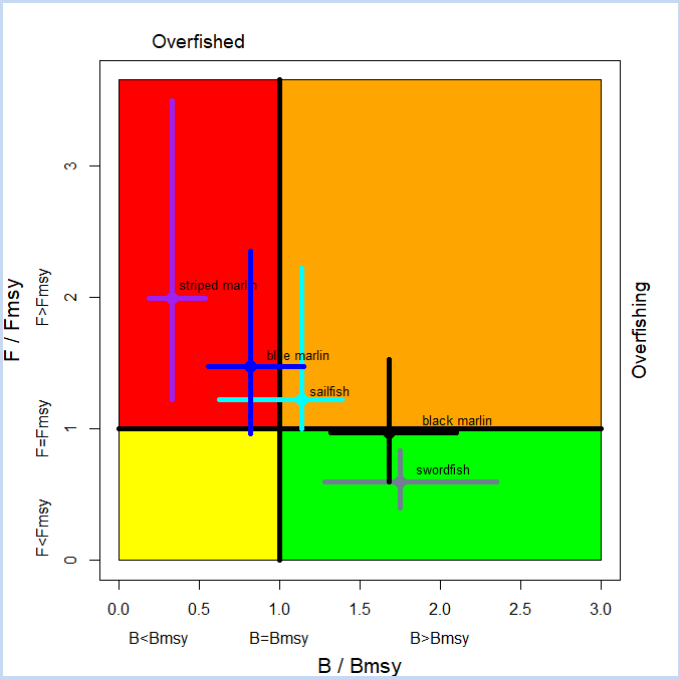

Fig. 3. Combined Kobe plot for swordfish (2018 with assessment conducted in 2020, grey), Indo-Pacific sailfish (2017 with assessment conducted in 2019, cyan), black marlin (2017 with assessment conducted in 2018, black), blue marlin (2017 with assessment conducted in 2019, blue) and striped marlin (2017 with assessment conducted in 2018, purple) showing the estimates of current stock size (SB or B, species assessment dependent) and current fishing mortality (F) in relation to optimal biomass and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs.

Tuna and seerfish – Neritic species

SC23.03 (para. 132) 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 2020 (Fig. 2):

- Bullet tuna (*Auxis rochei*) – Appendix 17
- Frigate tuna (*Auxis thazard*) – Appendix 18
- Kawakawa (*Euthynnus affinis*) – Appendix 19
- Longtail tuna (*Thunnus tonggol*) – Appendix 20
- Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix 21
- Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix 22

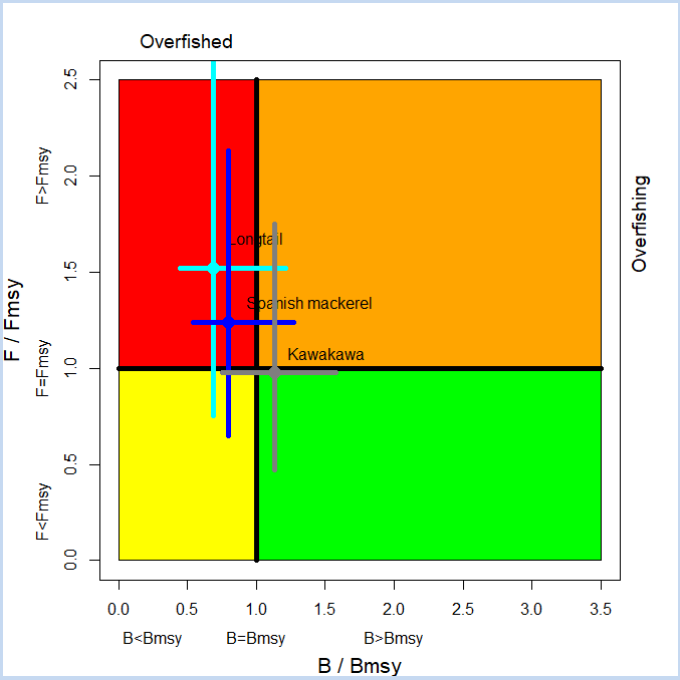

Fig. 2. Combined Kobe plot for longtail tuna, narrow-barred Spanish mackerel and kawakawa, showing the estimates of stock size (B) and current fishing mortality (F) in 2018 (assessment conducted in 2020) in relation to optimal spawning stock size and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs.

Sharks

SC23.04 (para. 134) 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 23
- Oceanic whitetip shark (*Carcharhinus longimanus*) – Appendix 24
- Scalloped hammerhead shark (*Sphyrna lewini*) – Appendix 25
- Shortfin mako shark (*Isurus oxyrinchus*) – Appendix 26
- Silky shark (*Carcharhinus falciformis*) – Appendix 27
- Bigeye thresher shark (*Alopias superciliosus*) – Appendix 28
- Pelagic thresher shark (*Alopias pelagicus*) – Appendix 29

Marine turtles

SC23.05 (para. 135) 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 30

Seabirds

SC23.06 (para. 136) 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 31

Marine Mammals

SC23.07 (para. 137) 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 32

GENERAL RECOMMENDATIONS TO THE COMMISSION

NATIONAL REPORTS FROM CPCS

SC23.08 (para. 31) **NOTING** that the Commission, at its 15th Session (in 2011), 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 2020, 25 reports were provided by CPCs (23 in 2019, 26 in 2018, 23 in 2017, 23 in 2016, 26 in 2015) (Table 2).

SC23.09 (para. 32) The SC **RECOMMENDED** that the Compliance Committee and Commission note the lack of compliance by 6 Contracting Parties (Members) and 2 Cooperating Non-Contracting Party (CNCPs) that did not submit a National Report to the Scientific Committee in 2020, noting that the Commission agreed that the submission of the annual reports to the Scientific Committee is mandatory

REPORT OF THE 15TH SESSION OF THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH (WPEB15)

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

SC23.10 (para. 59) 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 5, recalling that the IPOA-Seabirds and IPOA-Sharks were adopted by the FAO in 1999 and 2000, respectively, and recommended the development of NPOAs.

REPORT OF THE 2ND SESSION OF THE WORKING PARTY ON TROPICAL TUNAS (WPTT22)

Skipjack tuna Stock Assessment

SC23.11 (para. 78) The SC **NOTED** that the reference points for skipjack tuna are defined with respect to unfished spawning biomass only in resolution 16/02; nonetheless the notation is in terms of B (total exploitable biomass) instead of SB (spawning biomass). Although the resolution also specified Etarg (annual equilibrium exploitation rate associated with the unfished target spawning biomass), it was intended as a control parameter for the harvest control rule, rather than as an explicit target. Meanwhile Resolution 16/02 did not define a limit exploitation rate (Elim). The SC further **NOTED** that resolution 15/10 had specified a default depletion-based target and limit fishing mortality rate but it was discussed whether these are appropriate for skipjack tuna (the default values are defined only when MSY-based reference points can not be estimated robustly according to 15/10). As such the SC **RECOMMENDED** that the skipjack MSE project to revisit these reference points, including to investigate the plausibility of establishing a limit reference point for fishing mortality (or exploitation rate).) and to evaluate the .differences on the catch forecasts by using total biomass instead of spawning biomass in the HCR.

REPORT OF THE 16TH SESSION OF THE WORKING PARTY ON DATA COLLECTION AND STATISTICS (WPDCS16)

SC23.12 (para. 107) Furthermore, the SC **RECOMMENDED** the Commission to consider how to best take into account the confidentiality aspects inherent to such a dataset (e.g. through updates to Res. 12/02) while at the same time ensuring proper attribution of its ownership. (Refer to paras. 104 and 106 for qualifying details on this Recommendation)

SC23.13 (para. 109) **ACKNOWLEDGING** a potential lack of clarity in the current definition of "For reporting (Optional)" data elements in the context of the ROS minimum standard data fields, the SC **RECOMMENDED** that the Commission require CPCs to report such fields to the IOTC Secretariat (as part of their regular ROS data submissions) when these are available to the national observer programmes.

SC23.14 (para. 111) For this reason, the SC **RECOMMENDED** that an ad-hoc, intersessional Working Group on the development of EM Programme Standard be constituted and physical or virtual workshops

(depending on the circumstances) be held to further progress with the definition of EMS minimum standards.

SUMMARY DISCUSSION OF MATTERS COMMON TO WORKING PARTIES (CAPACITY BUILDING ACTIVITIES – STOCK ASSESSMENT COURSE; CONNECTING SCIENCE AND MANAGEMENT, ETC.)

Invited Expert(s) at the WP meetings

SC23.15 (para. 114) Given the importance of external independent review for working party meetings, the SC **RECOMMENDED** the Commission continues to allocate sufficient budget for invited scientific experts to be regularly invited to scientific working party meetings.

Meeting participation fund

SC23.16 (para. 116) 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

SC23.17 (para. 117) 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.

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

SC23.18 (para. 118) 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 7.

PROGRAM OF WORK AND SCHEDULE OF WORKING PARTY AND SCIENTIFIC COMMITTEE MEETINGS

Consultants

SC23.19 (para. 163) Noting the highly beneficial and relevant work done by IOTC stock assessment consultants 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.

REVIEW OF THE DRAFT, AND ADOPTION OF THE REPORT OF THE 23RD SESSION OF THE SCIENTIFIC COMMITTEE

SC23.20 (para. 168) The SC **RECOMMENDED** that the Commission consider the consolidated set of recommendations arising from SC23, provided at Appendix 38.