Report of the 26th Session of the IOTC Scientific Committee

India, 4 – 8 December 2023

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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
CKMR	Close-Kin-Mark-Recapture
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 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 stock Biomass (sometimes expressed as SSB)
SB_{MSY}	Spawning stock Biomass which produces MSY
SC	Scientific Committee (of the IOTC)
SCAF	Standing Committee on Administration and Finance (of the IOTC)
SE	Standard Error
SWIOFC	South West Indian Ocean Fisheries Commission
SS3	Stock Synthesis III
SSB	Spawning stock biomass
TAC	Total Allowable Catch
TAE	Total Allowable Effort
Taiwan,China	Taiwan, Province of China
TCAC	Technical Committee on Allocation Criteria
TCMP	Technical Committee on Management Procedures
tRFMO	tuna Regional Fisheries 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 26th Session of the Indian Ocean Tuna Commission (IOTC) Scientific Committee (SC) was held in Mumbai India and online, from 4 – 8 December 2023. A total of 106 delegates and other participants attended the Session (129 in 2022), comprised of 92 delegates (104 in 2022) from 21 Contracting Parties with no delegates from Cooperating Non-Contracting Parties (0 in 2022), and 14 participants from 11 observer organisations (including the invited experts). The meeting was opened by Mr. Parshottam Rupala, Hon'ble Minister of Fisheries, Animal Husbandry & Dairying, Government of India, Dr. Abhilaksh Likhi, Secretary, Department of Fisheries, Government of India, Ms. Neetu Kumari Prasad, Joint Secretary (Marine Fisheries), Department of Fisheries, Government of India and Shri. Pankaj Kumar, Commissioner of Fisheries, Government of Maharashtra. It was chaired by the Chairperson, Dr Toshihide Kitakado (Japan). The list of participants is provided at Appendix 1.

The following are the recommendations regarding stock status from the 26th Session of the Scientific Committee. The full list of recommendations is provided in Appendix 38.

Tuna – Highly migratory species

SC26.01 (para. 159) 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 2022 (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

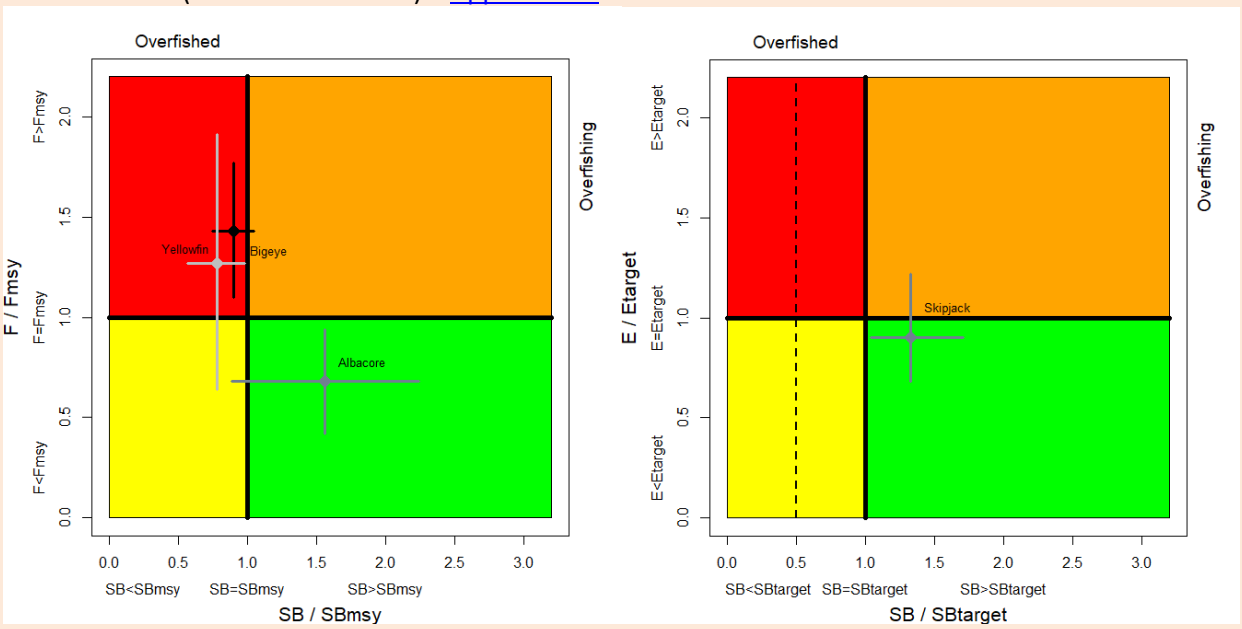

Fig. 1. (Left) Combined Kobe plot for bigeye tuna (black: status in 2021, with assessment conducted in 2022), and yellowfin tuna (light grey: 2020, with assessment conducted in 2021) and albacore (dark grey: 2020 with assessment conducted in 2022) showing the estimates of current spawning biomass (SB) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality. (Right) Kobe plot for skipjack tuna (2022 with assessment conducted in 2023) 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).

Tuna and seerfish – Neritic species

SC26.02 (para. 161) The SC **RECOMMENDED** that the Commission note the management advice developed for each neritic tuna (andseerfish) 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 2022 (Fig. 2):
Bullet tuna (*Auxis rochei*) – Appendix 12
Frigate tuna (*Auxis thazard*) – Appendix 13
Kawakawa (*Euthynnus affinis*) – Appendix 14
Longtail tuna (*Thunnus tonggol*) – Appendix 15
Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix 16

Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix 17

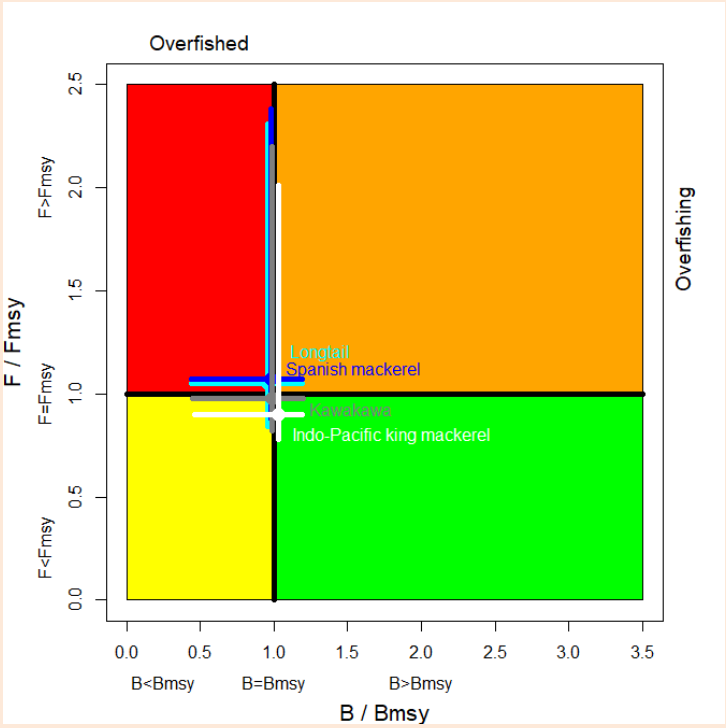

Fig. 2. Combined Kobe plot for longtail tuna (cyan), narrow-barred Spanish mackerel (blue), kawakawa (grey) (all for 2021 with assessment conducted in 2023) and Indo-Pacific king mackerel (2019 with assessment conducted in 2021 (white)), showing the estimates of stock size (B) and current fishing mortality (F) in relation to optimal biomass and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs. Given unresolved uncertainty in the assessment, status for bullet tuna, frigate tuna and Narrow-barred Spanish mackerel should be interpreted with caution.

Billfish

SC26.03 (para. 162) 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 2023 (Fig. 3):
Black marlin (*Istiompax indica*) – Appendix 18
Blue marlin (*Makaira nigricans*) – Appendix 19
Striped marlin (*Kajikia audax*) – Appendix 20
Indo-Pacific sailfish (*Istiophorus platypterus*) – Appendix 21
Swordfish (*Xiphias gladius*) – Appendix 22

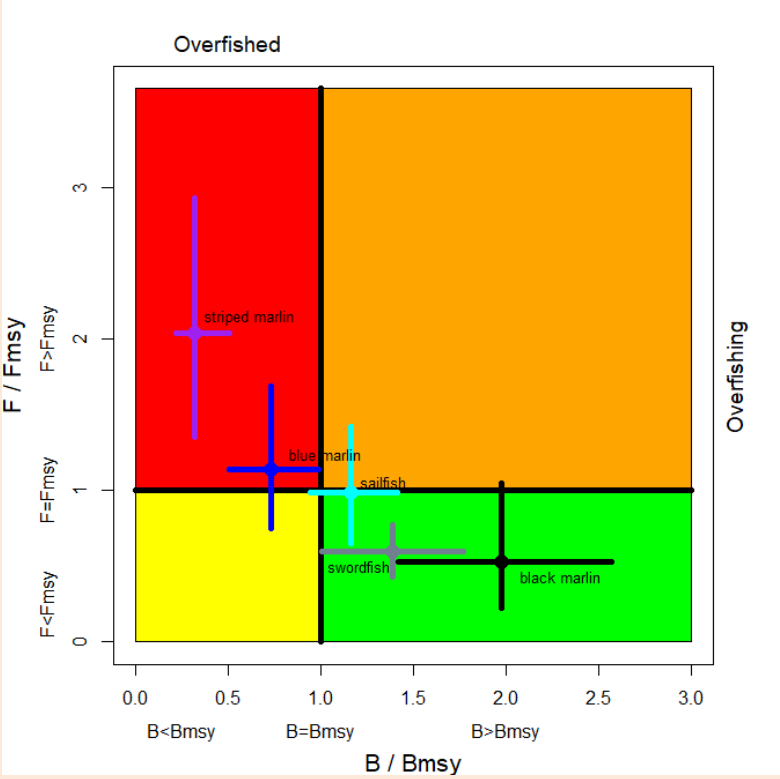

Fig. 3. Combined Kobe plot for swordfish (2021 with assessment conducted in 2023, grey), Indo-Pacific sailfish (2019 with assessment conducted in 2022, cyan), black marlin (2019 with assessment conducted in 2021, black), blue marlin (2020 with assessment conducted in 2022, blue) and striped marlin (2019 with assessment conducted in 2021, purple) showing the estimates of current stock size (SB or B, species assessment dependent) and current fishing mortality (F) in relation to optimal stock size and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs. Given unresolved uncertainty in the assessment, status for black marlin is uncertain.

Sharks

SC26.04 (para. 163) 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

SC26.05 (para. 164) 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

SC26.06 (para. 165) 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

SC26.07 (para. 166) 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

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. (NOTE: the year column indicates the year the stock status was determined, not the terminal year of the assessment model)

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		2019	2020	2021	2022	2023	Advice to the Commission
Albacore *Thunnus alalunga*	Catch (2022) (t) Mean annual catch (2018-2022) (t) MSY (x1,000 t) (95% CI) F_{MSY} (80% CI) SB_{MSY} (x1,000 t) (80% CI) F_{2020} / F_{MSY} (80% CI) SB_{2020} / SB_{MSY} (80% CI) SB_{2020} / SB_0 (80% CI)	46,625 40,740 45 (35-55) 0.18 (0.15-0.21) 27 (21-33) 0.68 (0.42-0.94) 1.56 (0.89-2.24) 0.36 (0.26-0.45)				**85%**		No new stock assessment was carried out for albacore in 2023, thus the stock status is determined on basis of the 2022 assessment. 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 2022 is based on the model developed in 2019 with a series of revisions that were noted during the WPTmT data preparatory meeting held in April 2022. There are some noticeable changes compared to the previous assessment data set, mainly related to how the fisheries are structured, and how the CPUE indices and length composition data are treated within the assessment model. Changes in stock status since the previous assessment are mainly due to changes in the CPUE. Thus, the stock status in relation to the Commission's interim B_{MSY} and F_{MSY} target reference points indicates that the stock is **not overfished** and is **not subject to overfishing** Click here for full stock status summary: Appendix 8
Bigeye tuna *Thunnus obesus*	Catch in 2022 (t) Average catch 2018-2022 (t) MSY (1,000 t) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 t) (80% CI) F_{2021} / F_{MSY} (80% CI) SB_{2021} / SB_{MSY} (80% CI) SB_{2021} / SB_0 (80% CI)	102,266 92,687 96 (83 –108) 0.26 (0.18–0.34) 513 (332–694) 1.43 (1.10–1.77) 0.90 (0.75–1.05) 0.25 (0.23–0.27)	**38%**			**79%**		No new stock assessment was carried out for bigeye tuna in 2023 and so the advice is based on the 2022 assessment. Two models were applied to the bigeye stock (Statistical Catch at Size (SCAS) and Stock Synthesis (SS3)), with the SS3 stock assessment selected to provide scientific advice. The reported stock status is based on a grid of 24 model configurations designed to capture the uncertainty on stock recruitment relationship, longline selectivity, growth and natural mortality. On the weight-of-evidence available in 2022, the bigeye tuna stock is determined to be **overfished** and **subject to overfishing.** As IOTC agreed on a bigeye Management Procedure (Res. 22/03) it should be noted that the stock assessment is not used to provide a recommendation on the TAC. Click here for full stock status summary: Appendix 9
Skipjack tuna	Catch in 2022 (t) Average catch 2018-2022 (t)	666,408 613,061		**60%**			**70%**	A new stock assessment was carried out for skipjack tuna in 2023 using Stock Synthesis with data up to 2022. The outcome of the 2023 stock

Katsuwonus pelamis	$E_{40\%SB0}$ (80% CI) SB_0 (t) (80% CI) SB_{2022} (t) (80% CI) SB_{2022} / SB_0 80% CI) SB_{2022} / $SB_{40\%SB0}$ (80% CI) SB_{2022} / $SB_{20\%SB0}$ (80% CI) SB_{2022} / SB_{MSY} (80% CI) F_{2022} / F_{MSY} (80% CI) F_{2022} / $F_{40\%SSB0}$ (80% CI) MSY (t) (80% CI)	0.55 (0.48–0.65) 2 177 144 (1 869 035–2 465 671) 1 142 919 (842 723–1 461 772) 0.53 (0.42–0.68) 1.33 (1.04–1.71) 2.67 (2.08–3.42) 2.30 (1.57–3.40) 0.49 (0.32–0.75) 0.90 (0.68–1.22) 584 774 (512 228–686 071)						assessment model is more optimistic than the previous assessment (2020) despite the high catches recorded in the period 2021-2022, which exceeded the catch limits established in 2020 for this period. The final assessment indicates that: The stock is above the adopted target for this stock ($40\%SB_0$) and the current exploitation rate is below the target exploitation rate with the probability of 70%. Current spawning biomass relative to unexploited levels is estimated at 53%. The spawning biomass remains above SB_{MSY} and the fishing mortality remains below F_{MSY} with a probability of 98.4 % Over the history of the fishery, biomass has been well above the adopted limit reference point ($20\%SB_0$). Subsequently, based on the weight-of-evidence available in 2023, the skipjack tuna stock is determined to be **not overfished** and **not subject to overfishing.** The catch limit calculated applying the HCR specified in Resolution 21/03 is [628, 606 t] for the period 2024-2026. 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 in recent years and a higher stock level relative to the target reference point, possibly due to skipjack life history characteristics and favourable environmental conditions. Noting that the environmental conditions are predicted to enter a less favourable period, it is important that the Commission ensures that catches of skipjack tuna during this period do not exceed the agreed limit, as occurred in recent years. In addition, the SC recognizes the potential impact on other associated stocks (bigeye and yellowfin) of exceeding the catch limits of skipjack tuna. Click here for full stock status summary: Appendix 10
Yellowfin tuna *Thunnus albacares*	Catch in 2022 (t) Average catch 2018-2022 (t) MSY (1,000 t) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 t) (80% CI) F_{2020} / F_{MSY} (80% CI) SB_{2020} / SB_{MSY} (80% CI) SB_{2020} / SB_0 (80% CI)	410,332 429,421 349 (286-412) 0.18 (0.15-0.21) 1,333 (1,018-1,648) 1.32 (0.68-1.95) 0.87 (0.63-1.10) 0.31 (0.24-0.38)			**68%**			No new stock assessment was carried out for yellowfin tuna in 2023 and so the advice is based on the 2021 assessment. On the weight-of-evidence available since 2018, the yellowfin tuna stock is determined to remain **overfished** and **subject to overfishing.** It is noted that the estimated productivity of the stock (MSY) was very low for some of the scenarios of the reference grid. Their plausibility and reasons for this low productivity are yet to be fully investigated. It is noted that there is also considerable uncertainty in the reported catches by some fisheries. In particular, several artisanal fisheries have increased their catches substantially in recent years, the implication of which should be further investigated. There was a lack of information to explain this

								sharp increase in catch. Inconsistencies in the biomass trend by region also remain unresolved and this also deserves further investigation. According to the K2SM, if catches are reduced to < 80% of 2020 levels there is a >50% probability of being above SB_{MSY} in 2030. if catches are reduced to less than 80% of 2020 levels there would be a >50% probability of ending overfishing ($F<F_{MSY}$) by 2030. The probability of breaching the biological limit reference point ($0.4SB_{MSY}$) with 2020 catches is 64% by 2030. The probability of breaching the F limit reference point ($1.4\ F_{MSY}$) with 2020 catch is 78% by 2030. The Commission has an interim plan for the rebuilding the yellowfin stock, with catch limitations based on 2014/2015 levels (Resolution 21/01 which superseded 19/01, 18/01 and 17/01). Some of the fisheries subject to catch reductions have achieved a decrease in catches in 2021 in accordance with the levels of reductions specified in the Resolution; however, these reductions were offset by increases in the catches from CPCs exempt from and some CPCs subject to limitations on their catches of yellowfin tuna. Click here for full stock status summary: Appendix 11

Neritic tunas and seerfish: 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		2019	2020	2021	2022	2023	Advice to the Commission
Bullet tuna *Auxis rochei*	Catch 2022 (t) Average catch 2018–2022 (t) MSY (1,000 t) F_{MSY} B_{MSY} (1,000 t) $F_{current}/F_{MSY}$ $B_{current}/B_{MSY}$ $B_{current}/B_0$	23,447 24,258 unknown unknown unknown unknown unknown unknown						No new stock assessment was conducted in 2023 and so the results are based on the results of the assessment carried out in 2021 using the data-limited techniques (C-MSY and LB-SPR), however the catch data for bullet tuna are very uncertain given the high percentage of the catches that had to be estimated due to a range of reporting issues. 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.** For assessed species of neritic tunas and seerfish in the 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 (8,590 t). This catch advice should be maintained until an assessment of bullet tuna is available. Considering that MSY-based reference points for assessed species can change over time, the stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice. Click here for a full stock status summary: Appendix 12
Frigate tuna *Auxis thazard*	Catch in 2022 (t) Average catch 2018–2022 (t) MSY (1,000 t) F_{MSY} B_{MSY} (1,000 t) F_{2019}/F_{MSY} B_{2019}/B_{MSY} B_{2019}/B_0	153,996 115,170 unknown unknown unknown unknown unknown unknown						No new assessment was conducted in 2023 therefore the results are based on the assessment conducted in 2021 using the data-limited techniques (C-MSY and LB-SPR), however the catch data for frigate tuna are very uncertain given the high percentage of the catches that had to be estimated due to a range of reporting issues. 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.** 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 (101,260 t). The reference period (2009-2011) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available under the assumption that also for frigate tuna MSY was reached between 2009 and 2011. This catch advice should be maintained until an assessment of frigate tuna is available. Considering that MSY-based reference points for assessed species can change over time, the stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice. Click here for a full stock status summary: Appendix 13
Kawakawa *Euthynnus affinis*	Catch in 2022 (t)	157,423		**50%**			**27%**	A new assessment was conducted for kawakawa in 2023 which examined a number of data-limited methods including C-MSY,

	Mean annual catch 2018-2022 (t) MSY (t) (80% CI) FMSY (80% CI) BMSY (t) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	155,982 154,000 (122,000 – 193,000) 0.60 (0.48 – 0.74) 258,000 (185 – 359) 0.98 (0.82–2.20) 0.99 (0.45 – 1.20)						OCOM, and JABBA models (based on data up to 2021). These models produced stock estimates that are not drastically divergent because they shared similar dynamics and assumptions. The C-MSY model has been explored more fully and therefore is used to obtain estimates of stock status. Based on the weight-of-evidence available, the kawakawa stock for the Indian Ocean is classified as **overfished but not subject to overfishing.** The assessment models rely on catch data, which are considered to be highly uncertain. The catch in 2022 was just 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. Click here for a full stock status summary: Appendix 14
Longtail tuna *Thunnus tonggol*	Catch 2022 (t) Mean annual catch (2018-2022) (t) MSY (80% CI) F_{MSY} (80% CI) B_{MSY} (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	136,271 131,320 133,000 (108 –165) 0.31 (0.22 – 0.44) 433,000 (272,000 – 690,000) 1.05 (0.84 – 2.31) 0.96 (0.44 – 1.19)		**76%**			**35%**	A new assessment was conducted for longtail tuna in 2023 which examined a number of data-limited methods including C-MSY, OCOM, and JABBA models (based on data up to 2021). These models produced stock estimates that are not drastically divergent because they shared similar dynamics and assumptions. The C-MSY model has been explored more fully and therefore is used to obtain estimates of stock status. Based on the weight-of-evidence currently available, the stock is considered to be both **overfished** and **subject to overfishing**. The catch in 2022 was above the estimated MSY and 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 being fished above 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 15
Indo-Pacific king mackerel	Catch in 2022 (t) Average catch 2018-2022 (t)	45,594 43,224			**35%**			No new assessment was conducted in 2023 so results are based on the assessment conducted in 2021 using the data-limited techniques (C-MSY and LB-SPR) (using data up to 2019). Analysis

Scomberomorus guttatus	MSY (1,000 t) F_{MSY} B_{MSY} (1,000 t) $F_{current}/F_{MSY}$ $B_{current}/B_{MSY}$ $B_{current}/B_0$	46.9 (37.7–58.4) 0.74 (0.56–0.99) 63.2 (42–94) 0.90 (0.78–2.01) 1.03 (0.46–1.19) 0.51 (0.23–0.60)						using the catch only method C-MSY indicates the stock is being exploited at a rate that is below F_{MSY} in recent years and that the stock appears to be above B_{MSY}, although the estimates would be more pessimistic if the stock productivity is assumed to be less resilient. The analysis using the length-based approach (LB-SPR) was also undertaken in 2021 and the results are not conflicting with CMSY in terms of status. The catch-only model has provided a more defensible approach in addressing the uncertainty of key parameters and the currently available catch data for the Indo-Pacific king mackerel appear to be of sufficient quality. Based on the weight-of-evidence currently available, the stock is considered to be **not overfished and not subject to overfishing.** Reported catches of Indo-Pacific king mackerel in the Indian Ocean has increased considerably since the late 2000s with recent catches fluctuating around estimated MSY, although the catch in 2021 was below the estimated MSY. This suggests that the stock is close to being fished at MSY levels and that higher catches may not be sustained despite the substantial uncertainty associated with the assessment, a precautionary approach to management is recommended. Click here for a full stock status summary: Appendix 16
Narrow-barred Spanish mackerel *Scomberomorus commerson*	Catch in 2022 (t) Average catch 2018-2022 (t) MSY (80% CI) F_{MSY} (80% CI) B_{MSY} (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	178,403 161,269 161,000 (132,000 – 197,000) 0.60 (0.48–0.74) 271,000 (197,000 – 373,000) 1.07 (0.88 – 2.38) 0.98 (0.44 – 1.19)		**73%**			**31%**	A new assessment was conducted for narrow-barred Spanish mackerel in 2023 which examined a number of data-limited methods including C-MSY, OCOM, and JABBA models (based on data up to 2021). These models produced stock estimates that are not drastically divergent because they shared similar dynamics and assumptions. The C-MSY model has been explored more fully and therefore is used to obtain estimates of stock status. Based on the C-MSY assessment, the stock appears to be **overfished and subject to overfishing.** The catch in 2022 was above the estimated MSY and the available gillnet CPUE shows a somewhat increasing trend in recent years although the reliability of the index as an abundance index remains unknown. Despite the substantial uncertainties, the stock is being fished above MSY levels and higher catches may not be sustained. Click here for a full stock status summary: Appendix 17

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 bycatch 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		2019	2020	2021	2022	2023	Advice to the Commission
Black marlin *Istiompax indica*	Catch in 2022 (t) Average catch 2018–2022 (t) MSY (1,000 t) (95% CI) F_{MSY} (95% CI) B_{MSY} (1,000 t) (95% CI) F_{2019}/F_{MSY} (95% CI) B_{2019}/B_{MSY} (95% CI) B_{2019}/B_0 (95% CI)	25,521 17,962 17.30 (11.00 – 35.02) 0.20 (0.12 - 0.34) 87.39 (53.82-167.70) 0.53 (0.22 – 1.05) 1.98 (1.42 – 2.57) 0.73 (0.53 – 0.95)						No new stock assessment was carried out for black marlin in 2023, thus the stock status is determined on the basis of the 2021 assessment based on JABBA, a Bayesian state-space production model (using data up to 2019). Since 2018, there has been no discernable improvement in the data available for black marlin and the subsequent assessment outputs remain uncertain and should be interpreted with caution. As such, there is no reasonable justification to change the stock status from **"Not assessed/Uncertain"**. The catch limits as stipulated in Resolution 18/05 have been exceeded for three consecutive years since 2020. Thus, it is recommended that the Commission review the implementation and effectiveness of the measures contained in this Resolution and consider the adoption of additional conservation and management measures. The Commission should provide mechanisms to ensure that catch limits are not exceeded by all concerned fisheries. Click here for full stock status summary: Appendix 18
Blue marlin *Makaira nigricans*	Catch in 2022 (t) Average catch 2018-2022 (t) MSY (1,000 t) (80% CI) F_{MSY} (80% CI) B_{MSY} (1,000 t) (80% CI) F_{2020}/F_{MSY} (80% CI) B_{2020}/B_{MSY} (80% CI) B_{2020}/B_0 (80% CI)	5,067 7,045 8.74 (7.14 –10.72) 0.24 (0.14 – 0.39) 35.8 (22.9 – 60.3) 1.13 (0.75 – 1.69) 0.73 (0.51 – 0.99) 0.36 (0.26 – 0.50)	**87%**			**72%**		No new stock assessment was carried out for blue marlin in 2023, thus the stock status is determined on basis of the 2022 assessment which was based on two different models: JABBA, a Bayesian state-space production model (age-aggregated); and SS3, an integrated model (age-structured) (using data up to 2020). Both models were consistent with regards to stock status. On the weight-of-evidence available in 2022, the stock is determined to be **overfished** and **subject to overfishing**. The current catches of blue marlin (average of 7,045 t in the last 5 years, 2018-2022) are lower than MSY (8,740 t). The stock is currently overfished and subject to overfishing. According to K2SM calculated (Table 2), a reduction of 20% of catches (5,700 t) compared to 2020 catches (7,126 t) would recover the stock to the green quadrant by 2030 with a probability of 79% and if the catches are reduced by 10% (6,413 t) the probability would be 67%. The Commission should note that the current catch limit for blue marlin in Resolution 18/05 (11,930 t, which was established as the MSY value estimated in 2016 stock assessment) is 36% higher than the new MSY estimated by the latest stock assessment in 2022 (8,740 t). Click here for full stock status summary: Appendix 19

Striped marlin *Kajikia audax*	Catch in 2022 (t) Average catch 2018-2022 (t) MSY (1,000 t) (JABBA) MSY (1,000 t) (SS3) F_{MSY} (JABBA) F_{MSY} (SS3) F_{2019}/F_{MSY} (JABBA) F_{2019}/F_{MSY} (SS3) B_{2019}/B_{MSY} (JABBA) SB_{2019}/SB_{MSY} (SS3) B_{2019}/B_0(JABBA) SB_{2019}/SB_0 (SS3)	3,431 2,898 4.60 (4.12 - 5.08)3 4.82 (4.48 - 5.16) 0.26 (0.20–0.33) 0.23 (0.23 - 0.23) 2.04 (1.35 - 2.93) 3.93 (2.30 - 5.31) 0.32 (0.22 - 0.51) 0.47 (0.35 - 0.63) 0.12 (0.10 – 0.19) 0.06 (0.05 - 0.08)			**100%**			No new stock assessment was carried out for striped marlin in 2023, thus the stock status is determined on the basis of the 2021 assessment based on two different models: JABBA, a Bayesian state-space production model (age-aggregated); and SS3, an integrated model (age-structured) (using data up to 2019). Both models were generally consistent with regards to stock status and confirmed the results from 2012, 2013, 2015, 2017 and 2018 assessments. On the weight-of-evidence available in 2021, 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. The 2022 catches (3,431 t) are lower than MSY (4,601 t) but are slightly above the limit set by Resolution 18/05 for that year which may be a concern if this trend continues. The stock has been overfished for more than a decade 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 as per Resolution 18/05, it needs to provide mechanisms to ensure the maximum annual catches remain between 900 t – 1,500 t. Click here for full stock status summary: Appendix 20
Indo-Pacific Sailfish *Istiophorus platypterus*	Catch in 2022 (t) Average catch 2018-2022 (t) MSY (1,000 t) (80% CI) F_{MSY} (80% CI) B_{MSY} (1,000 t) (80% CI) F_{2019}/F_{MSY} (80% CI) B_{2019}/B_{MSY} (80% CI) B_{2019}/B_0 (80% CI)	31,873 32,386 25.9 (20.8 – 34.2) 0.19 (0.15 - 0.24) 138 (108–186) 0.98 (0.65 – 1.42) 1.17 (0.94 – 1.42) 0.58 (0.47 – 0.71)				**54%**		No new stock assessment was carried out for Indo-Pacific Sailfish in 2023, thus the stock status is determined on basis of the 2022 stock assessment based on JABBA (using data up to 2019). Data poor methods (C-MSY and SRA) applied to SFA in 2019 relied on catch data only, which is highly uncertain for this species, and resulted in the stock status determined to be uncertain. To overcome the lack of abundance indices for this species, this assessment incorporated length-frequency data to estimate annual Spawning Potential Ratio (SPR). Normalised annual estimates of SPR were assumed to be proportional to biomass and incorporated as an index of relative abundance in the JABBA model (assuming no trends in annual recruitment in the long term). This is a novel technique applied to overcome the paucity of abundance data for SFA. On the weight-of-evidence available in 2022, the stock status of Indo-Pacific sailfish is determined to be **not overfished nor subject to overfishing.** The catch limits as stipulated in Resolution 18/05 have been exceeded for three consecutive years since 2020. In spite of the Kobe green status of the stock, it is recommended that the Commission review the implementation and effectiveness of the measures contained in this Resolution and consider the adoption of additional conservation and management measures. 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

								coastal gillnet and longline fisheries, and further exploration of stock assessment approaches for data poor fisheries are warranted. Given the limited data being reported for coastal 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 21
Swordfish *Xiphias gladius*	Catch in 2022 (t) Average catch 2018-2022 (t) MSY (1,000 t) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 t) (80% CI) F_{2021}/F_{MSY} (80% CI) SB_{2021}/SB_{MSY} (80% CI) SB_{2021}/SB_{1950} (80% CI)	23,597 28,994 30 (26–33) 0.16 (0.12–0.20) 55 (40–70) 0.60 (0.43–0.77) 1.39 (1.01–1.77) 0.35 (0.32–0.37)		**98%**			**97%**	In 2023 a new stock assessment was carried out for Swordfish in the IOTC area of competence to update the stock assessment undertaken in 2020. Two models were applied to the swordfish stock (ASPIC and Stock Synthesis (SS3)), with the SS3 stock assessment selected to provide scientific advice (as done previously). An update of the JABBA model was also conducted during the WPB meeting. Taking into account the characterized uncertainty, and on the weight-of-evidence available in 2023, the swordfish stock is determined to **be not overfished and not subject to overfishing.** The 2021 catches (23,237 t at the time of the assessment) were significantly lower than the estimated MSY level (29,856 t). Under those levels of catches, the spawning biomass was projected to likely increase, with a high probability of maintaining at or above the SB_{MSY} for the longer term. There is a very low risk of exceeding MSY-based reference points by 2031 if catches are maintained at 2021 levels (<1% risk that SB_{2031}< SB_{MSY}, and <1% risk that F_{2021}> F_{MSY}). The projections indicate that an increase of 40% or more from 2021 catch levels will not likely result in the biomass dropping below the SBMSY level for the longer term (with a 15% probability). Catches in 2022 (23,597 t) were still lower than the estimated MSY. Nevertheless, the Commission should consider monitoring the catches to ensure that the probability of exceeding the SB_{MSY} target reference points in the long term remains minimal. Taking into account the differential CPUE and biomass trends between regions, the WPB noted that there is recurring evidence for localised depletion in the South Western region (which appears to be more depleted than other regions) and suggests this should be further monitored. Click here for 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		2019	2020	2021	2022	2023	Advice to the Commission
Blue shark *Prionace glauca*	Reported catch 2022 (t) Estimated catch 2019 (t) Not elsewhere included (nei) sharks1 2022 (t) Average reported catch 2018-2022 (t) Average estimated catch 2015-19 (t) Avg. not elsewhere included (nei) sharks 2018-2022 (t) MSY (1,000 t) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 t) (80% CI) F_{2019}/F_{MSY} (80% CI) SB_{2019}/SB_{MSY} (80% CI) SB_{2019}/SB_0 (80% CI)	24,424 43,240 32,558 25,275 48,781 31,303 36.0 (33.5 - 38.6) 0.31 (0.306 - 0.31) 42.0 (38.9 - 45.1) 0.64 (0.53 - 0.75) 1.39 (1.27 - 1.49) 0.46 (0.42 - 0.49)			**99.9%**			No new stock assessment was carried out for blue sharks in 2023 and so the results are based on the assessment carried out in 2021 using an integrated age-structured model (SS3) (using data up to 2019). On the weight-of-evidence available in 2021, the stock status is determined to be **not overfished** and **not subject to overfishing**. Target and limit reference points have not yet been specified for pelagic sharks in the Indian Ocean. The 2021 assessment indicates that Indian Ocean blue shark is not overfished nor subject to overfishing. If the catches are increased by over 20%, the probability of maintaining spawning biomass above MSY reference levels ($SB>SB_{MSY}$) over the next 10 years will be decreased. The stock should be closely monitored. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission, so as to better inform scientific advice in the future. Click below for a full stock status summary: Blue sharks – Appendix 23
Oceanic whitetip shark *Carcharhinus longimanus*	Reported catch 2022 (t) Not elsewhere included (nei) sharks 2022 (t) Average reported catch 2018–2022 (t) Ave. (nei) sharks 2012–2022 (t)	41 32,558 35 31,303						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 2022 (t) Not elsewhere included (nei) sharks 2022 (t) Average reported catch 2018–2022 (t) Ave. (nei) sharks 2018–2022 (t)	607 33,949 198 33,612						

Shortfin mako *Isurus oxyrinchus*	Reported catch 2022 (t) Catches reported to MAK in 2022 (t) Average catches reported to MAK 2018-2022 (t) Catches in 2022 (MAK, SMA, LMA) (t) Average catches 2018-2022 (MAK, SMA, LMA) (t) Not elsewhere included (nei) sharks2 2022 (t) Average reported catch 2018-22 (t) Av. Not elsewhere included (nei) sharks2 2018-22 (t)	666 1,947 2,057 2,627 3,081 34,248 1,013 33,072						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 2022 (t) Not elsewhere included (nei) sharks 2022 (t) Average reported catch 2018–2022 (t) Ave. (nei) sharks 2018–2022 (t)	1,426 32,558 1,755 31,3032						
Bigeye thresher shark *Alopias superciliosus*	Reported catch 2022 (t) Not elsewhere included (nei) sharks2 2022 (t) Thresher sharks nei 2022 (t) Average reported catch 2018-22 (t) Av. Not elsewhere included (nei) sharks2 2018-22 (t) Av. Thresher sharks nei 2018-22 (t)	< 1 37,497 5,209 < 1 35,865 4,859						
Pelagic thresher shark *Alopias pelagicus*	Reported catch 2022 (t) Not elsewhere included (nei) sharks2 2022 (t) Thresher sharks nei 2022 (t) Average reported catch 2018-22 (t)	156 37,497 5,209 217						

	Av. Not elsewhere included (nei) sharks2 2018-22 (t) Av. Thresher sharks nei 2018-22 (t)	35,865 4,859						

*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}≥ 1)
Stock subject to overfishing (F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)		
Not assessed/Uncertain/Unknown		

1. OPENING OF THE SESSION

1. The 26th Session of the Indian Ocean Tuna Commission (IOTC) Scientific Committee (SC) was held in Mumbai India and online, from 4 – 8 December 2023. A total of 106 delegates and other participants attended the Session (129 in 2022), comprised of 92 delegates (104 in 2022) from 21 Contracting Parties with no delegates from Cooperating Non-Contracting Parties (0 in 2022), and 14 participants from 11 observer organisations (including the invited experts). The meeting was opened by Mr. Parshottam Rupala, Hon'ble Minister of Fisheries, Animal Husbandry & Dairying, Government of India, Dr. Abhilaksh Likhi, Secretary, Department of Fisheries, Government of India, Ms. Neetu Kumari Prasad, Joint Secretary (Marine Fisheries), Department of Fisheries, Government of India and Shri. Pankaj Kumar, Commissioner of Fisheries, Government of Maharashtra. It 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 and France (OT) (Appendix 4).

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
- International Pole-and-line Foundation (IPNLF)
- International Seafood Sustainability Foundation (ISSF)
- Marine Stewardship Council
- PEW Charitable Trusts
- Sustainable Fisheries and Communities Trust (SFACT)
- Shark Guardian
- Shark Project
- 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 6th Special Session and 27th Session of the Commission

5. The SC **NOTED** paper IOTC–2023–SC26–03 which outlined the decisions and requests made by the Commission at its 6th Special Session and 27th Session, held in February and May 2023 respectively, that related to the IOTC science processes. The SC **NOTED** that 9 new CMMs were adopted in 2023 by the Commission (consisting of 8 Resolutions and 1 Recommendation).
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 6th Special Session and 27th Session of the Commission also made a number of general comments and requests on the recommendations made by the Scientific Committee in 2022, the SC **AGREED** that any advice to the Commission would be provided in the relevant sections of this report.

4.2 Previous decisions of the Commission

8. The SC **NOTED** paper IOTC–2023–SC26–04 which outlined a number of Commission decisions, in the form of previous Resolutions that require a response from the SC in 2023 and **AGREED** to develop advice to the Commission in response to each request during the current Session.

9. The SC **NOTED** that there was a need to provide capacity building to facilitate better understanding of climate change issues. Tools should be developed to assist scientists in making progress on this topic.

5. SCIENCE RELATED ACTIVITIES OF THE IOTC SECRETARIAT IN 2023

5.1 Report of the Secretariat – Activities in support of the IOTC science process in 2023

10. The SC **NOTED** paper IOTC–2023–SC26–05 which provided an overview of the work undertaken by the IOTC Secretariat in 2023 and **CONGRATULATED** the IOTC Secretariat for its contributions to the science processes this year. These contributions included support to the Working Groups, Working Parties and Scientific Committee meetings; the 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; recruitment and management of consultants; oversight of scientific projects and facilitation of the attendance of the invited scientific experts that support IOTC technical meetings.

11. The SC **CONGRATULATED** the Secretariat for the successful organization and completion of the different Working Party meetings in 2023 using a combination of virtual and hybrid meetings. The SC **NOTED** the technical challenges posed by the hybrid meetings (additional cost of equipment, audio issues, internet connections, time zones and duration).

12. The SC **NOTED** that, in line with its agreement in 2022, virtual meetings were still conducted for certain meetings (such as Data preparatory meetings and Working Groups) to reduce the expenses travel imposes on CPCs as well as the IOTC MPF. All meetings requiring closer collaborations were held in a hybrid format.

13. The SC **NOTED** that in 2023, Secretariat staff continued to support collaborations and participated in several meetings with other organisations. The SC **ENCOURAGED** these ongoing collaborations.

14. The SC **ACKNOWLEDGED** the work of and **CONGRATULATED** the Data Section of the IOTC Secretariat for the several important activities carried on so far, such as the release of the Interactive Data Browser and the collation and clean-up of sales data from ISSF-associated canneries.

15. The SC **NOTED** how both these activities hold sensitive data assets (e.g., raised time-area catches for the five major IOTC species, and detailed catches by vessel), whose public release would be of great importance for the IOTC, and **AGREED** on the need to identify mechanisms that will guarantee data confidentiality and clarify the limits of applicability and caveats of all released information.

16. The SC **NOTED** that in line with its suggestion in 2022, the second and final terms of some Working Party Chairs and Vice-Chairs were extended due to no suitable alternatives being available, as was the case for both the WPTT and WPM.

17. The SC **NOTED** paper IOTC–2023–SC26–INF01 which provided and update on the Common Oceans Tuna Project.

18. The SC **THANKED** the representative of the project for this brief update and **SUGGESTED** that a joint tuna RFMO initiative to address common issues with tuna stock assessments could be carried out under the auspices of the project.

6. NATIONAL REPORTS FROM CPCS

6.1 National Reporting to the Scientific Committee: overview

19. The SC **NOTED** that 25 National Reports were submitted to the IOTC Secretariat in 2023 by CPCs (25 by CPs and 0 by a CNCP) (as well as a report by the invited experts, Taiwan,China). The abstracts of CPC reports are provided in Appendix 5.

20. 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.

21. 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 2023, of the 25 National Reports submitted, two were submitted shortly after the deadline.
22. The SC **NOTED** that National Reports should be submitted using the new E-Maris platform.
23. The SC **NOTED** the importance of consistency and standardisation in the format of reporting on fisheries in National Reports and again **REQUESTED** that CPCs follow the reporting template agreed by the Commission. The SC **NOTED** that in 2023, only two National Reports were submitted using older reporting templates. The Secretariat informed the SC that the latest template will continue to be published on the IOTC webpage (https://iotc.org/science), the SC meeting page and distributed through official Circular as requested by the SC in 2020.
24. In addition, the SC **NOTED** that the availability for download of the revised National Report templates from the IOTC Website was announced through IOTC Circular 2023/42 sent on the 10th of July 2023 as well as through the IOTC Science mailing list.
25. 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.
26. 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.
27. The SC **NOTED** that there was a slight decrease in the Submission of National reports by CPCs in 2023 when compared with the 26 reports provided by CPCs in 2022 (21 in 2021, 25 in 2020, 23 in 2019 and 26 in 2018; see Table 2).
28. The SC **NOTED** that spatialized catch and effort data for the drifting gillnet fishery of I.R. Iran operating in the high seas is not fully provided to the IOTC and **ACKNOWLEDGED** that I.R. Iran is currently considering the use of VMS and EMS to collect this information in the future. The SC **NOTED** that due to the small size of most vessels in Iran, it is challenging to deploy onboard observers.
29. The SC **NOTED** significant changes in trends of catch data for yellowfin tuna (among others) in the historical series provided by Kenya for their longline fisheries and **ACKNOWLEDGED** that these might be due to the vessels being used for research and training purposes from 2021 onwards.
30. The SC **ACKNOWLEDGED** the sudden and steady increase in catches of yellowfin tuna reported for the handline fishery of Oman since 2014, despite constant effort trends and **REQUESTED** further explanations on the matter. The SC **QUERIED** whether issues with species identification between longtail tuna and yellowfin tuna could be one of the driving factors.
31. The SC **NOTED** that Seychelles had issues in accurately reporting, in a timely manner, data extracted from their logbooks in the past. The SC **ACKNOWLEDGED** the recent improvements in the national data management process and **NOTED** that Seychelles might resubmit historical data soon, although additional work on the collection of size-frequency through port sampling is still required.
32. The SC **NOTED** the quasi-symmetrical spatial pattern north and south of the equator line in the fishing effort provided by Sri Lanka through a figure in their National Report, and **QUERIED** whether this could be caused by issues with the proper attribution of georeferenced information across the equatorial line. Sri Lanka were not able to provide an explanation for this pattern during the meeting.
33. The SC **REQUESTED** that CPC scientists ensure that all mandatory data submissions have been completed to avoid discrepancies between National Reports and the data held by the Secretariat.
34. The SC **NOTED** that mandatory scientific and statistical information such as discard levels, observer coverage, fleet statistics etc., which are of relevance for several IOTC Resolutions, is often only reported by CPCs in their national reports but not made available to the IOTC Secretariat in due time and in accordance with the reporting requirements prescribed in the Resolutions.

35. The SC **RECALLED** 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 Resolutions (and in particular Resolution 15/02 *On mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)*).

36. For these reasons, the SC **REQUESTED** all CPCs to ensure that information and data presented in the respective national reports and the official submissions available to the IOTC are in agreement.

Table 2. CPC submission of National Reports to the SC from 2013 to 2023.

CPC	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Contracting Parties (Members)											
Australia											
Bangladesh	n.a.	n.a.									
China											
Comoros											
Eritrea											
European Union											
France (OT)											
India											2 Dec
Indonesia											
Iran, Islamic Rep. of											
Japan											
Kenya											
Korea, Republic of											
Madagascar											
Malaysia											
Maldives, Rep. of											
Mauritius											
Mozambique											
Oman, Sultanate of											
Pakistan											2 Dec
Philippines											
Seychelles, Rep. of											
Somalia	n.a.										
Sri Lanka											
South Africa, Rep. of											
Sudan											
Tanzania, United Republic of											
Thailand											
United Kingdom											
Yemen											
Cooperating Non-Contracting Parties											
Liberia	n.a.	n.a.									

Green = submitted. Red = not submitted. Orange = Submitted using an outdated template or late n.a. = not applicable (not a CPC in that year). For 2023, the date of submission of the report is included in the table if the report was submitted after the deadline (**Note**: the deadline for submission was 19 November 2023).

6.2 Contracting Parties (Members)

37. The SC **NOTED** that in 2023 the Secretariat provided translations of all the submitted National report summaries in both English and French in response to the SC request in 2018.

38. The SC **RECOMMENDED** that the Compliance Committee and Commission note the lack of compliance by 5 Contracting Parties (Members) that did not submit a National Report to the Scientific Committee in 2023,

NOTING that the Commission agreed that the submission of the annual reports to the Scientific Committee is mandatory.

6.3 Cooperating Non-Contracting Parties (CNCPs)

39. The SC **NOTED** that no National Report was submitted to the IOTC Secretariat in 2023 by the Cooperating Non-Contracting Party (CNCP).

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 available upon request.

7. REPORTS OF THE 2023 IOTC WORKING PARTY MEETINGS

7.1 Report of the 13th Session of the Working Party on Neritic Tunas (WPNT13)

41. The SC **NOTED** the report of the 13th Session of the Working Party on Neritic Tunas (IOTC–2023–WPNT13–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 35 participants (cf. 36 in 2022). Eight participants received funding through the MPF.

42. The SC **NOTED** that for several of these species, the advice and assessments are treating them all as if they are a single stock in the Indian Ocean region. The SC **ACKNOWLEDGED** that the data is limited, but preliminary analyses indicate that there is significant stock structure for many of these species even though this structure has not been accurately delineated at this stage. The SC therefore **ENCOURAGED** additional studies to determine stock structure for neritic tuna and seerfish species.

43. The SC **ENDORSED** the development of a large-scale regional sampling program focusing on the collection of size-frequency data and tissue samples from coastal fisheries and also including the collection of morphometric data required to develop robust conversion factors, length-length and length-weight relationships. To this end, several Members expressed their interest to share samples in order to build on the stock structure project conducted and presented in 2020 (IOTC-2020-WPNT10-10).

44. The SC **NOTED** the comments from some CPCs questioning whether these species should be under the mandate of the IOTC as they are largely coastal and shared between coastal states. The Secretariat clarified that this question would be better addressed by the Commission as the SC is following the current IOTC Agreement which lists these species as being under the IOTC competence.

45. The SC **NOTED** the importance of data collection and mining for these species as they are of high importance to many Members. In addition, the socio-economic importance of these species should be investigated by the newly formed Working Party on Socio-Economics (WPSE).

46. The SC **NOTED** the recommendation by the WPNT to consider changing the name of the WP from the Working Party on Neritic Tunas to the Working Party on Neritic Tunas and Seerfish. The SC **AGREED** that this change may cause confusion to managers but that seerfish species will continue to be monitored and evaluated by the WP.

47. **NOTING** how issues in species identification are common for neritic tunas and seerfish in several fisheries and that this affects the accuracy of the time series of catch which are the main input for the assessment models, the SC **ENDORSED** the organisation of training workshops for fish species identification.

7.2 Report of the 21stSession of the Working Party on Billfish (WPB21)

48. The SC **NOTED** the report of the 21st Session of the Working Party on Billfish (IOTC–2023–WPB21–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 97 participants (cf. 51 in 2022). Eight participants received funding through the MPF.

49. The SC **NOTED** that the WPB had reviewed evidence that shortbill spearfish (*Tetrapturus angustirostris*) is being caught in IOTC fisheries and that the species population size may be declining. The SC **ACKNOWLEDGED** that the addition of shortbill spearfish in the official list of IOTC species may require a review of the IOTC Agreement, which would be a complex administrative process and unlikely to occur in the near future. The SC **AGREED** that a way to move forward may be for the Commission to adopt the same approach as for the main pelagic sharks caught in tuna and tuna-like fisheries (e.g., blue shark) and mandate the SC with collating information on this species and providing scientific advice for its management. As such the SC **RECOMMENDED** that the Commission endorse the SC's approach to address the captures of shortbill spearfish in IOTC fisheries.

7.2.1 Swordfish stock assessment

50. The SC **NOTED** that a new stock assessment was conducted in 2023 using SS3, an integrated age-structured model. The SC **ENDORSED** the results of the assessment model which indicated that the stock is not overfished and not subject to overfishing with a high probability (97%).

51. However, the SC **NOTED** that there was some key uncertainty in the assessment, particularly in one of the regions of the assessment where the Japanese longline CPUE time series showed some spikes over the last decade at a time when the catches were at a historically high level. The SC **NOTED** that this issue was considered to some extent in the assessment but **AGREED** that it would be useful to further explore it in the future.

52. The SC **NOTED** that an additional population model (i.e., ASPIC) was used for the assessment of the swordfish stock status, providing consistent results with SS3, and **ACKNOWLEDGED** that the use of multiple assessment models constitutes a good practice that should be continued in future Working Parties as much as possible.

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

53. 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*".

54. The SC **NOTED** that the catch limits stipulated in Res. 18/05 are based on estimates of MSY from older assessments that have subsequently been updated in 2021 (black marlin and striped marlin) and 2022 (blue marlin and Indo-Pacific sailfish), resulting in revised estimates of MSY.

55. The SC **NOTED** that for blue marlin and striped marlin, which are both assessed as overfished and subject to overfishing, the recent (2022) catches are significantly below (for blue marlin) or just above (for striped marlin) the Res 18/05 catch limits. However, the 2021 assessments have also generated K2SM projections which have indicated that recent catches for both species have substantially exceeded the levels that would return those stocks into the Kobe green quadrant by year 2029 for striped marlin and 2030 for blue marlin.

56. The SC **NOTED** that for black marlin and Indo-Pacific sailfish, reported catches continue to exceed the limits set out in Resolution 18/05 since 2020. While K2SM projections have not been undertaken for either stock, recent catches have exceeded the most recent median estimates of MSY (from the 2022 assessments for blue marlin and Indo-Pacific sailfish and the 2021 assessment for black marlin). The SC further **NOTED** that catches of both species are predominantly taken by gillnet which have increased substantially in recent years.

57. Subsequently, the SC **RECOMMENDED** that Resolution 18/05 be urgently revised and updated so as to reflect MSY based catch limits for each species based on the most recent stock assessment and projections information available, and to contain provisions to ensure that catches do not exceed such limits. The SC **REQUESTED** that for Indo-Pacific sailfish, K2SM projections be provided based on the most recent assessment so as to inform revised limits for that stock, and that further work is undertaken to improve the black marlin assessment to generate status and catch limit information.

7.3 Report of the 19th Session of the Working Party on Ecosystems and Bycatch (WPEB19)

58. The SC **NOTED** the report of the 19th Session of the Working Party on Ecosystems and Bycatch (IOTC–2023–WPEB19–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 100 participants (cf. 103 in 2022). Seven participants received funding through the MPF.

59. The SC **NOTED** the intention of the WPEB to use the assigned Data Preparatory meeting both for data and stock assessment model preparation issues for shortfin mako which is due to be assessed in 2024, and also to hold a bycatch mitigation measure workshop with a range of experts on this topic. The SC further **NOTED** that there is unlikely to be a lot of new information and data for shortfin mako so there should be plenty of time during that meeting to look at mitigation measures. The SC **NOTED** the intention of the WPEB Chair and the

Secretariat to reach out to experts both on mitigation measures and CPUE and stock assessments for this data preparatory meeting to make it as effective as possible.

60. The SC **NOTED** the proposal of the WPEB to hold the 2024 assessment meeting back-to-back with the WPB meeting and again following the WPB due to a workshop that WPB intends to hold before their meeting.

61. The SC **NOTED** the poor status of discards data in terms of quality and availability which should be submitted by CPCs through form 1DI. The SC **NOTED** that the data on taxa such as cetaceans, turtles and seabirds reported through these forms are mostly data on occurrences rather than fully raised data. They **ENCOURAGED** CPCs to increase their reporting levels through this form. The SC **NOTED** that as a result of this issue, data on cetaceans, marine turtles and seabirds are available only through the Regional Observer Scheme and are therefore very limited. The SC **SUGGESTED** that increasing the minimum required level of observer coverage may help to improve data for these species.

62. The SC **NOTED** the experience of Australia which showed that having 100% EMS coverage onboard vessels has the impact of significantly improving the data reported by fishers through logbooks.

63. The SC **NOTED** the ongoing work by the WPEB on ecoregions, further **NOTING** that no progress was made on this work in 2023 as the expert on this topic was not able to attend the WPEB meeting. The SC **NOTED** that the intention is for the ecoregions to be incorporated into future Ecological Risk Assessment (ERA) and stock assessment work for all species including tropical tunas. The SC **NOTED** that draft ecoregions have been mapped and the idea now is to conduct a pilot study to assess the suitability of these draft regions.

64. The SC **NOTED** that several longline fleets targeting swordfish in the IOTC area of competence are using submerged artificial lights (chemical light sticks or electrically powered lights) attached to the terminal gear for the purpose of attracting the target species and further **NOTED** that Resolution 16/07 prohibits all vessels from using artificial lights to attract fish, without specifying the type of fleet or gear subjected to the Resolution. The SC therefore **RECOMMENDED** that the Commission provides clarity on whether Resolution 16/07 applies to longline fisheries as the current wording is somewhat ambiguous. The SC also **SUGGESTED** that Resolution 16/07 could be amended to clearly state which fleets and/or gears are bound by the Resolution to avoid future doubts.

65. The SC **NOTED** that papers on the fins-naturally-attached approach were discussed extensively during the WPEB meeting and this is thought to be the best practice to prevent shark finning from occurring. The SC **NOTED** that different approaches to fins-partially attached (which is thought to also be suitable) can be taken such as using wires to attach fins to the main body of the shark or using a bag to put both the body and fins into. The SC **NOTED** that fins-naturally-attached also allows for the partial cutting of fins which can then be folded over to aid with storage and to help to avoid injuries to crew while moving the sharks.

66. The SC **RECOMMENDED** that the Commission consider extending measures to prevent finning of sharks such as fins naturally attached including partially attached and tethered for all fisheries or similar, alternative measures (for example, fins artificially attached), providing they had been assessed and endorsed by the SC and Compliance Committee as being equally or more likely to meet the conservation benefit (of a fins naturally attached measure) and are logistically feasible from a compliance monitoring perspective. The SC **NOTED** that while such other measures may be logistically more difficult to implement and monitor for governments, they may be more practical (and beneficial to crew safety) for the fishing industry when conducting their fishing operations and storing shark catches on board.

67. The SC **NOTED** that while the WPEB had held discussion on the scientific need to improve measures to prevent shark finning, the WPEB has not provided a summary of this evidence to the SC. Subsequently, the SC **REQUESTED** the WPEB to provide this information to support the SC and Commission's further consideration of this issue.

68. The SC **NOTED** that although an assessment was scheduled for porbeagle shark in 2023, an Executive Summary has not yet been developed for this species. The SC therefore **REQUESTED** the WPEB to develop an Executive Summary for this species.

69. The SC **NOTED** that a local assessment had been conducted for Indian Ocean humpback dolphins in India which assessed the population to be 'Vulnerable' (as opposed to the 'Endangered' assessment for the global population). The SC **SUGGESTED** that this be discussed during the next WPEB to determine whether a sub-population of this species should be added to the Executive Summary for cetaceans.

7.4.1 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

70. The SC **NOTED** paper IOTC–2023–SC26–06 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.

71. 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 6, recalling that the IPOA-Seabirds and IPOA-Sharks were adopted by the FAO in 1999 and 2000, respectively, and recommended the development of NPOAs.

72. 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.

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

74. The SC **NOTED** that there have been small revisions to the previous update on NPOAs in 2023 including the drafting of revisions of NPOAs by some CPCs and updates on the progress on the development of NPOAs by other CPCs.

75. The SC **NOTED** that Indonesia established a NPOA for sea turtles in 2022.

76. The SC **NOTED** that as Thailand's NPOA for seabirds is finalised but just awaiting the approval of relevant committees, the status of this should be changed from orange to yellow until final approval when it can be changed to green.

77. The SC **NOTED** that Kenya has finalised their NPOA for sharks and this is awaiting cabinet approval. The SC further **NOTED** that Kenya has also started to develop NPOAs for seabirds and sea turtles.

78. The SC **NOTED** that Seychelles has reviewed its NPOA for sharks which expired in 2020 and found that it was still valid so this has been extended. The SC further **NOTED** that the Seychelles Ministry for Environment is trying to work with BirdLife International to develop a NPOA for seabirds.

79. The SC **NOTED** that Bangladesh has finalised its NPOA for sharks and this is now awaiting approval from the relevant ministries. The SC further **NOTED** that Bangladesh has also put in place a new marine fisheries act which includes requirements for the live release of turtles and the mandatory use of circle hooks in hook and line fisheries.

7.4 Report of the 25th Session of the Working Party on Tropical Tunas (WPTT25)

80. The SC **NOTED** the report of the 25th Session of the Working Party on Tropical Tunas (IOTC–2023–WPTT25–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 91 participants (cf. 113 in 2022). Four participants received funding through the MPF.

81. The SC **NOTED** the independent review of the 2021 yellowfin tuna stock assessment that took place in Rome from February 6–10, 2023. Participants included independent experts, the IOTC Secretariat, chairs and modelers from the WPM, WPTT, and SC, as well as observers.

82. The SC **NOTED** that the independent panel has thoroughly examined a number of issues raised by the 2021 stock assessment and has offered suggestions for improvement. These issues include, but are not limited to, biological parameters, spatial structure, data weighting, selectivity assumptions, catch uncertainty, and model observations (CPUE indices, length composition, and tagging data). The SC **NOTED** that the recommendations called for a collaborative approach, with continued support from an independent expert, and that they placed more emphasis on the research area and process than on particular model configurations (or solutions).

83. The SC **NOTED** that it is necessary to look into catch uncertainties and that this is starting to come up frequently in IOTC assessments. The SC further **NOTED** that the assessment may be affected differently by the bias in the catch series' trend or scale. The SC suggested that some of the options for addressing catch uncertainty be examined at the data preparation meeting in 2024.

84. The SC **ACKNOWLEDGED** the significance of longline CPUE in the assessment but **NOTED** that there are still many problems with these CPUE indices, such as the unresolved impact of piracy. The SC suggested looking into the possibility of developing indices for other fisheries, like the gillnet fishery. It was noted, nevertheless, that the official gillnet data held by the Secretariat are insufficient for CPUE standardization since they lack geo-reference information and are not operational level. The SC **NOTED** that while some nations (like I.R.Iran) have gillnet data suitable for deriving CPUE indices, these data are typically restricted to coastal waters. Additionally, the Indian Ocean is home to a variety of gillnet fisheries where the data may be different. The SC **SUGGESTED** that some consultancy work be utilised to assess whether developing gillnet CPUE across the Indian Ocean is feasible.

85. The SC **NOTED** that the review did not recommend discarding the RTTO-IO tagging data, rather, it indicated that the data should be examined outside of the assessment model before including it in the assessment.

86. The SC **NOTED** that a new growth curve study for yellowfin tuna (IOTC-2023-WPTT25-11) has just been completed. This study was validated using the post-bomb radiocarbon method, which is a very promising method for age validations and has never been applied to yellowfin tuna before (IOTC-2023-WPTT25-20). This new growth equation is to be confirmed for inclusion in stock assessment in the 2024 WPTT data preparatory meeting.

87. The SC **NOTED** the update of yellowfin catch limits for 2023 and 2024 following resolution 19/01 and 21/01 was provided by the Secretariat.

7.4.1 Skipjack tuna stock assessment

88. The SC **NOTED** that the 2023 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 and the overall estimates indicate that the condition of the stock has significantly improved since the last assessment.

89. The SC also **NOTED** that the 2023 skipjack tuna stock assessment captured structural uncertainty through a grid of 36 models covering alternative assumptions on CPUE indices (PL, PSLS, and/or behavior indices), catchability trends (annual increase of 0 or 1.25%), SRR steepness (0.7, 0.8, or 0.9), and growth parameters (Linf fixed or estimated). 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.

90. The SC **NOTED** that there has been a substantial increase of fishery dependent abundance indices (PL and PSLS) in the last few years. The SC further **NOTED** that catches in 2021 (655 114 t) and 2022 (671 317 t) have both exceeded the TAC (513 572 t) by over 30%. The SC **NOTED** that in the assessment model, the increase in abundance was driven primarily by an increase in recruitment which was estimated to be above the long-term average.

91. The SC **NOTED** the growing evidence that environmental conditions may significantly influence recruitment of skipjack tuna and can produce widely varying recruitment levels between years. The SC further **NOTED** that the recent high recruitment estimated in the assessment is correlated with an increased level of surface chlorophyll (an indicator of ocean primary production) and that fluctuations in recruitment and chlorophyll content have been in phase since the early 2000s. However, a lower ocean productivity region (surface chlorophyll) was projected by 2023-2024, which may cause the recruitment to fall below average.

92. The SC **NOTED** that studying environmental factors, such as sea surface chlorophyll and the Indian Ocean Dipole Index, and how they interact with stock dynamics, is beneficial. The SC agreed that it is important to include environmental considerations when developing management recommendations and to make sure that these recommendations are resilient to changes in the environment (such as climate change) through tools like management strategy evaluations.

93. The SC **NOTED** that the three stock-recruitment steepness values included in the skipjack assessment are the same values used in the assessment for bigeye and yellowfin tuna. The SC discussed whether it is suitable or not to apply the same values for all three species of tropical tuna due to their significantly diverse life histories and spawning activities. The SC **SUGGESTED** that the WPTT might consider if the skipjack assessment should apply a smaller range of steepness values, and **NOTED** that some other RFMOs (such ICCAT and IATTC) seem to follow this approach. The SC **SUGGESTED** that if possible research should be done to provide plausible values.

94. The SC **NOTED** that the assessment is now able to provide an estimate of MSY-based reference point estimates since it has fixed an error that previously caused a flat-top production curve. As such, the SC **AGREED** that the use of the depletion based TRP for Skipjack tuna to define stock status should be reviewed before the next assessment, as part of a broader review of the application of Resolution 15/10, which lacks clarity regarding when MSY or depletion-based reference points should be applied, and the role of the interim LRPs within the management framework.

95. The SC **RECALLED** that IOTC Resolution 21/03, which superseded Resolution 16/02 requires the skipjack tuna stock assessment estimates to be used as inputs for the Harvest Control Rule (HCR) to calculate the TAC. The SC therefore **ENDORSED** the stock assessment and that the median estimates from the model ensemble are used to calculate the TAC for skipjack tuna. The SC **RECOMMENDED** that the Commission endorse the calculated annual TAC of 628 606 t for 2024-2026.

7.4.2 Update on the WGFAD04 and WGFAD05

96. The SC **NOTED** the report of the 4th and 5th working group meetings on FADs (IOTC-2023-WGFAD04-R and IOTC-2023-WGFAD05-R). The meetings were attended by 75 and 116 participants respectively (cf. 111 in 2022).

97. The SC **NOTED** that, in response to Resolutions 23/02 and 23/03, a workplan was created to assess the effects of FAD closure during WGFAD04. Following the completion of the analyses by scientists, the WPFAD05 examined the findings and requested more analyses, which were subsequently completed and reviewed by WPTT25.

98. The SC **NOTED** that the analysis focused on the recovery of the three species of tropical tuna under various fishery closure modality and assumptions (e.g., whether there is a redistribution of catches among seasons). Nevertheless, the analysis was not meant to address a specific number of days of closure for a specific gear.

99. The SC **NOTED** the quantitative analyses presented during the meeting (IOTC-2023-WGFAD05-13 and IOTC-2023-WPTT25-INF08). The analyses which were all conducted with a 10 year time frame indicated that the most positive impact on the stocks for the three tuna species, in order of the largest to smallest benefits, would be (i) a three-month complete closure for all gears, (ii) a two-month complete closure for all gears, and (iii) a three-month oceanwide PS log school closure. In addition, several scenarios with closures applied to other gears also achieve the objective of recovering bigeye and yellowfin to the green quadrant of the Kobe plot in 10 years. However, the SC **NOTED** that these benefits were estimated under the assumption that there would not be an increase in catches from other gears during this time and further **NOTED** that the full benefits of these closures would only been seen if there is no reallocation of catches to other gears or time periods. The analyses further indicated that the period that would result in the best outcomes from the closure would be during Q1, Q3 and Q4 for BET and YFT and Q3 and Q4 for SKJ. In addition, the SC **RECALLED** that Resolution 23/03 (para. 3) states that "The IOTC Scientific Committee shall provide advice and recommendations no later than 31st December 2023 on appropriate fishing closures applicable to all fishing gears." As such the SC **RECOMMENDED** the Commission take these analyses into account, with results shown in Annex IX of the WPTT report (IOTC-2023-WPTT25-R) and Figures a-c (below), and **REQUESTED** the WPTT to consider conducting further analysis intersessionally to assess the impacts of all gears on stock status so that this issue can be comprehensively addressed. The SC **NOTED** that some artisanal fleets may struggle to implement closures due to socio-economic dependence on the resources and so **REQUESTED** that the WGFAD look into excluding artisanal fleets from future analyses.

100. The SC **NOTED** that the quantitative analysis was based on the stock assessments for each species and therefore the gear groupings were the same as those used in the stock assessments. The SC also **NOTED** that in the case of BET, the majority of the catch in the gear group BB+PS(AFAD) was contributed by small purse seiners operating on AFADs while catch contributed from BB is small.

101. The SC **NOTED** that the Jelly-FAD is an example of how the implementation of biodegradable DFADs can be achieved, further **NOTING** that other actions have been also carried out in the Indian Ocean for BIOFAD testing using alternative designs and materials and this work has been presented to the WGFAD and WPEB for many years. The SC further **NOTED** that the IATTC has recently adopted a step-wise approach to the full

adoption of biodegradable DFADs (IATTC C-23-04). The SC therefore **RECOMMENDED** that the Commission initiate an ambitious step-wise approach for the implementation of biodegradable DFADs as soon as possible.

102. The SC **NOTED** that some delegations expressed the view that that WGFAD05 was not thought to be optimal in the sense that it is not as purely scientific as it should be. There was also a mixture of scientific and opinion papers and a mixture of debate in those topics, with the opinion papers being disproportionally long. The SC **NOTED** the suggestion that there should be a clear division between scientific and opinion topics at future meetings, that papers should be carefully chosen for each topic at the chair's discretion in collaboration with the IOTC Secretariat, and that sufficient time should be allotted for scientific discussions.

103. On this subject, the SC **NOTED** that an observer presented a different viewpoint, arguing that there shouldn't be a limited definition or viewpoint on what constitutes science and that the availability of data access, the capacity for independent data analysis, and other factors should all be considered in scientific discussions.

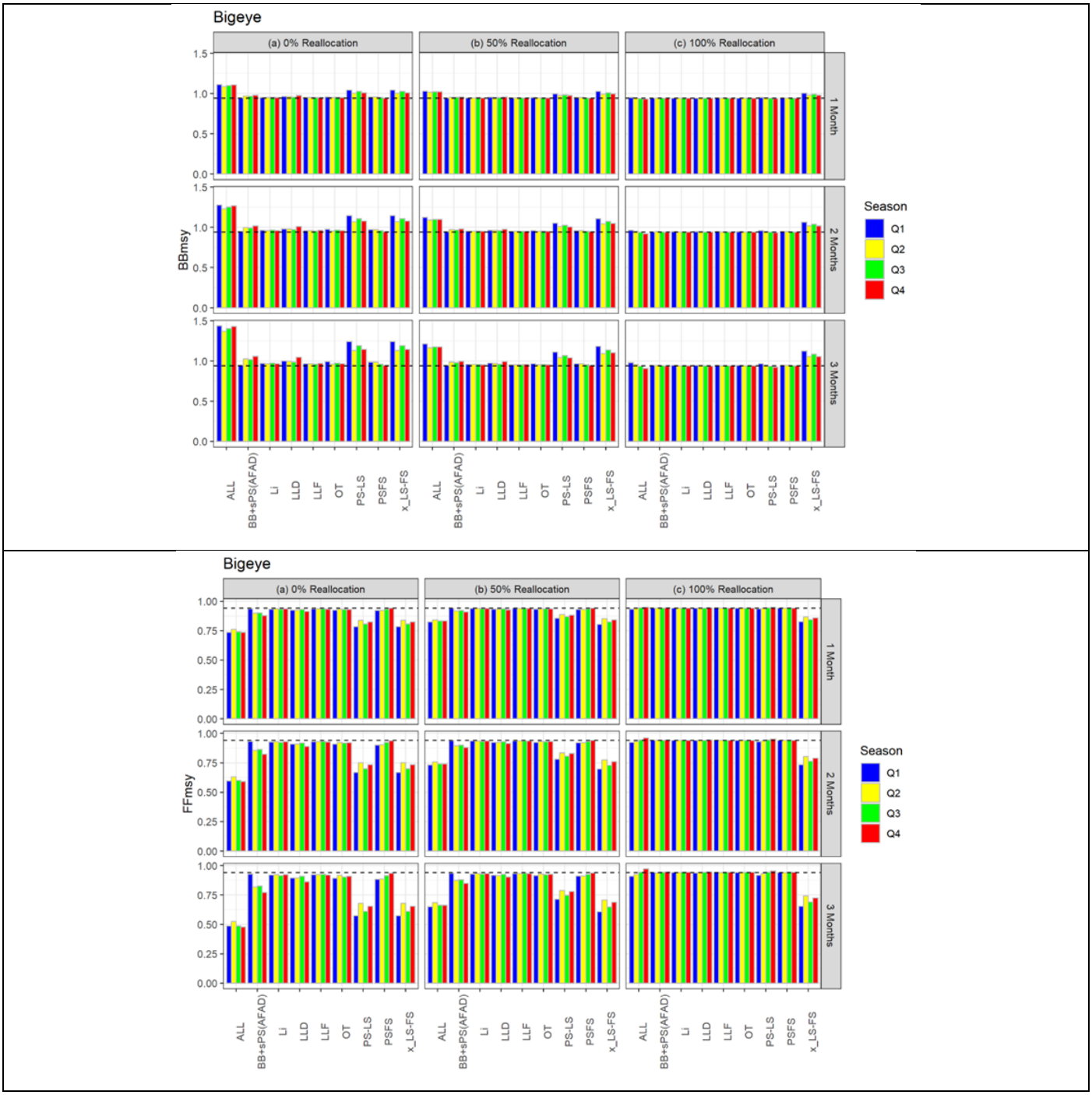

Figure a: Bigeye tuna: Impacts of closure scenarios on the stock status (B/BMSY and F/FMSY) by the end of a 10-year projection period. The duration of the closure (1 to 3 months) is given by row, and the type of reallocation in catch (100% or 0%) is given by column. The bars denote the season, i.e., quarter (Q1 to Q4) when the closure is implemented. ALL: All fleets,

BB+PS(AFAD): Baitboat and small purse seiners operating on AFADs; LI: Lines, LLD: Deepwater longline; LLF: Longline freezer; x_LS-FS: Catch from PS log school captured as free schools during closed season; OT: Other gears PS-LS: Purse seine log-school (DFAD); PS-FS: Purse seine free school. Dashed line: Implementing recommended catch limits (Bigeye: 80,583 t) without reallocation or closure.

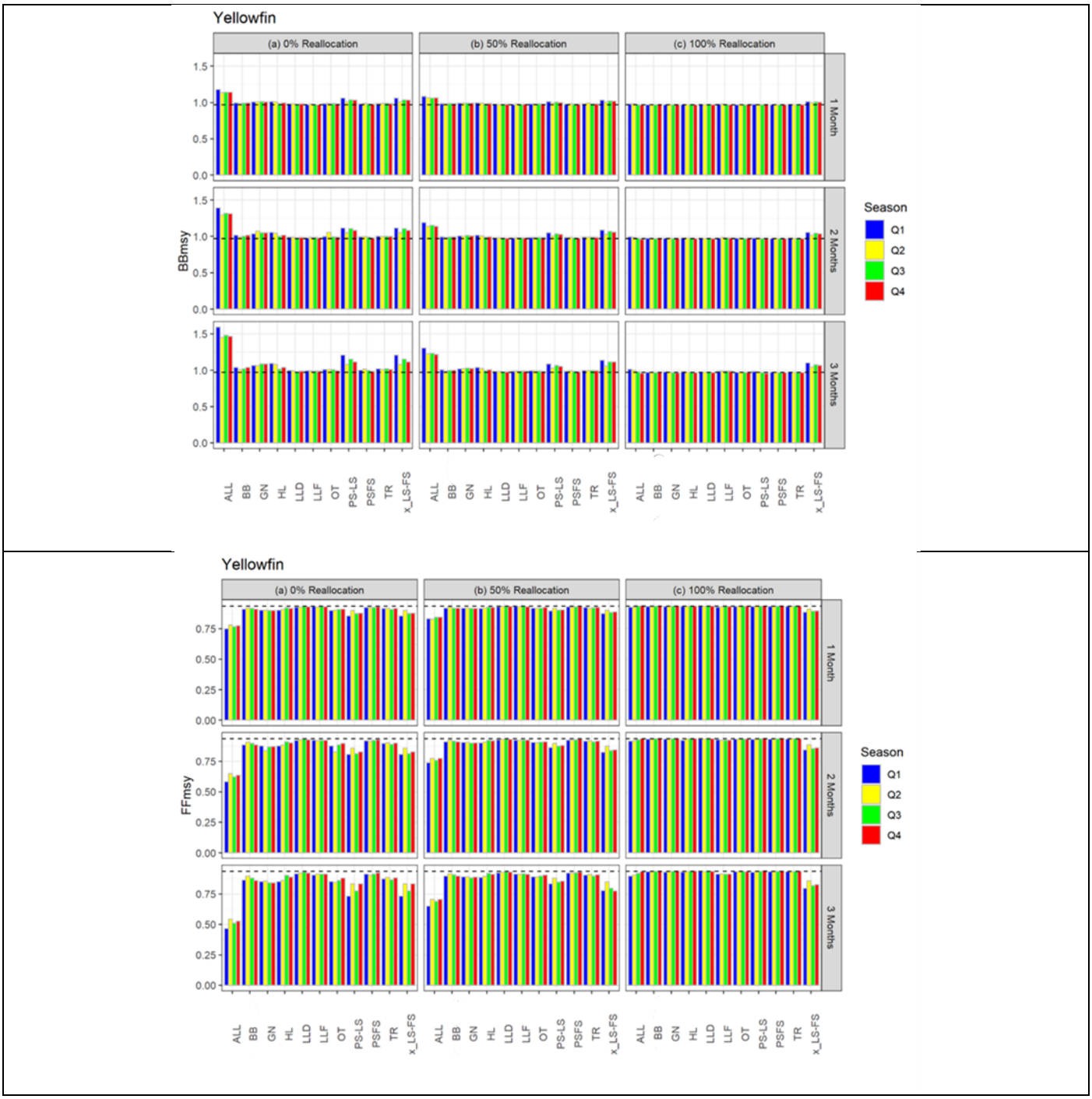

Figure b: Yellowfin tuna: Impacts of closure scenarios on the stock status (B/BMSY and F/FMSY) by the end of a 10-year projection period. The duration of the closure (1 to 3 months) is given by row, and the type of reallocation in catch (100% or 0%) is given by column. The bars denote the season, i.e., quarter (Q1 to Q4) when the closure is implemented. ALL: All fleets included; BB: Baitboat operating on AFADs; GN: Gillnet; HL: Handline; LLD: Deepwater longline; LLF: Longline freezer; x_LS-FS: Catch from PS logs school captured as free school during closed season; OT: Other gears; PS-LS: Purse seine log-school (DFAD); PS-FS: Purse seine free school; TR: Trolling: Implementing recommended catch limits (Yellowfin: 379,673 t) without reallocation or closure.

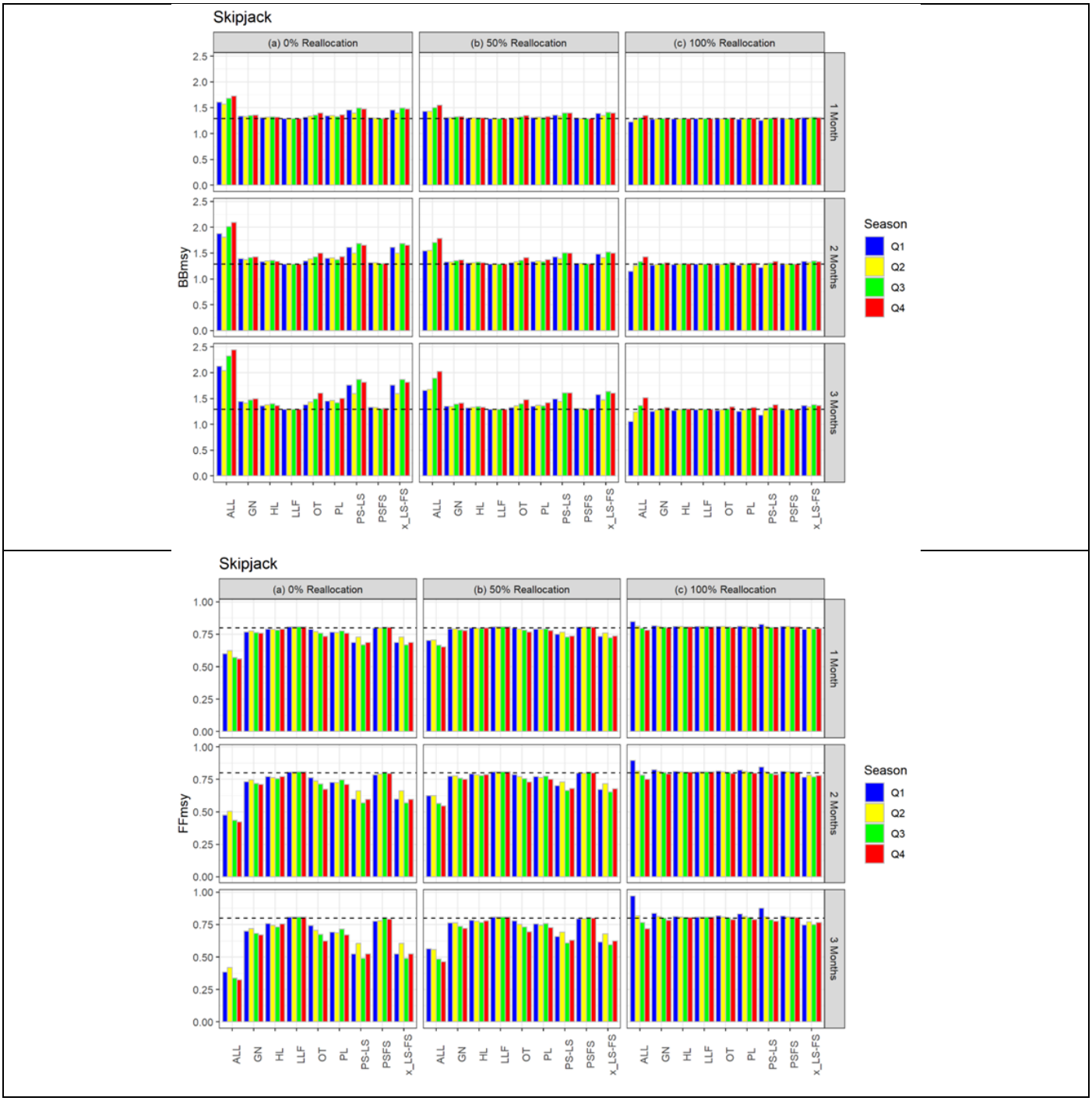

Figure c: Skipjack tuna: Impacts of closure scenarios on the stock status (B/BMSY and F/FMSY) by the end of a 10-year projection period. The duration of the closure (1 to 3 months) is given by row, and the type of reallocation in catch (100% or 0%) is given by column. The bars denote the season, i.e., quarter (Q1 to Q4) when the closure is implemented. ALL: All fleets included; GN: Gillnet; HL: Handline; LLF: Longline freezer; x_LS-FS: Catch from PS log school captured as free schools during closed season; OT: Other gears; PL: Pole and line; PS-LS: Purse seine log-school (DFAD); PS-FS: Purse seine free school. Dashed line: Implementing recommended catch limits (Skipjack: 513,512 t) without reallocation or closure.

7.4.3 Bigeye Tuna MP

104. The SC **RECALLED** that Resolution 22/03 adopted the bigeye management procedure and that the application of the bigeye management procedure resulted in a recommended TAC of 80,583 t per year for 2024 and 2025.

105. The SC **NOTED** the consideration of exceptional circumstances for the bigeye tuna MP in 2023 were discussed extensively at WPTT25 and evidence reviewed included new biological parameters and fishery operations, input data, and a comparison of the estimated population trend in the assessment with operating models.

106. The SC agreed with the review findings that there was no evidence for exceptional circumstances and **RECOMMENDED** that the agreed TAC for 2024 and 2025 should remain unchanged.

7.4.4 Other Matters

107. The SC **NOTED** document IOTC–2023–SC26–11 which provided information on a close-kin mark-recapture pilot study for Indian Ocean yellowfin tuna, including the following abstract provided by the authors:

> "*A close-kin mark-recapture (CKMR) design study completed in 2022 estimated that the collection of approximately 30,000 samples per year from Indian Ocean yellowfin tuna, over a five-year period, would provide an estimate of absolute abundance with an acceptable level of precision. The Working Party on Methods and Working Party on Tropical Tunas noted the logistical challenges in collecting this many samples and suggested a staged approach to the implementation of CKMR for yellowfin tuna. This paper outlines a proposal for the implementation of a CKMR pilot project for Indian Ocean yellowfin tuna to evaluate the logistics and feasibility of sampling, including as assessment of the quality of the DNA collected from key locations. The Scientific Committee is invited to provide feedback on this proposal*."

108. The SC **NOTED** that because the CPUE indices have many uncertainties that are often challenging to resolve, the CKMR can provide an alternative method of providing abundance estimates for tuna assessments.

109. The SC **NOTED** that a full 5-year sampling programme with a target of collecting up to 30,000 samples annually (70% juveniles, 30% adults) is being proposed for the pilot project. The SC further **NOTED** that the proposal was based on a 2020 design study for yellowfin tuna. A secondary goal of the project is to develop an IO-specific epigenetic clock to determine the age of yellowfin tuna.

110. The SC **NOTED** while sampling juvenile fish from the PS fishery is relatively easy upon landing, sampling adults from the longline fishery, which involves longer trips, may be more challenging. The SC **ENCOURAGES** liaising with CPCs to have an early consultation on sample collection from some of the major fisheries.

111. The SC **NOTED** that while fin clip samples are common and are useful for studying stock structure, muscle tissue is better suited for CKMR. Muscle tissue is specifically needed for the epigenetic ageing of yellowfin tuna, which is one of the pilot study's components.

112. The SC **NOTED** that the misidentification of juvenile yellowfin and bigeye tuna can be screened out through the genetic approach as part of the CKMR study.

113. The SC **NOTED** the broad support and expression of interest in cooperation from several CPCs, such as the EU, Kenya, China, Maldives, and Sri Lanka. The SC agreed that the project has the potential to be a significant milestone for the yellowfin assessment.

114. Following the presentation of document IOTC-2023-SC26-11 the SC **RECOMMENDED** that pursuing the development of the Close-Kin Mark Recapture project for yellowfin tuna should be a high priority for the Commission.

7.5 Report of the 14th Session of the Working Party on Methods (WPM14)

115. The SC **NOTED** the report of the 14th Session of the Working Party on Methods (IOTC–2023–WPM14–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 39 participants (cf. 60 in 2023). Three participants received funding through the MPF funding.

116. The SC **NOTED** that the WPM has reviewed and discussed a wide range of issues including MSE progress for IOTC species, multi-species MSE, exceptional circumstances considerations for bigeye tuna MSE, joint CPUE standardisations, and close kin mark recapture design study for yellowfin tuna.

7.5.1 Update on TCMP06

117. The SC **NOTED** document IOTC-2023-TCMP06-R on the Report of the 6th session of the TCMP held in May 2023. The SC **NOTED** that the WPM had taken into consideration the recommendations and discussions held at that meeting.

118. The SC **NOTED** the following requests made on the skipjack MSE: (1) Investigating the model-based MP; (2) revising the tuning window and revisiting the shape of HCR function, and (3) Increasing options for

"maximum TAC change" to include a symmetric 15% or 25% (both upward/downward changes) and asymmetric 15% upward and 10% downward, or 25% upward and 15% downward change.

119. The SC also **NOTED** the requests made on the swordfish MSE: (1) Investigate the model-based MP with MSY-related reference point parameters (in addition to the current depletion reference points); (2) investigating TAC constrains including a symmetric 15% or 10%, and asymmetric 15% upward and 10% downward.

120. The SC **NOTED** the above requests has been the focus of MSE work led by the modelers. The SC further **NOTED** that the SKJ and SWO MSE is currently thought to be in a relatively advanced stage of development in comparison to other species.

7.5.2 Management Strategy Evaluation Progress

121. The SC **NOTED** the good progress made in Management Strategy Evaluations exercises for IOTC species in 2023, and the useful discussions of MSE work at the MSE Task Force meeting (a technical expert group of the WPM) and the TCMP meeting in 2023.

7.5.3 Albacore MSE

122. The SC **NOTED** that the challenges encountered when conditioning OMs based on the albacore stock assessment have been resolved when using Approximate Bayesian Computation (ABC) to condition the albacore OMs. ABC can offer a variety of solutions to potential problems that may arise during conditioning (e.g., cannot account for recent observed catches). The SC endorsed this OM procedure and agreed that a final set of OMs be constructed for the MP evaluation.

7.5.4 Skipjack tuna MSE

123. The SC **NOTED** the SKJ MSE focused on addressing the requests made by TCMP06. The SC **NOTED** that the biomass dynamic model (BDM) did not work. The SC further **NOTED** that that the TAC changes tested under the MP is shown to be much less than the TAC constraint applied. The SC agreed that these TAC changes scenarios should still be completed.

124. The SC **NOTED** a few requests made by the WPM15 including reconditioning the OM with the new assessments, and further robustness tests to evaluate autocorrelation in the recruitment deviates comparable to observed recruitment. The SC **REQUESTED** the results to be presented at the TCMP-07 in Feb 2024.

7.5.5 Yellowfin tuna MSE

125. The SC **NOTED** that there has been no further progress on the OM development of yellowfin tuna, pending the results of the new yellowfin stock assessment scheduled in 2024 following the external review of model that took place in February in 2023.

7.5.6 Swordfish MSE

126. The SC **NOTED** that although the two types of MP performed similarly, the data-based MP produced wider inter-annual variability, comparatively higher catches, and increased uncertainty regarding future catches. Additionally, because it is directly linked to the CPUE index, the data-based MP is more responsive. It was also noted that in both robustness trials, the data-based MP outperforms the model-based MP.

7.5.7 General MSE issues

127. The SC **RECALLED** that TCMP and Commission requested to improve the communication of the MSE results by reducing the amount of technical content and for the creation of a small working group to discuss and agree on ways to improve communication between scientists and managers. The SC **NOTED** that the small group has now be convened with the first meeting expected to take place end of the year or early next year.

128. The SC **NOTED** that a virtual TCMP is planned for February 2024, with the main goal of reviewing the MSE work for skipjack tuna and swordfish. It is anticipated that the WPM(MSE) task force meeting in April will address any requests or recommendations made during that meeting. If the MP can be finalized it then can be presented to the TCMP in May to be ready for consideration by the Commission.

129. The SC **NOTED** that there is a need to ensure that any code and input files used for developing MPs is housed internally on an accessible platform, so it is available to other users and not lost when developers move on to other tasks. The SC **NOTED** that ICES uses a Transparency and Assessment Framework (TAF) which is a

useful frontend to direct users to the locations of relevant documents and code (e.g. Github repositories) that enable users to re-run assessments and other analyses, but that a much smaller system would be needed for the IOTC. The SC **NOTED** that most important information to be curated would be the input files, executables, and control files (not the large volume of output files), and **RECOMMENDED** that the Commission ensure that the IOTC Secretariat is provided with the necessary resources to manage the curation of this information.

7.6 Report of the 19th Session of the Working Party on Data Collection and Statistics (WPDCS19)

130. The SC **NOTED** the consolidated list of recommendations from the 19th Session of the Working Party on Data Collection and Statistics provided as an appendix to the report. The meeting was attended by 55 participants (cf. 117 in 2022) and the SC **NOTED** that the report is currently being finalised and will be shared via e-mail among participants for comments, revision, and adoption. Four participants received funding through the MPF.

131. The SC **ACKNOWLEDGED** the continuous efforts from the Secretariat, with important contributions from CPCs, to further improve on the process of reporting and validating mandatory fishery statistics to the IOTC.

132. The SC **NOTED** the trends in reporting quality for the main IOTC datasets by species category, and that in the case of annual retained catches these are reported according to IOTC requirements for an average of 80% of their annual totals in recent years, although with a drop in quality for neritic species.

133. The SC **NOTED** with concern the lower quality levels estimated for all other datasets (catch and effort and size-frequency) and particularly for data-poor species, which has been constantly highlighted as a major issue by all concerned Working Parties.

134. The SC **NOTED** the activities from the Secretariat aiming at improving the reporting and management of all statistical fishery data, including the updates of the IOTC forms and the definition of new forms to support reporting of data for activities on drifting objects and anchored fish aggregating devices.

135. The SC **RECALLED** how the data reporting forms presented by the Secretariat have become mandatory for the provision of statistical information to the IOTC, and that dedicated regional workshops will be held in Q1 and Q2 2024 to support CPCs in fully adopting the new forms and procedures.

136. The SC also **NOTED** the updated results of the study on the FAO matrix approach for the characterisation of IOTC fisheries and **ACKNOWLEDGED** the importance of this activity.

137. The SC **ENDORSED** the proposed updates to the IOTC data submission processes, and more specifically:

    a. the introduction of Form 3-DA and 3-AA
    b. the decommissioning of Form 3-AR, 3-FA, 3-SU, and 1-RC-YFT
    c. the entry into force of the *ad-interim* data reporting workflow and supporting tools starting with the 2024 data reporting cycle (i.e., by the deadline of 30 June 2024)
    d. that the trial of the FAO matrix approach for the characterisation of IOTC fisheries are extended to cover all Indian Ocean fisheries
    e. that ROS data be reported to the IOTC exclusively through the consolidated ROS Excel data reporting forms or as *.ros* files produced by the ROS electronic data collection tools.

138. The SC **ACKNOWLEDGED** the request to clarify the issues with data reporting requirements identified with Res. 12/02 and 19/07, as well as the request to change the status of reporting of fishing craft statistics from *voluntary* to *mandatory* in Res. 15/02 and **RECOMMENDED** that the Commission takes these requests in due consideration at the next revision of all concerned resolutions.

139. The SC **NOTED** the papers presented by national scientists and the wide range of topics discussed, from improvements to data collection systems, to implementation of new methodologies for data collection and estimation, including the development of new logbooks to consider the increased complexity of data reporting requirements.

140. The SC **NOTED** the status of the digital ocean atlas developed for Seychelles, which provides detailed ocean-climate information, **CONSIDERED** the resources necessary to develop online indicators for the whole Indian Ocean, and **ENDORSED** the implementation of a scoping study to further develop all presented indicators, possibly though an online atlas, and devise the most effective ways to present these to the SC and its Working Parties.

141. The SC **ACKNOWLEDGED** the capacity building activities delivered by the Secretariat through the regular budget of IOTC and with support from external partners and donors such as the European Union, the United Kingdom of Great Britain and Ireland, and OFCF Japan.

142. The SC **ACKNOWLEDGED** the progresses accomplished by Indonesia in re-estimating their historical catch series from 2010 to 2021, and while **ENDORSING** the proposed general methodology, **NOTED** that there still are issues in some of the species-specific reconstructed historical time series such as: significant fluctuations in the revised catch statistics for several species, inconsistent patterns for specific years (e.g., 2018) and issues in continuity and magnitude with the historical catches pre-2010 (**Fig. d**).

Figure d Comparison of total annual retained catch by species between Indonesia's new revision (ESTIMATIONS) and the IOTC best scientific estimates (IOTC) for the 16 IOTC species

143. For this reason, the SC **AGREED** to continue providing general guidance to resolve this issue and as a first step **ENCOURAGED** Indonesia to liaise with the Secretariat and present updates on their yellowfin tuna historical time series at the next data preparatory meeting of the WPTT in May 2024.

7.6.1 Update on WGEMS03

144. The SC **NOTED** the report of the 3rd ad hoc working group meeting on Electronic Monitoring Standards (IOTC-2023-WGEMS03-R). The meeting was attended by 89 participants (cf. 104 in 2022).

145. The SC **ACKNOWLEDGED** the discussions regarding the outcomes of the WGEMS, including feedback on the challenges required to collect ROS data through EMS, and the outputs of a desk study on alternative data collection mechanisms for IO artisanal fisheries.

146. **ACKNOWLEDGING** that Res. 23/08 requires the revision of the ROS data fields, the SC **ENDORSED** the request of setting up an intersessional working group (either by correspondence, or remotely) convening interested WPDCS and WGEMS participants to discuss and review:

a) The scientific need for each ROS data field (as proposed by the ROS expert workshop of 2018)
b) The status (mandatory / mandatory when feasible / optional) of each ROS data field
c) The possibility of adding EMS-specific elements to the list of ROS mandatory data fields
d) The inclusion of proper mechanisms / classifications, within the ROS data fields, to better capture details on fins naturally attached to sharks
e) The summary of capabilities, advantages, and drawbacks of collecting ROS data fields through alternative methods such as EMS, human onboard observers, port-sampling, self-reporting, etc. (as well as a combination of these).

and **REQUESTED** that this group reports to the next session of the WGEMS and WPDCS

7.6.2 Other matters

Yellowfin tuna catch limits for 2023 and 2024 (Res. 19/01 and 21/01)

147. The SC **ACKNOWLEDGED** that Indonesia and I.R. Iran have recently (July 2023) re-submitted their historical yellowfin tuna catch data for all fisheries subject to Res. 19/01, and that these revisions address the proper categorization of artisanal / industrial fisheries *sensu* IOTC for Indonesia and the proper breakdown of offshore gillnet catches for I.R. Iran.

148. The SC **ACKNOWLEDGED** that these revisions are such to exclude Indonesian longline industrial fisheries from those subject to 19/01, as the baseline catch for the fishery is now less than 2,000 t, and sensibly reduce the baseline catches for the industrial gillnet fishery of I.R. Iran, although keeping the negative catch limits estimated for the fishery.

149. The SC **RECALLED** how due to the unavailability of catch data for 2023 (to be provided by the deadline of 30 June 2024) all presented catch limits for 2024 are *estimated* with the assumption that catches for 2023 will be equal to (or less than) the calculated limits for the year.

150. The SC also **RECALLED** that in agreement with the text of Res. 21/01, provided catch limits refer to CPCs, and not distinct fleets, and therefore shall be calculated as such.

151. Considering this, the SC **ENDORSED** the annual catch limits for 2023 (calculated) and 2024 (estimated) as deriving from Res. 19/01 and 21/01 and presented in Appendix 33 as Table 1 and Table 2, respectively.

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

152. 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

153. 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

154. The SC **NOTED** that in 2023, the MPF provided funding for 7 participants to attend the various working parties throughout the year.

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

155. 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 CPC scientific observers, both on board and at port need to have hard copies.

156. The SC **NOTED** that OFCF Japan has facilitated the translation and shipment of ID guides in partnership with the IOTC Secretariat, with short-term funding provided by OFCF Japan. The SC expressed its gratitude to OFCF Japan for conducting these important activities.

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

157. The SC **RECALLED** its recommendation in 2022 that the Commission revise the current Rules of Procedure (if necessary) to allow Chairs to serve an additional year or years beyond two terms if no suitable candidates are available to replace them once their terms are completed. The SC **NOTED** that the Commission endorsed the SC recommendations as its own and that therefore this recommendation was approved. In light of this recommendation the terms of several Working Party Chairs as well the SC Chair was extended beyond their two terms and the SC **RECOMMENDED** that this be noted and endorsed by the Commission.

158. 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.

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

8.1 Tuna – Highly migratory species

159. 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 2023 (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

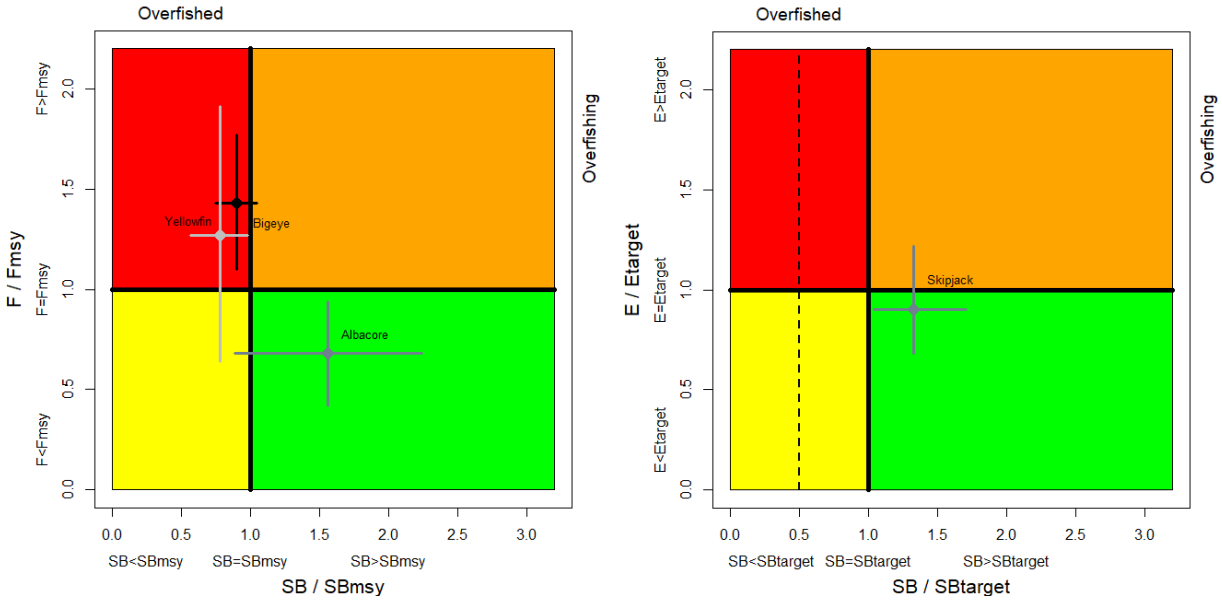

Fig. 1. (Left) Combined Kobe plot for bigeye tuna (black: status in 2021, based on the assessment conducted in 2022), and yellowfin tuna (light grey: 2020, with assessment conducted in 2021) and albacore (dark grey: 2020 with assessment conducted in 2022) showing the estimates of current spawning biomass (SB) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality. (Right) Kobe plot for skipjack tuna (2022 with assessment conducted in 2023) 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).

160. The SC **NOTED** paper IOTC–2023–SC26–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 seerfish – neritic species

161. The SC **RECOMMENDED** that the Commission note the management advice developed for each neritic tuna (and seerfish) 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 2023 (Fig. 2):

Bullet tuna (*Auxis rochei*) – Appendix 12

Frigate tuna (*Auxis thazard*) – Appendix 13

Kawakawa (*Euthynnus affinis*) – Appendix 14

Longtail tuna (*Thunnus tonggol*) – Appendix 15

Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix 16

Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix 17

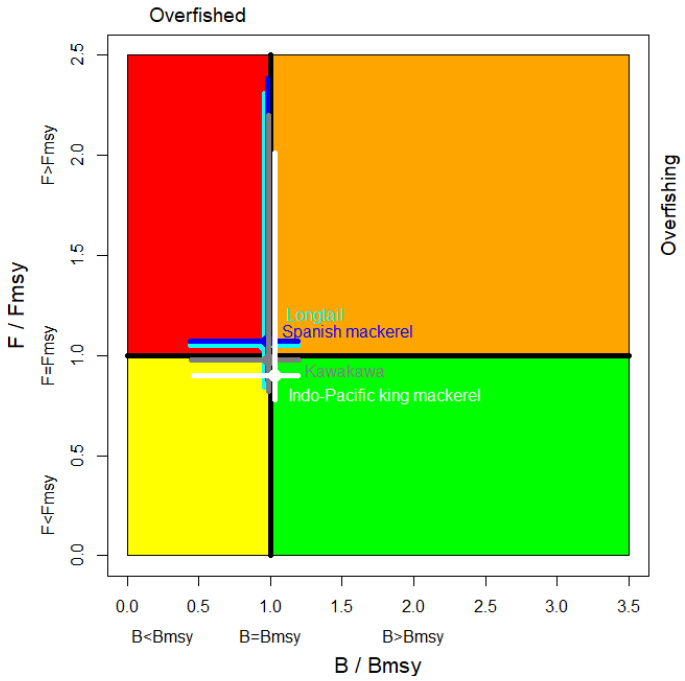

Fig. 2. Combined Kobe plot for longtail tuna (cyan), narrow-barred Spanish mackerel (blue), kawakawa (grey) (all for 2021 with assessment carried out in 2023) and Indo-Pacific king mackerel (2019 with assessment conducted in 2021 (white)), showing the estimates of stock size (B) and current fishing mortality (F) in relation to optimal biomass and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs. Given unresolved uncertainty in the assessment, status for bullet tuna, frigate tuna and Narrow-barred Spanish mackerel should be interpreted with caution.

8.3 Billfish

162. 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 2023 (Fig. 3):

Black marlin (*Istiompax indica*) – Appendix 18

Blue marlin (*Makaira nigricans*) – Appendix 19

Striped marlin (*Kajikia audax*) – Appendix 20

Indo-Pacific sailfish (*Istiophorus platypterus*) – Appendix 21

Swordfish (*Xiphias gladius*) – Appendix 22

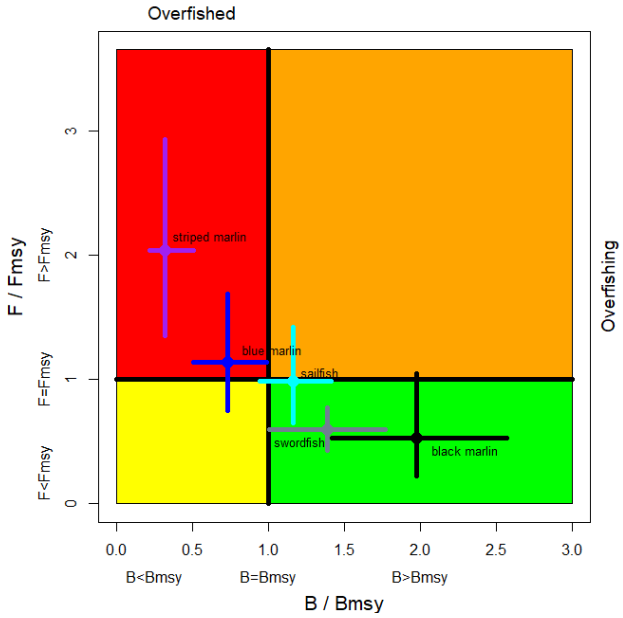

Fig. 3. Combined Kobe plot for swordfish (2021 with assessment conducted in 2023, grey), Indo-Pacific sailfish (2019 with assessment conducted in 2022, cyan), black marlin (2019 with assessment conducted in 2021, black), blue marlin (2020 with

assessment conducted in 2022, blue) and striped marlin (2019 with assessment conducted in 2021, purple) showing the estimates of current stock size (SB or B, species assessment dependent) and current fishing mortality (F) in relation to optimal stock size and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs. Given unresolved uncertainty in the assessment, status for black marlin is uncertain.

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

9.1 Sharks

163. 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

164. 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

165. 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

166. 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

167. The SC **NOTED** paper IOTC–2023–SC26–07 which provided an update on the status of implementation and reporting to the IOTC Secretariat set out by Resolution 22/04 On a Regional Observer Scheme (ROS) including the coverage estimated for both the longline and purse seine industrial fisheries from concerned CPCs, and how these compare to the expected minimum coverage level.

168. The SC **CONGRATULATED** the Secretariat for the compilation of the data which provide a comprehensive view of the status of the ROS.

169. The SC **ENCOURAGED** CPCs to validate the information provided in appendices A, B and C of paper IOTC-2023-SC26-07 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.

170. The SC **NOTED** that the annual observer coverage estimated by the Secretariat for longline fisheries (Appendices B1-B2 of paper IOTC-2023-SC26-07) is calculated as the proportion of hooks observed with respect to the total number of hooks deployed by the fleet while the third paragraph of the IOTC Resolution 22/04 mentions a coverage of "*at least 5% of the number of operations/sets*", further **NOTING** that the number of fishing sets is also used in ICCAT, IATTC and WCPFC for deriving observer coverage and that harmonisation in methods should be sought across tuna RFMOs.

171. The SC **ACKNOWLEDGED** that this *estimated* coverage is intended as an independent summary of the level of proper ROS reporting to the IOTC and might differ from what the CPCs include in their national reports because of a) availability (in the latter) of historical total efforts as number of sets, b) availability of additional information with respect to what reported to the Secretariat.

172. The SC also **RECALLED** that for the sake of clarity and to support the cross-verification of the information provided, the summary tables of *estimated* ROS coverage are broken down to the *fleet* level rather than to the CPC level.

173. While **NOTING** that there are still many CPCs that have been unable to meet the minimum of 5% coverage, due to the importance of observer data the SC **NOTED** that raising this minimum level of coverage would be beneficial.

174. The SC **NOTED** that due to the CoViD-19 pandemic, the level of observer coverage in 2020-2021 was very low for many CPCs which has affected the average coverage for 2018-2022 as reported in the paper.

175. The SC **ACKNOWLEDGED** that the estimated levels of coverage provided in Appendix B.1 of IOTC-2023-SC26-07_rev1 are based on the number of hooks (observed and total), as this effort unit is the only one generally available to the IOTC Secretariat. The SC further NOTED that the issue had been previously raised during SC25 and therefore **REITERATED** its **RECOMMENDATION** (SC25.34 (Para. 172)) that at the next revision of Res. 15/02 this is amended to include the mandatory reporting of sets/operations as a additional unit of effort for longline fisheries.

176. The SC **NOTED** reports from some CPCs which are looking to further develop their observer schemes as well as roll out EMS across parts of their fleets which will help to increase the coverage for these fleets. **NOTING** that it is mandatory for CPCs to report ROS information for all vessels listed in IOTC record of authorisation, that clarity will be sought for the research vessels, which are collecting scientific data on their compliance obligation.

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

177. The SC **NOTED** that in 2022, full comprehensive training was completed in all four participating CPCs and pilot deployments had been carried out in two CPCs. The SC **NOTED** that this project finished at the end of 2022.

178. The SC **NOTED** that the Secretariat plans to continue working with CPCs to further develop their observer schemes and to finalise the electronic tools for ROS data collection and management so that data can easily be imported into the ROS database. This will help to ensure that the ROS continues to provide information required of the Commission.

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

11.1 Progress on previous recommendations from WPs and the SC

179. The SC **NOTED** paper IOTC–2023–SC26–10 which provided the SC with an update on the progress made on its 2022 recommendations (also available in Appendix 34).

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

11.2 Program of Work (2024–2028) and assessment schedule

11.2.1 Program of Work

181. The SC **NOTED** IOTC–2023–SC26–08 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.

182. 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.

183. 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.

184. 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.

185. 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** Address the issues identified as priorities by the yellowfin tuna peer review panel (February 2023)	**Abundance indices development** In view of the coming assessments of yellowfin, bigeye, and skipjack develop abundance time series for each tropical tuna stock for the Indian Ocean • Continue to develop CPUE indices from Longline, PS, Pole and line fisheries, and fishery independent indices of abundance such as those derived from echosounder buoys. • Explore and support the development of gillnet CPUE indices for fleets (e.g., Iran, Pakistan and Sri Lanka) • Evaluate effect of changes of spatial coverage on the longline CPUE through the Joint CPUE workshop and estimate spatial temporal abundance distribution through VAST modelling approach	**Analysis of tagging data** Analyze data from IOTC tagging programs outside stock assessment models and evaluate its utility and impact on stock assessments.
WPEB	**Fisheries data collection** 1.1 Catch composition reconstruction (initial focus Sri Lanka, Pakistan and Indonesia) 1.1.2 Historical data mining for the key species and IOTC fleets (e.g., as artisanal gillnet and longline coastal fisheries) including workshops: 1.1.3 Historical data mining for the key species, including the collection of information about catch, effort and spatial distribution of those species and fleets catching them 1.1.4 CPUE standardisation and review of additional abundance indicators series for each key shark species and fishery in the Indian Ocean	**Shark research and management strategy** 2.1 Implementation of work suggested by shark work plan consultancy 2.2 Prioritising shark research based on previous work and including analysing gaps in knowledge	**Ecoregions development** Support for the development and refinement of ecoregions in the Indian Ocean: • Development of a pilot study (focused on two ecoregions: one coastal, the Somali Current ecoregion and one oceanic, the Indian Ocean Gyre ecoregion)
WPNT	**Data mining and collation** Collate and characterize operational level data for the main neritic tuna fisheries in the Indian	**Stock assessment / Stock indicators** Explore alternative assessment approaches and develop improvements where necessary based on the data available to determine stock status	**Biological information (parameters for stock assessment) including stock structure (connectivity)**

	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)). • Reconstruction of historical catch by CPCs using recovered or captured information. • Re-estimation of historic catches (with consultation and consent of concerned CPCs) 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)	for longtail tuna, Spanish mackerel and kawakawa	• Quantitative biological studies are necessary for all neritic tunas throughout their range to determine key biological parameters including age-at-maturity, and fecundity-at-age/length relationships, age-length keys, age and growth, longevity which will be fed into future stock assessments. Priorities for longtail tuna, kawakawa and Spanish mackerel. Genetic research to determine the connectivity of neritic tunas throughout their distributions (This should build on the stock structure work conducted in other previous studies)
WPTmT	**Stock structure (connectivity and diversity)** 1.1 Genetic research to determine the connectivity of albacore throughout its distribution and the effective population size.	**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) 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	**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. 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.

		sampling, are required to ensure that adequate samples are collected. 2.1.2 Quantitative biological studies are necessary for albacore throughout its range to determine spatio-temporal patterns in 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.	
WPB	**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 inter-sessionally prior to the next WPB. Funding is needed to support the workshop participation of CPCs and expert(s) on billfish reproduction (expecting to have confirmation from the host organization).	**Biological and ecological information** 2.1 Age and growth research 2.1.1 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) 2.2 Spawning time and locations 2.2.1 Collect gonad samples from billfish or utilise any other scientific means to confirm the spawning time and location of the spawning areas 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. 2.3 Stock structure (connectivity and diversity) 2.3.1 Continue work on determining stock structure of Billfish species, using complimentary data sources, including genetic and microchemistry information as well as other relevant sources/studies.	**Billfish bycatch mitigation** WPB and CPCs scientists to firstly, review and summarise existing information on billfish bycatch mitigation, including also factors influencing at-haul and post-release mortality of billfish, and secondly to undertake further research to inform gaps in understanding on potential effective mitigation approaches, to provide options for the Commission to reduce fishing mortality for species where that is required (e.g. Black Marlin, Striped Marlin and Sailfish) focusing on gillnet and longline fisheries but also including recreational and sport fishing activities.
WPDCS	**Coastal fisheries data collection** 1.2 Assist the implementation of data collection and sampling activities for fisheries insufficiently sampled. Recommended actions include: (regional) training on species identification, designing sampling guidelines for IOTC fisheries.	**Evaluation of catch and effort data uncertainties** 2.1 Review of historical nominal catches and catch-and-effort data for all stocks being assessed in the following years to determine the level of uncertainty to be used for stock assessment and management procedures	**Workshops to clarify data reporting requirements and support preparation of annual submissions**

	Priority to be given to the following countries / fisheries: • Indonesia • India • Bangladesh • Pakistan • I.R. Iran • Kenya • Somalia • Sri Lanka		
WPM	Continuation of Management Strategy Evaluation for Albacore, Skipjack, Yellowfin, Bigeye tunas as well as Swordfish	Peer review of BET MSE as per the ToRs endorsed by the SC	

11.2.2 Assessment schedule

186. The SC **ADOPTED** a revised assessment schedule, ecological risk assessment and other core projects for 2024–28, 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 Consultants

187. 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.

11.3 Schedule of meetings for 2024 and 2025

188. The SC **NOTED** paper IOTC–2023–SC26–09 which outlined the proposed schedule for IOTC Working Parties and SC meetings for 2024 and 2025.

11.3.1 Data preparatory meetings and Hybrid meetings

189. **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 since 2019 data preparatory meetings were successfully held for the WPTmT, WPTT and WPEB, 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 **RECOMMENDED** 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.

190. The SC **NOTED** that there had been a few teething problems holding meetings in a hybrid format in 2023, especially related to the costs associated with the audio-visual equipment required, as well as the issues associated with ensuring the equipment was suitable to ensure full participation of both those in person as well as those connecting virtually. However, the SC **AGREED** on the utility of facilitating both in-person and virtual participation at future meetings to ensure increased participation and reduce the logistical costs for many CPCs and observers. As such, the SC **RECOMMENDED** that future Scientific Committee meetings continue to be held in a hybrid format, as well as working parties if possible. The SC further **RECOMMENDED** that all presentations at these meetings be made in person to ensure the aforementioned issues did not adversely affect the quality of the advice being provided.

11.3.2 Final Meeting schedule

191. The SC **REQUESTED** that the schedule of Working Party and Scientific Committee meetings for 2024 and 2025 provided at Appendix 37 be communicated by the IOTC SC Chairperson to the Commission for its endorsement.

12. OTHER BUSINESS

12.1 Election of a Chair and a Vice-Chair for the next biennium (Chair and Secretariat)

192. The SC **NOTED** that the second term of the current Chairperson, Dr Toshihide Kitakado, is due to expire at the end of the current SC meeting and as per the IOTC Rules of Procedure (2014), participants are required to elect a new Chairperson for the next biennium.

193. Noting the Rules of Procedure (2014), the SC called for nominations for the position of Chairperson of the IOTC SC. No nominations were received. Taking into account the recommendation outlined in paragraph 157 above a CPC proposed that Dr Kitakado continue as SC chair for another term as an interim measure. The proposal received substantial support from the members in the meeting and therefore Dr Toshihide Kitakado was re-elected as Chairperson of the SC for the next biennium.

194. The SC **NOTED** that the current Vice-Chairperson, Dr Denham Parker had vacated his post in 2023. As per the IOTC Rules of Procedure (2014), participants are required to elect a new Vice-Chairperson/s for the next biennium.

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

13. ADOPTION OF THE REPORT OF THE 26TH SESSION OF THE SCIENTIFIC COMMITTEE

196. The SC **RECOMMENDED** that the Commission consider the consolidated set of recommendations arising from SC26, provided at Appendix 38.

197. The report of the 26th Session of the Scientific Committee (IOTC–2023–SC26–R) was **ADOPTED** by correspondence.

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APPENDIX 2
AGENDA FOR THE 26TH SESSION OF THE SCIENTIFIC COMMITTEE

Date: 4 - 8 December 2023
Location: Hotel St Regis, Mumbai, India/Hybrid
Time: 09:00 – 17:00 daily
Chair: Dr Toshihide Kitakado (Japan)
Vice-Chair: NA

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 27th Session of the Commission.
   - 4.2 Previous decisions of the Commission

5. **SCIENCE RELATED ACTIVITES OF THE IOTC SECRETARIAT IN 2023** (IOTC Secretariat)
   - 5.1 Report of the Secretariat – Activities in support of the IOTC science process in 2023

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

7. **REPORTS OF THE 2023 IOTC WORKING PARTY MEETINGS**
   - 7.1 IOTC–2023–WPNT13–R Report of the 13th Session of the Working Party on Neritic Tunas
   - 7.2 IOTC–2023–WPB21–R Report of the 21st 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–2023–WPEB19–R Report of the 19th 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 Other matters
   - 7.4 IOTC–2023–WPTT25–R Report of the 25th Session of the Working Party on Tropical Tunas
     - 7.4.1 Skipjack tuna stock assessment
     - 7.4.2 Update on the WGFAD04 and WGFAD05
     - 7.4.3 Bigeye tuna MP considerations
     - 7.4.4 Other matters
   - 7.5 IOTC–2023–WPM14–R Report of the 14th Session of the Working Party on Methods
     - 7.5.1 Update on TCMP06
     - 7.5.2 Management Strategy Evaluation Progress
   - 7.6 IOTC–2023–WPDCS19–R Report of the 19th Session of the Working Party on Data Collection and Statistics
     - 7.6.1 Update on WGEMS03
     - 7.6.2 Other matters

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
- 7.7.2 Invited Expert(s) at the WP meetings
- 7.7.3 Meeting participation fund
- 7.7.4 IOTC species identification guides: Tuna and tuna-like species
- 7.7.5 Chairpersons and Vice-Chairpersons of the SC and its subsidiary bodies

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 (2024–2028) and assessment schedule
  - 11.2.1 Program of Work
  - 11.2.2 Assessment schedule
  - 11.2.3 Consultants
- 11.3 Schedule of meetings for 2024 and 2025
  - 11.3.1 Data preparatory meetings
  - 11.3.2 Final meeting schedule

12 OTHER BUSINESS (Chairperson)

12.1 Election of a Chair and a Vice-Chair for the next biennium (Chair and Secretariat)

13 REVIEW OF THE DRAFT, AND ADOPTION OF THE REPORT OF THE 26th SESSION OF THE SCIENTIFIC COMMITTEE (Chairperson)

APPENDIX 3
LIST OF DOCUMENTS

Document	Title
IOTC–2023–SC26–01a	Draft: Agenda of the 26th Session of the Scientific Committee
IOTC–2023–SC26–01b	Draft: Annotated agenda of the 26th Session of the Scientific Committee
IOTC–2023–SC26–02	Draft: List of documents of the 26th Session of the Scientific Committee
IOTC–2023–SC26–03	Outcomes of the 6th Special Session and 27th Session of the Commission (IOTC Secretariat)
IOTC–2023–SC26–04	Previous decisions of the Commission (IOTC Secretariat)
IOTC–2023–SC26–05	Report of the Secretariat – Activities in support of the IOTC science process in 2023 (IOTC Secretariat)
IOTC–2023–SC26–06	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–2023–SC26–07	Update on the implementation of the regional observer scheme (IOTC Secretariat)
IOTC–2023–SC26–08	Revision of the program of work (2024–2028) for the IOTC science process (IOTC Secretariat)
IOTC–2023–SC26–09	Proposed schedule of Working Party and Scientific Committee meetings for 2024 and 2025 (IOTC Secretariat)
IOTC–2023–SC26–10	Progress on SC25 recommendations (IOTC Secretariat)
IOTC–2023–SC26–11	A close-kin mark-recapture pilot study for Indian Ocean yellowfin tuna (Williams A, Tremblay-Boyer L, Hillary R, Preece A)
Executive Summaries	
IOTC–2023–SC26–ES01	Status of the Indian Ocean Albacore (ALB: *Thunnus alalunga*) resource
IOTC–2023–SC26–ES02	Status of the Indian Ocean bigeye tuna (BET: *Thunnus obesus*) resource
IOTC–2023–SC26–ES03	Status of the Indian Ocean skipjack tuna (SKJ: *Katsuwonus pelamis*) resource
IOTC–2023–SC26–ES04	Status of the Indian Ocean yellowfin tuna (YFT: *Thunnus albacares*) resource
IOTC–2023–SC26–ES05	Report on Biology, Stock Status and Management of Southern Bluefin Tuna: 2023 (from CCSBT)
IOTC–2023–SC26–ES06	Status of the Indian Ocean bullet tuna (BLT: *Auxis rochei*) resource
IOTC–2023–SC26–ES07	Status of the Indian Ocean frigate tuna (FRI: *Auxis thazard*) resource
IOTC–2023–SC26–ES08	Status of the Indian Ocean kawakawa (KAW: *Euthynnus affinis*) resource
IOTC–2023–SC26–ES09	Status of the Indian Ocean longtail tuna (LOT: *Thunnus tonggol*) resource
IOTC–2023–SC26–ES10	Status of the Indian Ocean Indo-Pacific king mackerel (GUT: *Scomberomorus guttatus*) resource
IOTC–2023–SC26–ES11	Status of the Indian Ocean narrow-barred Spanish mackerel (COM: *Scomberomorus commerson*) resource
IOTC–2023–SC26–ES12	Status of the Indian Ocean black marlin (BLM: *Makaira indica*) resource
IOTC–2023–SC26–ES13	Status of the Indian Ocean blue marlin (BUM: *Makaira nigricans*) resource

Document	Title
IOTC–2023–SC26–ES14	Status of the Indian Ocean striped marlin (MLS: *Tetrapturus audax*) resource
IOTC–2023–SC26–ES15	Status of the Indian Ocean Indo-Pacific sailfish (SFA: *Istiophorus platypterus*) resource
IOTC–2023–SC26–ES16	Status of the Indian Ocean swordfish (SWO: *Xiphias gladius*) resource
IOTC–2023–SC26–ES17	Status of the Indian Ocean blue shark (BSH: *Prionace glauca*)
IOTC–2023–SC26–ES18	Status of the Indian Ocean oceanic whitetip shark (OCS: *Carcharhinus longimanus*)
IOTC–2023–SC26–ES19	Status of the Indian Ocean scalloped hammerhead shark (SPL: *Sphyrna lewini*)
IOTC–2023–SC26–ES20	Status of the Indian Ocean shortfin mako shark (SMA: *Isurus oxyrinchus*)
IOTC–2023–SC26–ES21	Status of the Indian Ocean silky shark (FAL: *Carcharhinus falciformis*)
IOTC–2023–SC26–ES22	Status of the Indian Ocean bigeye thresher shark (BTH: *Alopias superciliosus*)
IOTC–2023–SC26–ES23	Status of the Indian Ocean pelagic thresher shark (PTH: *Alopias pelagicus*)
IOTC–2023–SC26–ES24	Status of marine turtles in the Indian Ocean
IOTC–2023–SC26–ES25	Status of seabirds in the Indian Ocean
IOTC–2023–SC26–ES26	Status of cetaceans in the Indian Ocean
Other meeting reports	
IOTC–2023–WPNT13–R	Report of the 13th Session of the Working Party on Neritic Tunas
IOTC–2023–WPB21–R	Report of the 21st Session of the Working Party on Billfish
IOTC–2023–WPEB19–R	Report of the 19th Session of the Working Party on Ecosystems and Bycatch
IOTC–2023–WPM14–R	Report of the 14th Session of the Working Party on Methods
IOTC–2023–WPDCS19–R	Report of the 19th Session of the Working Party on Data collection and Statistics
IOTC–2023–WPTT25–R	Report of the 25th Session of the Working Party on Tropical Tunas
IOTC-2023-TCMP06-R	Report of the 6th Session of the Technical Committee on Management Procedures
IOTC-2023-WGFAD05-R	Report of the 5th meeting of the Working Group on FADs
IOTC-2023-WGEMS03-R	Report of the 3rd meeting of the Working Group on Electronic Monitoring Standards
National Reports	
IOTC–2023–SC26–NR01	Australia
IOTC–2023–SC26–NR02	Bangladesh, People's Republic of
IOTC–2023–SC26–NR03	China
IOTC–2023–SC26–NR04	Comoros
IOTC–2023–SC26–NR06	European Union (Including Annexes)
IOTC–2023–SC26–NR07	France (OT)
IOTC–2023–SC26–NR08	India
IOTC–2023–SC26–NR09	Indonesia
IOTC–2023–SC26–NR10	Iran, Islamic Republic of

Document	Title
IOTC–2023–SC26–NR11	Japan
IOTC–2023–SC26–NR12	Kenya
IOTC–2023–SC26–NR13	Korea, Republic of
IOTC–2023–SC26–NR14	Madagascar
IOTC–2023–SC26–NR15	Malaysia
IOTC–2023–SC26–NR16	Maldives, Republic of
IOTC–2023–SC26–NR17	Mauritius
IOTC–2023–SC26–NR19	Oman
IOTC–2023–SC26–NR20	Pakistan
IOTC–2023–SC26–NR21	Philippines
IOTC–2023–SC26–NR22	Seychelles
IOTC–2023–SC26–NR24	South Africa
IOTC–2023–SC26–NR25	Sri Lanka (Including Annexes)
IOTC–2023–SC26–NR27	Tanzania
IOTC–2023–SC26–NR28	Thailand
IOTC–2023–SC26–NR29	United Kingdom of Great Britain and Northern Ireland
Information Papers	
IOTC–2023–SC26-INF01	Update on the Common Oceans Tuna Project, November 2023
IOTC–2023–SC26-INF02	Untangling the Net of 'Bycatch' in Commercial Shark Fisheries: The Interplay between International Fisheries Law and CITES
IOTC–2023–SC26-INF03	Taiwan,China Report 2023 (Available on Request)

APPENDIX 4
NATIONAL STATEMENTS

The SC noted the following statements made by Mauritius

REPUBLIC OF MAURITIUS

MINISTRY OF FOREIGN AFFAIRS, REGIONAL INTEGRATION AND INTERNATIONAL TRADE

No. 11/2023 (18570/46/142V25)

The Ministry of Foreign Affairs, Regional Integration and International Trade of the Republic of Mauritius presents its compliments to the Secretariat of the Indian Ocean Tuna Commission (IOTC) and has the honour to refer to the holding of the 26th Session of the IOTC Scientific Committee to be held from 4 to 8 December 2023 in Mumbai, India.

The Ministry has the honour to transmit copy of two statements by the Republic of Mauritius on Agenda item 6. The Ministry would appreciate it if the attached statements by Mauritius could be annexed to the report of the meeting and be posted on the IOTC website.

The Ministry of Foreign Affairs, Regional Integration and International Trade of the Republic of Mauritius avails itself of this opportunity to renew to Secretariat of the Indian Ocean Tuna Commission the assurances of its highest consideration.

Port Louis, 30 November 2023

The Secretariat
Indian Ocean Tuna Commission
P.O. Box 1011 Victoria
Mahé
Seychelles

Newton Tower, Sir William Newton Street, Port Louis
Tel: (230) 405 2500 Fax: (230) 208 8087, (230) 212 6764, Email: mfa@govmu.org

26th Session of IOTC Scientific Committee
4-8 December 2023, Mumbai, India

Agenda Item 6: National Reports from CPCs

Statement by the Republic of Mauritius

National Report submitted by the United Kingdom

The Republic of Mauritius will not repeat its position on the issues raised in the National Report submitted by the United Kingdom since that position is well known to this Committee.

The Republic of Mauritius would like to take this opportunity to inform this Committee that the Republic of Mauritius and the United Kingdom are currently engaged in negotiations on the exercise of sovereignty over the Chagos Archipelago.

However, the Republic of Mauritius wishes to point out that its position with regard to the purported membership of the United Kingdom in the Indian Ocean Tuna Commission as a coastal State and on the issues raised in the National Report of the United Kingdom remains unchanged.

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

26th Session of IOTC Scientific Committee
4-8 December 2023, Mumbai, India

Agenda Item 6: National Reports from CPCs

Statement by the Republic of Mauritius

National Report submitted by France

The Republic of Mauritius wishes to point out that the Island of Tromelin is not a French territory, as claimed by France in its National Report.

The Republic of Mauritius reiterates that the Island of Tromelin forms an integral part of its territory and rejects France's sovereignty claim over that island as well as France's claim to any sovereign right or jurisdiction over the Exclusive Economic Zone adjacent to that island.

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

The SC noted the following Statement by France-OT

26th Session of IOTC Scientific Committee

4-8 December 2023

Statement by the FRANCE Overseas Territories

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 5
NATIONAL REPORT EXECUTIVE SUMMARIES (2023)

Australia (IOTC-2023-SC26-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 very low relative to the scale of the regional IOTC fishery. In 2022, two Australian longliners from the Western Tuna and Billfish Fishery and nine longliners from the Eastern Tuna and Billfish Fishery operated in the IOTC Area of Competence. They caught 9.2 t of albacore (Thunnus alalunga), 19 t of bigeye tuna (Thunnus obesus), 15.8 t of yellowfin tuna (Thunnus albacares), 83 t of swordfish (Xiphius gladius) and 0.2 t of striped marlin (Kajikia audax). In 2022, one blue shark was landed by the Australian longline fleet operating in the IOTC Area of Competence and 4,395 other sharks were discarded/released. In addition, in 2022 the review rate for electronic monitoring footage of longline hook deployed in the WTBF was 11.1%. The actual catch of southern bluefin tuna (Thunnus maccoyii) in the purseseine fishery targeting this species was 5,250 t in 2022. There was no skipjack tuna (Katsuwonus pelamis) caught by purse-seine fishing.

Bangladesh (IOTC-2023-SC26-NR02)

Tuna and tuna-like other highly migratory species have become high pace in the priority list to the Government of Bangladesh (GoB) 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 ABNJ. But it is not possible yet to take this opportunity by harnessing tuna and tuna-like fishes from expanded EEZ and 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 aspect 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 find out the opportunity of tuna and tuna-like fishes from Bangladesh marine waters and ABNJ on a pilot basis. Basically, there is no specific tuna fishery in Bangladesh. Tuna and tuna-like fishes are by catch from industrial fishing vessels (trawler), as well as by artisanal mechanized fishing vessels. Statistically, it shows that tuna and tuna-like fishes (mackerels) comprise about 8.82% (12102 MT) in industrial sector and 1.59% (9047 MT) in artisanal mechanized sector in the year 2021-22. Still bill fishes are reported as “other marine fish” in the fish logbooks. Nowadays, the catch and effort data system for marine sector is being developed by Sustainable Coastal and Marine Fisheries Project (SCMFP) through FAO and it seems that after few years’ species wise data for tuna and tuna-like fishes will be available. 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 of Bangladesh.

China (IOTC-2023-SC26-NR03)

Deep-frozen longline (LL) targeting for tropical tuna and frozen LL targeting albacore are the only two fishing gears used by Chinese fleets to catch tuna and tuna-like species in the Indian Ocean Tuna Commission (IOTC) Area of Competence. The total number of Chinese LL fleets operating in the IOTC Area of Competence in 2022 was 78. The number of active deep-frozen LL fleets and frozen LL fleets were remained 70 and 8 in 2022, which had no change compared with 2021. The tropical tuna catch (bigeye and yellowfin tuna) of Chinese LL fleets in 2022 was estimated at 7,491MT, which was 157 MT higher than that in 2021 (7,334MT). The albacore LL catch for 2022 was estimated at 5,930MT, higher

than in 2021 (2,360MT). Both the logbook and observer programs are being implemented for the Chinese LL fleets. In 2022, four scientific observers were deployed on board LL fleets to collect data for both target and bycatch species as required.

Comoros (IOTC-2023-SC26-NR04)

La pêche en Union des Comores est exclusivement artisanale, pratiquée sur des embarcations non pontées en bois et en fibre de verre, motorisées et non motorisées d'une longueur de 2 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, non seulement à la socio-économie du pays (55% de l'emploi total du secteur agricole soit environ 7000 pêcheurs), et source de sécurité alimentaire et nutritionnelle, mais aussi elle constitue une importante source des moyens de subsistance, de bien-être et de diversité culturelle pour les personnes exerçantes directement ou indirectement cette activité. Les techniques de pêche utilisées sont essentiellement la ligne de traine, la palangrotte, la ligne à main légère et peu de filet pour les petits pélagiques. La durée de la marée est d'une journée à 7 jours. Le circuit commercial des captures en général est très simple (Pêcheurs-Vendeur-Consommateur) et les produits de la pêche sont uniquement destinés au marché national (consommateurs locaux et autoconsommations). 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. Suite à une analyse approfondie réalisée de la FAO sur les données collectées (2011-2014), une réorientation du plan d'échantillonnage s'est effectuée et appliquée en 2015. Et, depuis 2017, la collecte de données est réalisée intégralement sur smartphone. La production annuelle issue de l'enquête de 2022 est estimé à 20 305 tonnes sur un ensemble de 4 825 embarcations.

Eritrea (No National Report Submitted) – No longer members after 2023.

European Union (IOTC-2023-SC26-NR06)

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 targeting the three species of tropical tunas:
    - 26 active vessels
    - 219,881 t of catch
        - YFT 40 %
        - SKJ 54 %
        - BET 9 %
- Longliners targeting swordfish with significant associated catches of some pelagic shark species
    - 10 active vessels
    - 2,572* 10^6 hooks
    - 5,474 t of catch
        - SWO 40 %
        - BSH 51 %
        - SMA 7 %
- Longliners targeting swordfish with significant associated catches of tunas (La Réunion)
    - 21 active vessels (≥12m)
    - 3,61 * 10^6 hooks
    - 1,776 t of catch
        - SWO 48 %
        - YFT & BET 22 %
        - ALB 23 %

The second is a coastal segment, understanding vessels of less than 12 m fishing for and testing broad pelagic species and associated species, some of which use anchored fish aggregating devices (AFADs) over Mayotte and La Réunion Islands, the two outermost regions of the European Union of the Indian Ocean. This coastal segment corresponds to the following:

- Longliners
    - 21 vessels at Reunion Island (<12m)
        - 0,601 *10^6 hooks
        - 502 t of catch
            - SWO 31 %
            - YFT & BET 28 %
            - ALB 22 %
    - 2 vessels at Mayotte Island
        - 71 t of catch
            - YFT 54 %
            - SWO 32 %
- Trolling line and hand-lines
    - Reunion: 130 vessels
        - 515,6 t of catch
    - Mayotte: 132 vessels
        - 282 t of catch

The fishing capacity of the EU fleet authorised to deploy a fishing activity for large pelagic species in the IOTC Convention Area is managed 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 named Sustainable Fisheries Partnership Agreements (SFPA).
In accordance with IOTC Resolution 15/02, flag EU Member States (Spain, France, Italy, Portugal and United Kingdom) have undertaken scientific data Characteriising 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-2023-SC26-NR07)
Depuis le passage de Mayotte comme territoire sous régime communautaire depuis le 1er janvier 2014, l'outre-mer français tropical de l'océan Indien ne concerne plus que les îles Éparses qui sont rattachées à l'administration supérieure des Terres Australes et Antarctiques françaises (TAAF). Un parc naturel marin a été créé le 22 février 2012 (décret n°2012-245), il s'agit du PNM des Glorieuses, qui dépend des îles Éparses et s'étend sur l'ensemble de la ZEE des Glorieuses.
Les Iles Éparses (France Territoires) ne disposent pas de flottilles thonières immatriculées pour ce territoire. Néanmoins, l'administration des TAAF délivre des licences de pêche à des palangriers et senneurs français et étrangers souhaitant pêcher dans les eaux administrées par France Territoires, et un programme observateur embarqué accompagne l'octroi de ces licences. En 2022, il n'y a pas eu de formation OBSPEC organisée par l'administration des TAAF et aucun observateur n'a embarqué au cours de l'année 2022 sur les thoniers senneurs ou navires auxiliaires sous pavillon français ou étranger opérant dans la zone. Des observations en mer sur les palangriers français basés à La Réunion sont faites par des observateurs embarqués ou via l'auto-échantillonnage (collecte de données par les capitaines). Ces observations sont pilotées par l'IRD sur des fonds européens dans le cadre du projet 'Data Collection Framework' (DCF). En 2022, 112 opérations de pêche ont été observées sur 3 navires réunionnais dans les ZEE des Iles Éparses, dont 40 par observation embarquée et 72 via l'auto-échantillonnage. Les données des palangriers sous pavillon UE-France ont été présentées dans le

rapport UE-FR. Le dispositif de recherche actuel de la France (IRD & Ifremer principalement) sur les grands pélagiques recouvre les des activités de pêche, des débarquements et de la biométrie des espèces cibles et des rejets, l'étude des comportements migratoires des grands pélagiques, des études sur les dispositifs de concentration de poissons, la collecte de données observateurs à partir d'un suivi électronique, des études génétiques et microchimiques pour la délimitation des stocks, la mise au point de mesures d'atténuations des prises accessoires et de la déprédation, la mortalité après rejet des pêcheries européennes à la senne et palangrière du requin pointe blanche océanique, ainsi que le développement d'une innovation pour faciliter une libération rapide de la mégafaune marine capturé à la palangre et améliorer la survie des individus. La plupart des projets sont financés sur appels d'offre internationaux, européens ou nationaux. On trouvera dans ce rapport la liste des différents projets qui se sont poursuivis ou ont débuté en 2022. On trouvera de plus des projets impliquant directement la CTOI même si ces projets sont en cours de lancement.
La France a participé activement à tous les groupes de travail organisés par la CTOI, et a présenté 12 contributions scientifiques en 2022.

India (IOTC-2023-SC26-NR10)
The total landings of tuna and tuna-like species along Indian coasts had been showing a decreasing trend in the recent past with an increase in 2022. Total catch recorded during 2022 increased by 17.23% with reference to 2021. The total landings of tuna and tuna-like species for 2022 is estimated at 1,92,988.11 tonnes, against 1,59,744.04 tonnes during 2021. Gillnets remained the major gear contributing to the tuna and tuna like fish catch during 2022 also (28.93%). Small purse seine and trawl nets (19.92% and 15.81% respectively), followed by handline and hook and line were the principal gears contributing the catch. Pole and line fishing, practiced exclusively in the waters of the Lakshadweep archipelago, contributed 3.44% to the total landings. Other gears like ring seine, drift longline, troll line, also contributed to the tuna landings in small quantities during the year.
Considerable spatial variation was observed in the tuna and tuna like species landings during 2022. The west coast of India (FAO area 51) contributed the larger share to the landings (63.78%) and the balance 36.22 % landings came from the east coast (FAO area 57). Tuna landings in 2022 comprised of eight species, out of which five species representing the neritic (59.38%) and three from the oceanic group (40.62%). Kawakawa (*Euthynnus affinis*, 38.24%) and Skipjack (*Katsuwonus pelamis*; 23.00%) contributed the maximum tuna catch, followed by Yellowfin tuna (*Thunnus albacares*) (17.35%).
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-2023-SC26-NR09)
For fisheries management purposes, Indonesian waters are divided into eleven Fisheries Management Areas (FMA). Three of them are 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 the Andaman Sea). Indonesian fishers operate various fishing gears such as longline, purse seine, handline, and gillnet to catch large pelagic fishes like tuna, skipjack, bilfishes, etc. Longline is the primary fishing gear type targeting tunas that operate in those FMAs. The total catch of the main species of tunas in 2022 was estimated at around 271,056 tons1 which are composed of yellowfin tuna (66,765 tons), bigeye tuna (32,267 tons), skipjack tuna (159,376 tons), and albacore (12,648 tons). Landing ports, both artisanal and industrial, are still consistently monitored through port based monitoring programs and observer programs conducted by Directorate General of Capture Fisheries (DGCF).

Iran (Islamic Republic of) (IOTC-2023-SC26-NR10)
Iran (Islamic Republic of) has fishing grounds in the Caspian Sea, the Persian Gulf and the Oman Sea, located in the northern and southern waters of the country. The southern waters of Iran are the most important resources for large pelagic species.
There are four coastal provinces (Khuzestan, Bushehr, Hormozgan and Sistan & Baluchestan Provinces) in those areas, with vast resources in terms of 5800 km of coastline along the Persian Gulf and the Oman Sea. They are located between the longitudes from 48° 30' north to 61° 25' east. Iran, with an interest in fisheries, has concluded a number of bilateral agreements that regulate fishing in the area (through RECOFI and bilateral agreements, e.g. Iraq, Oman, Kuwait and etc.) For Iranian fishermen, the Arabian Sea is the gateway to the northwest Indian Ocean and the opportunity to harvest tuna and other highly migratory large pelagic species. It has been a tradition for Iranian fishers to fish offshore and in the last few decades, gillnet and purse seine fisheries have become the established fishing methods for Iranian fishers in the international waters of the northwest of the Indian Ocean. Therefore, Iran joined the Indian Ocean Tuna Commission (IOTC) in 2002 and it has been one of the active countries in the commission.
In a brief overview, the total aquatic production including catch and aquaculture was 1,353,000 Mt in 2022, of which 601,000 Mt from aquaculture and around 719,000 Mt came from catch which comprised (96%) from southern waters, and 33,000 tonnes (4%) from northern waters. The catch quantity of large pelagic species (including by-catch) in Iran was 316,252 Mt in 2022 reported to the IOTC Secretariat and around 282,377 Mt belongs to tuna and tuna-like fishes in the Indian Ocean areas. Those catch consist are mainly comprised of tropical tuna with 37.6% (118,435 Mt), neritic tuna 40.8% (129,132 Mt) and billfish species with 11% (34,809 Mt), 0.9% (3,031 Mt) different species of shark and around 9.7% (30,844Mt) Other non-targeted species.

Japan (IOTC-2023-SC26-NR11)
This Japanese national report describes following eight relevant topics stipulated in the 2023 national report guideline mainly in recent five years (2018-2022) (2022 is provisional) , i.e. (1) Fishery information (longline and purse seine fishery), (2) fleet information, (3) catch and effort by species and fishery, (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. Purse seiners have not operated in the Indian Ocean since 2021. Japan has been dispatching scientific observers in accordance with the Resolution 11/04 (superseded by 22/04), whose coverage for longline fishery has been more than the 5% compliance level in recent years except for 2020-2022 due to COVID-19 pandemic. Observer coverage for purse seine fishery is highly variable. 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-2023-SC26-NR12)
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 606 artisanal vessels are engaged in the fishing for tuna and tuna like species in 2022 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 (261 tons), yellowfin tuna (18.7 tons) Bigeye tuna (11.6 tons), Sharks (80.7 tons) while other species combined (101 tons). Artisanal fishers landed 388 tons of marlins, 6160 tons of tuna and tuna like species and 989 tons of sharks and rays. Catches of scombrids increased to 6,160 tons which was a sharp increase compared to 1,953 tons and 1,613 tons in 2020 and 2021compared 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. 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.

Republic of Korea (IOTC-2023-SC26-NR13)

The number of active vessels in 2022 was 5 for longline fishery and 2 for purse seine fishery. With this fishing capacity, Korean tuna longline fishery caught 812 ton in 2022, which was 20% lower than that of 2021. The fishing efforts in 2022 were 1,667 thousand hooks. The fishing efforts averaged for 5 recent years (2018-2022) were 4,146 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. In 2020, Korean longline vessels moved again to the eastern Indian Ocean to operate southern bluefin tuna. Korean tuna purse seine fishery in the Indian Ocean recorded 13,877 ton in 2020. In 2020, 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 2020 were 610 sets, which mainly distributed in the western and central tropical areas around 40°E-70°E. In 2020, national scientific observers for longline fishery were not dispatched onboard for implementing observer program due to the worldwide spread of the COVID-19. Regarding purse seine fishery, regional scientific observers were dispatched onboard.

Madagascar (IOTC-2023-SC26-NR14)

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. Aucun palangrier national n'a obtenu de licence de pêche durant l'année 2022. 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 qui est celui de Toamasina. Le programme de collecte de fiches de pêche et d'échantillonnage au port de débarquement, mis en oeuvre depuis 2014, nous permet d'avoir des données sur la distribution de taille des espèces capturées.

Les prises des palangriers de 2017 à 2021 varient entre 127 tonnes et 197 tonnes, et celles de 2022 sont nulles. Cette variation est légèrement proportionnelle à celle de l'effort de pêche (exprimé en nombre d'hameçons déployés). Influencée par la diminution du nombre de navire en activité depuis 2018, la capture moyenne annuelle des palangriers est de 164 tonnes. Elle est constituée de 57% de thons, 19% de poissons porte-épées, 12% de requins et 13% d'autres espèces. La capture en thons est majoritairement composée des thons obèses, des germons et des albacores.

Les engins de pêche utilisés sont principalement le filet maillant, la ligne et la palangre.

Malaysia (IOTC-2023-SC26-NR15)

Total catch of marine fish from Malaysian waters in 2022 were 1.308 million mt, a slight decreased 1.5% compared to 1.328 million in 2021. The total landing in 2022 were attributed to the catch from 48,605 registered vessels with trawlers, purse seines, drift nets contributed large percentage of the

catches. In 2022, marine fish production from the west coast of Peninsular Malaysia (Malacca Straits) contributed 728,623 mt (55.7%) out of the total catch.
Neritic tuna contributes 57,992 mt (4.4%) of Malaysia's marine fish landings in 2022. Purse seiners are the main fishing gears in neritic tuna fisheries, especially the 40-69.9 GRT (Zone C) and >70 GRT (Zone C2) vessel size, with longtail tuna dominated the landings followed by kawakawa and frigate tuna. In 2022, neritic tuna landings in west coast Peninsular Malaysia amounted to 15,846 mt; increasing by 37% compared to 9,974 mt in 2021. Meanwhile landings of neritic tuna in Malaysia ranged from 51,472 mt to 74,489 mt (2016-2022). The highest catch was recorded in 2017 with 74,489 mt. Landings of neritic tuna in Malaysia appear to have stabilized from 2016 to 2021.
The catch of oceanic tuna from the Indian Ocean decreased 13.5% from 1965.9 mt in 2021 to 1,701.2 mt in 2022. Albacore landings declined from 1,271.2 mt in 2021 to 1258.5 mt in 2022. Albacore tuna formed nearly 74% of the total catches in the form of whole frozen tuna meanwhile, Yellowfin contributed 20% and Bigeye 6% of total catches in frozen and gutted forms.
Malaysia have updated the national logbook to include all the species as requested in Resolution 19/04. Monitoring of tuna landing and inspection by Port Inspector is ongoing. DOFM monitored and tracked the deep-sea and tuna vessels using National VMS. DOFM have installed CCTV on tuna vessels as a tool for EMS.

Maldives (IOTC-2023-SC26-NR16)
Maldives is a tuna fishing nation with a history dating back hundreds of years. Pole and line and handlines are the primary gears employed by Maldivian fishers to target catch skipjack (Katsuwonus pelamis), yellowfin (*Thunnus albacares*), frigate (*Auxis thazard*) and kawakawa (*Euthynnus affinis*). Total tuna catch has increased from a little over 30,000 tons in 1970 to 154,743 tons in 2022. Skipjack and yellowfin tuna are the most important species with 99% skipjack being landed by of pole and line. Yellowfin tuna catch from the pole and line fishery represent 32% of all yellowfin tuna caught in 2022 with the remaining being landed by the handline fishery. The tuna fleet operates entirely within the Maldives EEZ, with the exception of the longline fleet during its operation prior to 2019. In 2022, the tuna fleet consisted of 736 vessels with the majority of the vessels being in the 12.5 to 32.5 length range. Maldives fishery data collection employs various tools such as logbooks, electronic reporting, real-time web enabled databases, vessel monitoring systems and Electronic Monitoring Systems (EMS).

Mauritius (IOTC-2023-SC26-NR17)
In 2022, Mauritius had 4 purse seiners, 1 supply vessel and 13 industrial longliners operating in the tuna fishery. The four purse seiners are large freezer vessels with three having an overall length of 89.4 m each and the fourth one is 71.95 m. The longliners are all industrial boats of more than 24 meters in length. In 2022, there was no semi-industrial longliner in operation.
All the longliners carried out fishing activities inside and outside the EEZ of Mauritius and a total of 31 fishing trips were undertaken for a total of 2171 fishing days and a deployment of 6877244 hooks. The majority of the catch consisted of yellowfin (47.8%) followed by bigeye (27.2%), albacore (15.2%), and swordfish (3.0%). Their total catch amounted to 3384.8 tonnes and the CPUE was 0.49kg/hook. These longliners transhipped most of their main catch which included yellowfin, albacore, bigeye and swordfish at sea while the remaining catch were unloaded at Port Louis for the local market.
The Mauritian purse seiners operated between latitude 12oN to 10oS and longitude 46o to 69oE. The total catch of the four purse seiners amounted to 25804.68t comprising 36.9% yellowfin, 53.4% skipjack and 8.0% bigeye tuna for 695 positive sets out of a total of 717 sets.
Sampling exercises were carried out on the catches that were unloaded in port by the industrial longliners. 2110 fishes were sampled on the industrial longliners operating inside and outside the EEZ. In the artisanal fishery, 330 fishes were sampled for length frequency. Sampling exercises were also carried out on the Mauritian purse seiners when they called at Port Louis and 4017 fish were measured.

Mozambique (No National Report Submitted)

Oman (IOTC-2023-SC26-NR19)

The total production of the Omani fishery sector amounted to around 748,000 Tons in 2022 with an increase of approximately 16% compared to 2017. Tuna species considered as highly valuable products for Omani consumers, have experienced significant increases in the total annual production. 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. For the industrial fleet contribution reached 6.9% in the total landing up to 51803 Ton in 2022. Costal fleet landed 5.1 thousand Ton in 2022. On the other hand, Artisanal and coastal fleets have, however, increased slightly in the number of vessels and fishermen.

The Sultanate's total fish production for the year 2022, by about 748 thousand tons from 2021 production by 19% and with a total value amounting to about 465 million Omani riyals. Artisanal fishing contributed a percentage 92.3% of this production amounted to approximately 688 thousand tons with a value of 408 million Omani riyals, while the quantities of commercial fishing production amounted to 51,803 thousand tons, forming a contribution rate of 6.5% of the total production, while coastal fishing contributed by 0.7%, with catch quantities estimated at approximately 5,062 thousand tons.

Pakistan (IOTC-2023-SC26-NR20)

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 2022 was 44,360 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 44,360 ton. Major share of the landing was by tunas (61.35%) followed by seerfishes (0.08%), dolphinfish (9.17%) and billfish (25.77%). Among the tunas, yellowfin was dominating with 20.19%, followed by frigate (33.37%), Tuna Nei (18.38%), longtail (18.25 %), kawakawa (0.06%) and skipjack (0.03%). 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 44,360 m. tons in 2022. 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 2022 (as compared to June) because of extremely low catches in March and April 2022 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 2022. 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 2021) 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-2023-SC26-NR21)

In 2017 (07 October to 19 December), the Philippines had 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. During the fishing operations, a total of 25,551 kg bigeye, 72,680 kg yellowfin, and 144,566 kg skipjack were caught and all catches 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 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.

Although inactive from the years 2018 onwards, the Philippines as a Contracting Member of the IOTC continues its strong commitment to the effective management, conservation, and sustainable use of highly migratory fish stocks in the IOTC Area of Competence.

Seychelles (IOTC-2023-SC26-NR22)

The Seychelles National Report summarizes activities of the Seychelles' fishing fleet targeting tuna and tuna-like species in the WIO for the year 2022 in comparison with previous years. It also summarizes research, and data collection related activities as well as actions undertaken in 2022 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 8 vessel in 2017 to 4 vessels in 2022. In 2022 the nominal effort decreased further by 93 days (3%) when compared to the previous year to reach a total of 2,934 days fished. The total catch for the purse seine fleet dropped by 1.8 % from 122,885 MT in 2021 to 120,642 MT in 2022. The corresponding catch rate was f 41.12 MT/ fishing day, compared to 40.60 MT/ fishing day during the previous year. Catches of yellowfin tuna increased by 5% whilst catches of bigeye tuna and skipjack tuna decreased by 10% and 4% respectively when compared to the previous year.

The Seychelles Industrial longline fleet comprised of 58 vessels in 2022 compared to 64 vessels in 2021. The total catch reported by the industrial longline fleet for the year 2022 was estimated at 9,898 MT of which 2,894 MT consisted of yellowfin tuna. The estimated catch rate was 0.36 Mt/1000 hooks for the year 2022 which is the same as to what was recorded for the previous year. hooks).

In 2022, the total catches by the Semi industrial vessels increased by 18% to reached 2,073 MT compared to 1,758MT the previous year. The fishing effort increased by 80% thus giving a mean catch rate of 0.42 MT/ 1000 hooks for the year 2022 compared to 0.64 MT/ 1000 hooks for the previous year.

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 effort were made in the year 2022 to clear the backlog in longline fishery logbook and length frequency data for years 2021 and 2022. A new module in the Observe software was also developed and tested to upgrade data management for the longline fishery. Implementation of the new system will start in the year 2024.

Somalia (No National Report Submitted)

South Africa (IOTC-2023-SC26-NR24)

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 right holders. In more recent years, the South African-flagged longline fleet catch a combination of tropical and temperate tunas, alongside swordfish. In 2021, 23 longline vessels were active in the IOTC Area of Competence, which is one more than in 2021. Effort (hooks set) continued to increase in 2022 (1 295 129) compared to 2021 (901 104) but was still less than that of 2019 (1 355 677). As such, 2020 is considered a low effort year. One Japanese-flagged vessel operated under joint-venture in South African waters in 2021. However more fishing effort was undertaken by South African flagged vessels in 2021 resulting in a marginal increase in catches of all tuna species and a substantial increase in swordfish catch. Landings of shortfin mako and blue sharks increased despite the prohibition of wire traces and shark targeting. There was no Tuna Pole-line effort in the Indian Ocean area of competence in 2022. A total of 279 862 hooks were observed in the IOTC area of competence during 2022 which equates to 21.6% observer coverage.

Sri Lanka (IOTC-2023-SC26-NR25)

The total production of tuna and tuna like species of Sri Lanka in year 2022 was 81973t. 80% of the catch was from the EEZ. 36%of the total catch was Yellow fin tuna, 37%Skipjack tuna and 5.6%was bigeye tuna. 8% of the total catch was bill fish while Sword fish dominate in the catch. The total shark catch was 626t. The YFT catch reductions adhered as per 19/01. Large scale Gill net are being surveyed and reduced in number and length as per resolution 17/07.

Over 5000 boats engaged in large pelagic fishing in both high seas and within EEZ. 1642 vessels were authorized to fish in high seas and 1485 vessels were active. 99% of the high seas operating vessels are less than 24m. VMS is mandatory for high seas operating vessels. Major fishing gears were long line and gill net. The gill nets are being discouraged and directed to selective gears. 29%, 21% and 27% of vessels were exclusively operated for longline, gill net and ring net respectively. 22%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 number of fishing trips and vessels are being kept anchored most of the time. On board observers were deployed in all vessels >24m and pilot project on EMS is ongoing. Port State Measures are being implemented through e-PSM application. Coastal data collection is being improved by introducing better sampling techniques and to achieve the length frequency data as per the required proportions.

Sudan (No National Report Submitted)

Tanzania (IOTC-2023-SC26-NR27)

The United Republic of Tanzania is a coastal state striving to sustainably utilise and enhance management and conservation of the fisheries resources within its marine waters. Various industrial and artisanal fisheries operate in Tanzania.

The commonly employed industrial fishing gears within the Tanzanian Exclusive Economic Zone (EEZ), and beyond, are longline and purse seine. Currently, two longlines and one purse seine operate within the Tanzania EEZ and on the high seas. Catch data of tuna and tuna-like fish species are collected using log sheets. The three industrial fishing vessels reported a total of Yellowfin tuna 2908.2 tons (t); Bigeye

tuna 1130.1t, Skipjack tuna 8343t; Swordfish 6.2t; Blue marlin 0.9t, Albacore 0.03t and Striped marlin 0.07t, that is 112.9t for longlines and 12,282t for purse seine. In addition, 29 foreign fishing vessels operated in the Tanzanian EEZ and reported a total catch of 3,047.7t of tuna and tuna-like species in 2022.

Catch assessment surveys in 2022 show that four main artisanal fishing gears, namely ring nets, gill nets, handlines, and small coastal longlines used to catch tuna and tuna-like species in Tanzania. Total fish catch by species recorded were Kanadi kingfish 2.03t, Bigeye 351.22t, Swordfish 150.82t, Kawakawa 39.91t, Dogtooth tuna 3.29t, Yellowfin tuna 559.62t, Narrow barred Spanish mackerels 86.02t, Frigate tuna 963.59t, Bullet tuna 235.69t, Longtail tuna 430.1t, Skipjack tuna 342.51, Sailfish 109.93t, Wahoo 72.9t, Kawakawa 31.91t, Dolphin fish 52.83 and others including sharks and rays 325t.

For a long time, Tanzania has been actively enhancing its data collection, analysis, and reporting capabilities in the fisheries sector. Key initiatives that have been and are still being undertaken include capacity-building missions, including that of the IOTC Secretariat, to train fisheries officers in data collection and reporting. Training sessions in 2022 and 2023 focused on improving the skills of personnel involved in fisheries data collection. In addition, a Fisheries Information System (FIS) has been upgraded to incorporate data from the EEZ and territorial waters, particularly in addressing challenges facing catches from artisanal fisheries. Capacity-building efforts were provided to enumerators, particularly on fish species identification and collection of biometric and morphometric characters. Furthermore, discussions are ongoing to streamline data collection, handling, and analysis systems among various competent fisheries authorities, given the complexity of fisheries management systems in the country.

Thailand (IOTC-2023-SC26-NR28)

Thailand has advanced for implementing a comprehensive system to combat IUU fishing. It has taken a reform 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 since 2015 to present. In addition, for Thai overseas vessels, they are required to install vessel monitoring system (VMS), electronic reporting system (ERS) and electronic monitoring system (EM). Traceability system for catches from Thai-flagged vessel has been developed including introduction of fishing logbook and landing declaration.

In 2022, Thailand had no fishing vessel operated in the high sea of IOTC area of competence. Thailand had only domestic purse seiners in the Andaman Sea, the number of licensed fishing vessel was 219 vessels. In 2022, kawakawa is the main composition accounted for 31.82% of the total catch of tuna and tuna-like species, followed by skipjack tuna 22.25%, longtail tuna 20.86%, frigate tuna 18.93%, bullet tuna 4.60%, Indo-Pacific king mackerel 0.70%, narrow-barred Spanish mackerel 0.62%, Indo-Pacific sailfish 0.19% and yellowfin tuna 0.03%.

The recreational fishery for tuna and tuna-like species is rarely found in the Andaman Sea of Thailand. The measures for ecosystem and bycatch protection have been implemented, e.g., National Plan of Action for Conservation and Management of Sharks of Thailand, covering 5 years period of 2020 – 2024 and the national regulations following the FAO Guideline to Reduce Sea Turtle Mortality in Fishing Operation. Moreover, Thailand is in process to review the NPOA – Seabirds by the National Committee on Fisheries Policy and it will be implemented in the near future. There were no national research programs on non-target species, e.g., sharks and marine turtles, in 2022 because most of the specified stock described in the report are rarely found in Thai waters.

United Kingdom of Great Britain and Northern Ireland (IOTC-2023-SC26-NR29)

This report is from the UK and primarily concerns the recreational fisheries in the British Indian Ocean Territory (BIOT). The UK had no commercial fleet operating during 2022.

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 National Report summarises fishing in the BIOT recreational fishery in 2022 and provides details of research activities undertaken to date within the MPA.
The recreational fishery landed 7.5 tonnes of tuna and tuna like species on Diego Garcia in 2022. Principle target tuna species of the industrial fisheries (yellowfin and skipjack tunas) contributed to 21.3% 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 21/01 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 245 yellowfin tuna from this fishery. The mean length was 68.7cm. 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 2022 the BIOT Environment Officer continued to take forward the current conservation priorities. Recommendations of the Scientific Committee and those translated into Resolutions of the Commission have been implemented as appropriate by the BIOT Authorities.

Yemen (No National Report Submitted)

Liberia (No National Report Submitted)

APPENDIX 6

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 (2023)

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 has drafted a NPOA for shark and rays which is now in the process of being finalised and approved by the relevant ministries. 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 and includes provisions for the protection of seabirds. Bangladesh does not have any flagged purse seine or longline vessels so do not consider there to be any problems with seabird interactions in their fisheries. **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. A Marine Fisheries Rules act was finalised in 2023 which requires the use of turtle excluder devices onboard shrimp trawlers. The act also requires live release of marine turtles for all gear and the mandatory use of circle hooks for hook and line fishing.
China		–		–			**Sharks:** China is currently considering developing an NPOA for sharks. Regulations relating to the conservation of sharks managed by RFMOs has been updated. **Seabirds:** China is currently considering developing an NPOA for seabirds. Regulations relating to the conservation of seabirds managed by RFMOs has been updated. **Marine turtles:** No information received by the Secretariat.

–Taiwan,China		1st: May 2006 2nd: May 2012		1st: May 2006 2nd: Jul 2014			**Sharks:** No revision currently planned. **Seabirds:** No revision currently planned. **Marine turtles:** Wildlife Protection Act introduced in 2013, Protected Wildlife shall not be disturbed, abused, hunted, killed, traded, exhibited, displayed, owned, imported, exported, raised or bred, unless under special circumstances recognized in this or related legislation. *Cheloniidae spp.*, *Caretta*, *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)		2009		2009, 2011		2015	**Sharks:** approved on 05-Feb-2009. **Seabirds:** Implemented in 2009 and 2011. 2009 for Barrau's petrel and 2019 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 for the period 2015-2020. This is still being applied and currently is under evaluation in view of its renewal.
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 first drafted a NPOA in 2010 then later developed a revised NPOA for sharks and rays for the period 2016-2020. Indonesia is in the process of revising the latest version of the shark NPOA. Indonesia has also established a national plan of action for whale sharks from 2021-2025 through Ministerial Decree No. 16 of 2021. **Seabirds:** An NPOA was finalized in 2016 **Marine turtles:** Indonesia established an NPOA for Marine Turtles in 2022. Indonesia has also been implementing Ministerial Regulations 12/2012 and 30/2012 regarding capture fishing business on high seas to reduce turtle bycatch. Indonesia is also cooperating with Coral Triangle countries including Malaysia, the Philippines, the Solomon Islands, Papua New Guinea, and Timor Leste through Coral Triangle Initiatives on Coral Reefs, Fish, and Food Security (CTI CFF) platform to protect threatened migratory species, including marine turtles. The CTI CFF is now developing a regional plan of action (RPOA) 2020-2030 and areas of critical habitats, such as migratory corridors, nesting beaches, and Inter-nesting and feeding areas, have been identified.
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, 2016		03-Dec-2009, 2016			**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 has been finalised and is awaiting cabinet approval. This document shall put in place a framework to ensure the conservation and management of sharks and their long-term sustainable use in Kenya. **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 has started to prepare a NPOA for seabirds in 2023. **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 has started to prepare a NPOA for turtles in 2023.
Korea, Republic of		08-Aug-11		2019		–	**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.
Madagascar		–		–			**Sharks:** Madagascar has developed a NPOA for sharks which is awaiting final ministerial approval. **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. The final NPOA was published in 2015. 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:** Maldives is in the final stages of developing an action plan on seabird nesting sites. Article 12 of IPOA states that if a 'problem exists' CPCs adopt an NPOA. IOTC Resolution 05/09 suggests CPCs to report on seabirds to the IOTC Scientific Committee if the issue is appropriate'. Maldives considers that seabirds are not an issue in the Maldives fisheries, both in the pole-and-line fishery and in the longline fishery. The new longline fishing regulations has provision on mitigation measures on seabird bycatch. **Marine turtles:** Standards of code and conduct for managing sea turtles have been developed by the Environmental Protection Agency in the drafted National sea turtle management plan under the protected species regulation. 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. **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:** The drafting of an NPOA-sharks started in 2017 but has not yet been finalised. **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:** A stakeholder consultation workshop was conducted in 2016 to review the actions of the draft NPOA – Sharks. The final version of the NPOA – Sharks has been submitted to the provincial fisheries departments for endorsement but has not yet been finalised. 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. Sharks are landed with the fins attached and each and every part of the body of sharks are utilised. **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 I 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. Pakistan is also in the process of drafting a NPOA for cetaceans.
Philippines		Sept. 2009		–			**Sharks:** A NPOA sharks was published in 2009 and this document is under periodic review. **Seabirds:** Development has not begun. **Marine turtles:** No information received by the Secretariat.
Seychelles, Republic of		Apr-2007 2016		–			**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.
Somalia							**Sharks:** Somalia is currently revising its fisheries legislation (current one being from 1985) and has completed the necessary steps for required for the consultative process to begin in order to develop these NPOA. **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		2013 2022		2008			**Sharks**: The NPOA-sharks was first approved and published in 2013. A revised version of the document was finalised in 2022 following extensive review including input from the research community and affected stakeholders. **Seabirds**: The NPOA seabirds was published in August 2008 and fully implemented. The NPOA is in the process being updated in 2022. **Marine turtles**: A report from 2019 on the implementation of FAO guidelines to reduce marine turtle mortality has been provided to the IOTC. Bycatch in South African fisheries is considered to be very low. 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		2013 2018					**Sharks:** The first NPOA-sharks was finalized in 2013 then revised in 2018 which was valid until 2022. This version is in the process of being reviewed. Shark data collection is done through logbooks and a large pelagic data collection programme. NARA has started to collect fisheries and biological data on blue, silky and scalloped hammerhead sharks. **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:** A NPOA has been drafted but not finalised. **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 and has been submitted to the Secretariat and FAO. **Seabirds:** The NPOA – Seabirds for Thailand has been completed and is now awaiting approval from relevant Committees. Thailand has the Notification of the Department of Fisheries on Requirement and Regulations of Fishing Vessels Operating Outside Thai Water in IOTC Area of Competence (IOTC) B.E. 2565 (2022), Clause 18 and 21 include 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:** Liberia does not currently have a NPOA for sharks **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.

Colour key	
Completed	
Drafting being finalised	
Drafting commenced	
Not begun	

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	10–Dec–19	End of SC in 2025	3rd term (interim)
	Vice-Chair	Dr Gorka Merino	EU	08-Dec-23	End of SC in 2025	1st term
WPB	Chair	Dr Jie Cao	China	08–Sep–23	End of WPB in 2025	1st term
	Vice-Chair	Dr Sylvain Bonhommeau	EU,France	08–Sep–23	End of WPB in 2025	1st term
WPTmT	Chair	Dr Toshihide Kitakado	Japan	29–July–22	End of WPTmT in 2028	1st term
	Vice-Chair	Dr Jiangfeng Zhu	China	29–July–22	End of WPTmT in 2028	1st term
WPTT	Chair	Dr Gorka Merino	EU,Spain	03–Nov–23	End of WPTT in 2025	Ext 2nd term
	Vice-Chair	Dr Shiham Adam	IPNLF	03–Nov–23	End of WPTT in 2025	Ext 2nd term
WPEB	Chair	Dr Mariana Tolotti	EU,France	15–Sept–21	End of WPEB in 2025	2nd term
	1st Vice-Chair	Dr Mohamed Koya	India	15–Sept–21	End of WPEB in 2025	2nd term
	2nd Vice-Chair	Dr Charlene da Silva	South Africa	15–Sept–21	End of WPEB in 2025	2nd term
WPNT	Chair	Dr Farhad Kaymaram	I.R. Iran	7–July–23	End of WPNT in 2025	1st term
	Vice-Chair	Mr Bram Setyadji	Indonesia	7–July–23	End of WPNT in 2025	1st term
WPDCS	Chair	Dr Julien Barde	EU,France	3–Dec–21	End of WPDCS in 2023	1st term
	Vice-Chair	Mr Nuwan Gunawardane	Sri Lanka	3–Dec–21	End of WPDCS in 2023	1st term
WPM	Chair	Dr Hilario Murua	ISSF	28–Oct–23	End of WPM in 2025	Ext 2nd term
	Vice-Chair	Dr Ann Preece	Australia	28-Oct-23	End of WPM in 2025	1st term
WGFAD	Co-Chair	Dr Gorka Merino	EU,Spain	06-Oct-21	End of WGFAD in 2024	1st term
	Co-Chair	Mr Avelino Munwane	Mozambique	03-Oct-22	End of WGFAD in 2024	1st term
WGEMS	Chair	Dr Hilario Murua	ISSF	17-Nov-21	End of WGEMS in 2024	1st term
	Vice-Chair	Dr Don Bromhead	Australia	17-Nov-21	End of WGEMS in 2024	1st term

APPENDIX 8
EXECUTIVE SUMMARY: ALBACORE (2023)

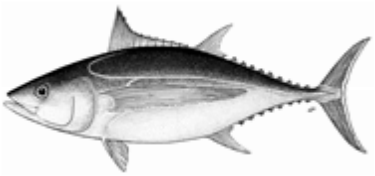


Table 1. Status of albacore (*Thunnus alalunga*) in the Indian Ocean

Area	Indicators – 2022 assessment		2022 stock status determination[3]
Indian Ocean[1]	Catch (2022) (t)[2]	46,625	85%
	Mean annual catch (2018-2022) (t)	40,740	
	MSY (x1,000 t) (95% CI)	45 (35-55)	
	F_{MSY} (80% CI)	0.18 (0.15-0.21)	
	SB_{MSY} (x1,000 t) (80% CI)	27 (21-33)	
	F_{2020} / F_{MSY} (80% CI)	0.68 (0.42-0.94)	
	SB_{2020} / SB_{MSY} (80% CI)	1.56 (0.89-2.24)	
	SB_{2020} / SB_0 (80% CI)	0.36 (0.26-0.45)	

[1]Stock boundaries defined as the IOTC area of competence;
[2]Proportion of catch fully or partially estimated for 2022: 14.7%;
[3]2020 is the final year that data were available for this assessment

Table 2: Probability of stock status with respect to each of four quadrants of the Kobe plot. Percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

	Stock overfished (SB_{2020} / SB_{MSY}<1)	Stock not overfished (SB_{2020} / SB_{MSY}≥ 1)
Stock subject to overfishing (F_{2020} / F_{MSY}≥ 1)	1%	9%
Stock not subject to overfishing (F_{2020} / F_{MSY}≤ 1)	5%	85%
Not assessed/Uncertain / Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was carried out for albacore in 2023, thus the stock status is determined on basis of the 2022 assessment. 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 2022 is based on the model developed in 2019 with a series of revisions that were noted during the WPTmT data preparatory meeting held in April 2022. There are some noticeable changes compared to the previous assessment data set, mainly related to how the fisheries are structured, and how the CPUE indices and length composition data are treated within the assessment model.

The current assessment has utilised the new joint CPUE series that shows some differences compared with the last assessment. This is mainly related to changes in standardisation methodology, which were partly caused by limited operational data access for joint CPUE analysis. Compared to the last assessment, the CPUE index in the southwestern fishery (LL3) shows a somewhat flatter overall trend, the CPUE index in the northwestern fishery (LL1) also exhibited considerably larger variability. Further, the size composition data are significantly down-weighted within the assessment model, and length samples from fisheries other than longline fisheries are effectively given a zero weight. This is to reduce the bias that can be introduced by potentially unrepresentative or problematic length samples.

The final set of model options included alternative models using the northwest and southwest CPUE indices. Both sets of indices suggested a considerable difference in biomass trend between 1990 and now which highlights the uncertainty with respect to the model estimates of recent biomass trends. The two sets of indices effectively monitor different components of the albacore stock. The CPUE in the western area (LL1+3) may best represent the abundance of albacore at this time. The western area also represents a significant proportion of the albacore biomass in the Indian Ocean. The eastern indices are affected by changes in targeting.

Trends in the northwest CPUE series suggest that the biomass vulnerable to longline has declined to around 45-50% of the levels observed in 1980-82, whereas a much smaller decline was observed in the southwest CPUE series for the same period. Prior to 1980 there were 20 years of moderate fishing, after which total catches of albacore tuna in the Indian Ocean have more than doubled (**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 2020 were marginally below the MSY level estimated by the SS3 model. Fishing mortality represented as F_{2020}/F_{MSY} is 0.68 (0.42–0.94). Biomass is estimated to be above the SB_{MSY} level (1.56 (0.89–2.24)) from the SS3 models (**Table 1**, **Fig. 3**). These changes in stock status since the previous assessment are mainly due to changes in the CPUE. Thus, the stock status in relation to the Commission's interim B_{MSY} and F_{MSY} target reference points indicates that the stock is **not overfished** and is not **subject to overfishing** (**Table 1**).

Outlook. 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 current catch appears to be sustainable in the short term although the projections are based on model assumptions that may be associated with high levels of uncertainty (see management advice below for more detail). It should be noted with caution 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. Considerable uncertainty remains in the SS3 assessment conducted in 2022, particularly due to the conflicts in key data inputs, caution is therefore advised for the interpretation of the K2SM. The K2SM indicates that there is little risk of violating the target and limit reference points with current and moderate increases in catch in the short term. Current catches (46,625t for the statistical year 2022; **Table 1**) are just above the estimated level of MSY.

There remains considerable uncertainty resulting from changes in the CPUE series which are not well understood, model instability in response to updated data, growth variability and poor fits to the size data. It should be noted that neither CPUE series or other model assumptions account for any change in catchability/effort creep over the time series.

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 2022 (46,625 t) 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 models (**Table 3**);
- 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**: the fishing mortality at the time of the assessment was considered to be below the interim target reference point of F_{MSY}, and therefore below the interim limit reference point of $1.4*F_{MSY}$ (**Fig. 3**)
  - **Biomass**: the spawning biomass at the time of the assessment was considered to be above the target reference point of SB_{MSY}, and therefore above the limit reference point of $0.4*SB_{MSY}$ (**Fig. 3**)
- **Main fisheries (mean annual catch 2018-2022)**: albacore are caught using longline (82.7%), followed by line (14.2%) and purse seine (1.5%). The remaining catches taken with other gears contributed to 1.7% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2018-2022)**: the majority of albacore catches are attributed to vessels flagged to Taiwan,China (54.6%) followed by Indonesia (21.9%) and China (9.8%). The 26 other fleets catching albacore contributed to 13.6% of the total catch in recent years (**Fig. 2**).

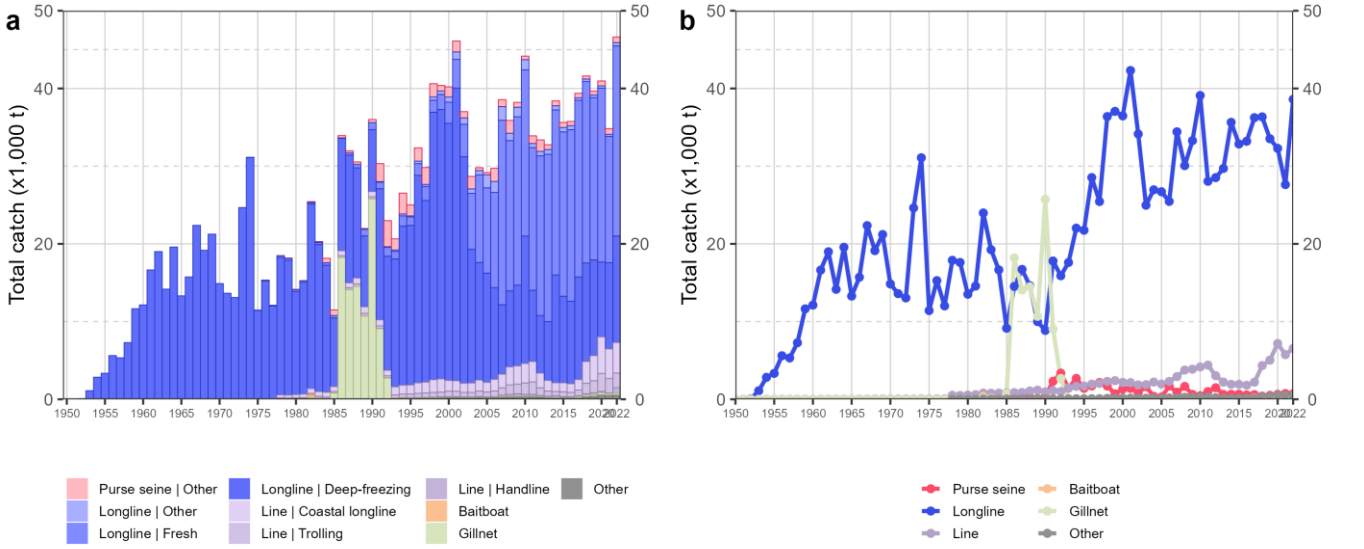


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tonnes; t) by fishery and (b) individual nominal catches (metric tonnes; t) by fishery group for albacore during 1950-2022. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

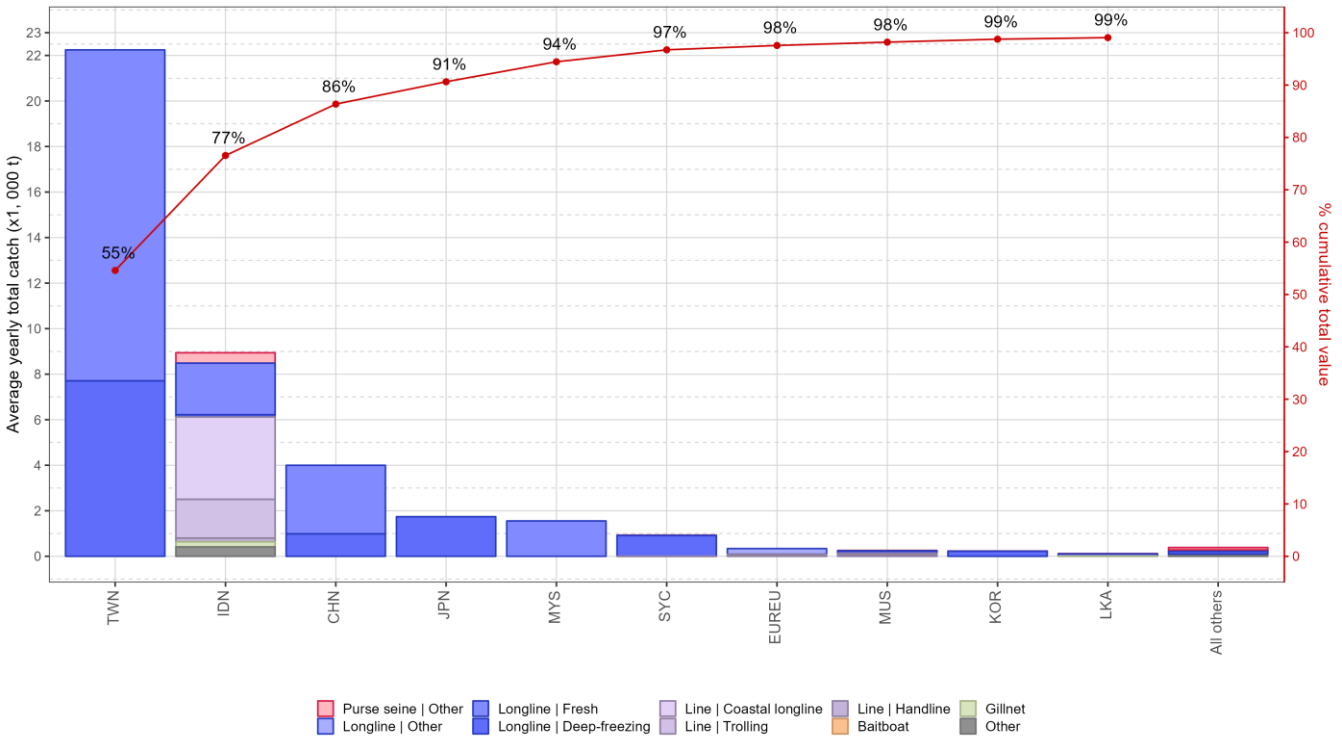


Fig. 2. Mean annual catches (metric tonnes; t) of albacore by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

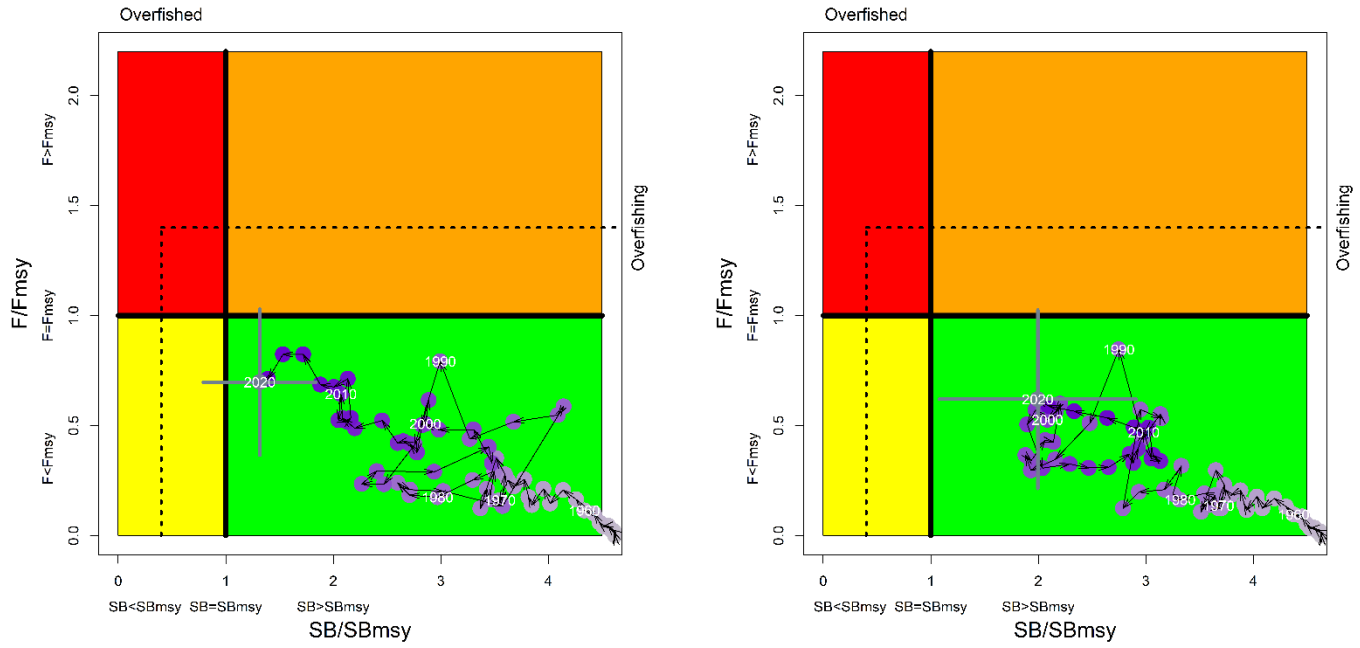


Fig. 3. Albacore: SS3 Indian Ocean assessment Kobe plot for the two model options considered: (i) Model fitted to the North-western CPUE; (ii) Model fitted to the South-western CPUE. Purple circles indicate the trajectory of the point estimates for the spawning biomass (SB) ratio and fishing mortality (F) ratio for each year 1950–2020 (the grey lines represent the 95 percentiles of the 2020 estimate). Target (F_{target} and SB_{target}) and limit (F_{lim} and SB_{lim}) reference points are shown

Table 3. Albacore: SS3 aggregated Indian Ocean assessment Kobe II Strategy Matrix based on the model options (i) Model 1 and (ii) Model 2. Probability (percentage) of violating the MSY-based target (top) and limit (bottom) reference points for constant catch projections (2020 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 2020) and probability (%) of violating MSY-based target reference points (SB_{targ} = SB_{MSY}; F_{targ} = F_{MSY})**								
	60% (24,644)	70% (28,751)	80% (32,858)	90% (36,966)	100% (41,073)	110% (45,180)	120% (49,288)	130% (53,395)	140% (57,502)
$SB_{2023} < SB_{MSY}$	0.006	0.016	0.022	0.036	0.045	0.069	0.097	0.123	0.154
$F_{2023} > F_{MSY}$	0	0	0.003	0.029	0.1	0.204	0.326	0.434	0.529
$SB_{2030} < SB_{MSY}$	0.03	0.047	0.087	0.135	0.19	0.28	0.395	0.505	0.603
$F_{2030} > F_{MSY}$	0	0	0.001	0.037	0.141	0.3	0.453	0.565	0.618
Reference point and projection timeframe	**Alternative catch projections (relative to the catch level for 2020) and probability (%) of violating MSY-based target reference points (SB_{Lim} = 0.4*SB_{MSY}; F_{Lim} = 1.4*F_{MSY})**								
	60% (24,644)	70% (28,751)	80% (32,858)	90% (36,966)	100% (41,073)	110% (45,180)	120% (49,288)	130% (53,395)	140% (57,502)
$SB_{2023} < SB_{Lim}$	0	0	0	0	0.001	0.002	0.005	0.006	0.012
$F_{2023} > F_{Lim}$	0	0	0	0	0.001	0.011	0.056	0.117	0.213
$SB_{2030} < SB_{Lim}$	0.004	0.009	0.022	0.042	0.074	0.118	0.169	0.243	0.344
$F_{2030} > F_{Lim}$	0	0	0	0	0.008	0.073	0.21	0.374	0.496

APPENDIX 9
EXECUTIVE SUMMARY: BIGEYE TUNA (2023)

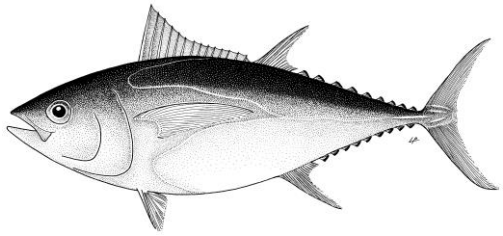


Table 1. Status of bigeye tuna (*Thunnus obesus*) in the Indian Ocean

Area[1]	Indicators		2022 stock status determination[4]
Indian Ocean	Catch 2022[2] (t) Mean annual catch 2018-2022 (t)[3]	102,266 92,687	79%
	MSY (1,000 t) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 t) (80% CI) F_{2021}/F_{MSY} (80% CI) SB_{2021}/SB_0 (80% CI) SB_{2021}/SB_{MSY} (80% CI)	96 (83 – 108) 0.26 (0.18 – 0.34) 513 (332 – 694) 1.43 (1.10–1.77) 0.25 (0.23 – 0.27) 0.90 (0.75 – 1.05)	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2]Proportion of 2022 catch fully or partially estimated by IOTC Secretariat: 18.7%
[3]Including re-estimations of EU PS species composition for 2018 (only requested for stock assessment purposes)
[4]2021 is the final year that data were available for this assessment
*Estimated probability that the stock is in the respective quadrant of the Kobe Plot (**Table 2**), derived from the confidence intervals associated with the current stock status.

Table 2. Probability of stock status with respect to each of four quadrants of the Kobe plot. Percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account

	Stock overfished (SB_{2021} / SB_{MSY}<1)	Stock not overfished (SB_{2021} / SB_{MSY}≥ 1)
Stock subject to overfishing (F_{2021} / F_{MSY}≥ 1)	79%	17%
Stock not subject to overfishing (F_{2021} / F_{MSY}≤ 1)	2%	2%
Not assessed / Uncertain / Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was carried out for bigeye tuna in 2023 and so the advice is based on the 2022 assessment. In the 2022 assessment, two models were applied to the bigeye stock (Statistical Catch at Size (SCAS) and Stock Synthesis (SS3)), with the SS3 stock assessment selected to provide scientific advice. The reported stock status is based on a grid of 24 model configurations designed to capture the uncertainty on stock recruitment relationship, longline selectivity, growth and natural mortality. Spawning biomass in 2021 was estimated to be 25% (80% CI: 23-27%) of the unfished levels (**Table 1**) and 90% (75-105%) of the level that can support MSY. Fishing mortality was estimated at 1.43 (1.1-1.77) times the F_{MSY} level. Considering the characterized uncertainty, the assessment indicates that SB2021 is below SBMSY and that F_{2021} is above FMSY (79%). On the weight-of-evidence available in 2022, the bigeye tuna stock is determined to be **overfished** and **subject to overfishing** (**Table 2**).
As IOTC agreed on a bigeye Management Procedure (Res. 22/03) it should be noted that the stock assessment is not used to provide a recommendation on the TAC.

Management Procedure. A management procedure for Indian Ocean Bigeye tuna was adopted under Resolution 22/03 by the IOTC Commission in May 2022 and was applied to determine a recommended TAC for Bigeye tuna for

2024 and 2025. A review of evidence for exceptional circumstances, was also conducted following the adopted guideline (ref SC 2021 report appendix 6A) as per the requirements of Resolution 22/03. The review covered information pertaining to i) new knowledge about the stock, population dynamics or biology, ii) changes in fisheries or fisheries operations, iii) changes to input data or missing data, and iv) inconsistent implementation of the MP advice. The evaluation concluded that there were no exceptional circumstances requiring either further research or management action on the TAC calculated by the MP. Application of the MP in 2022 results in a recommended TAC of 80,583t per year for 2024 and 2025.

Outlook. Catch in 2021 (94,803 t) and catch in 2022 (102,266 t) of bigeye tuna were above the recommended TAC for 2024 and 2025 from the application of the bigeye tuna MP. Achieving the objectives of the Commission for this stock will require effective implementation of the MP TAC advice by the Commission going forward, a requirement further emphasised by the current status of the stock estimated from the stock assessment to be overfished and subject to overfishing.

Management advice. The TAC recommended from the application of the MP specified in Resolution 22/03 and Resolution 23/04 is 80,583t / year for the period 2024-2025. The recommended TAC is 15% below the 2021 catch (this is constrained by the maximum TAC change).

The following key points should also be noted:

- **Main fisheries (mean annual catch 2018-2022)**: bigeye tuna are caught using purse seine (45.7%), followed by longline (34.4%) and line (12.8%). The remaining catches taken with other gears contributed to 7% of the total catches in recent years (**Fig. 1**).

- **Main fleets (mean annual catch 2018-2022)**: the majority of bigeye tuna catches are attributed to vessels flagged to Indonesia (24.9%) followed by EU (Spain) (18%) and Seychelles (14.4%). The 29 other fleets catching bigeye tuna contributed to 42.5% of the total catch in recent years (**Fig. 2**).

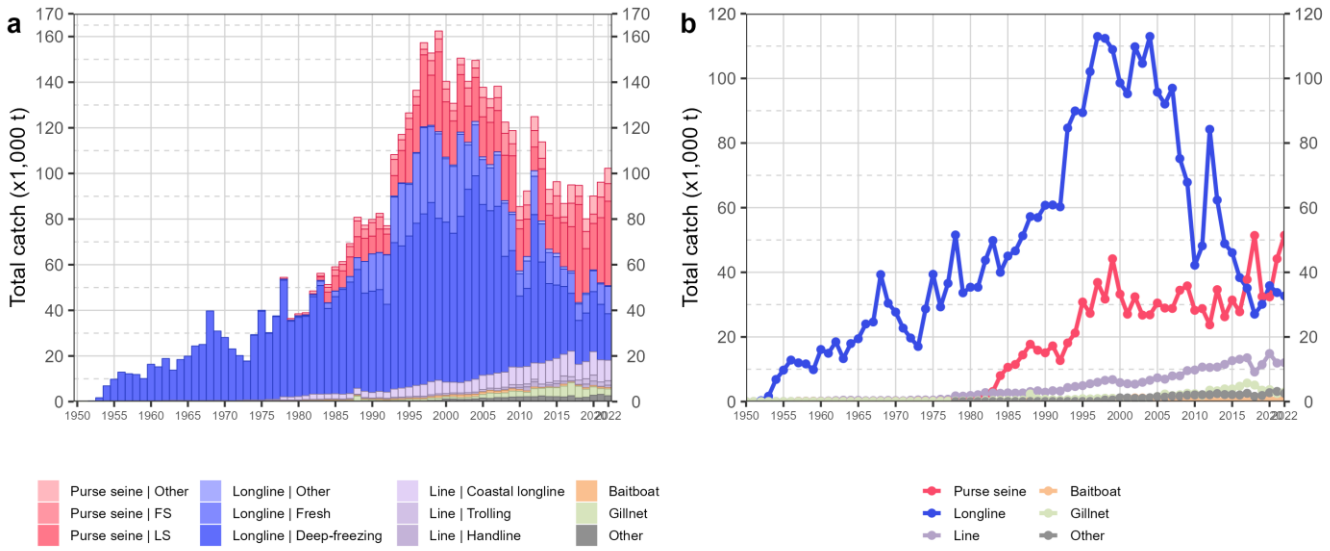


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tonnes; t) by fishery and (b) individual nominal catches (metric tonnes; t) by fishery group for bigeye tuna during 1950-2022. FS = free-swimming school; LS = school associated with drifting floating objects. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

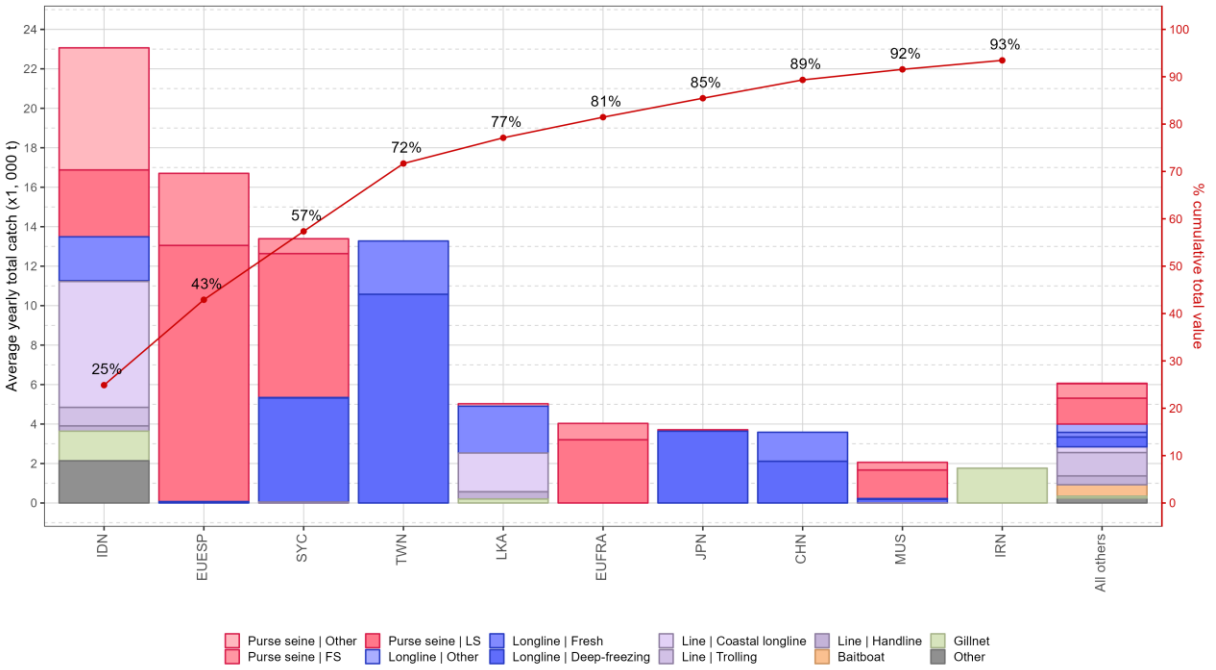


Fig. 2. Mean annual catches (metric tonnes; t) of bigeye tuna by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet. FS = free-swimming school; LS = school associated with drifting floating objects. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

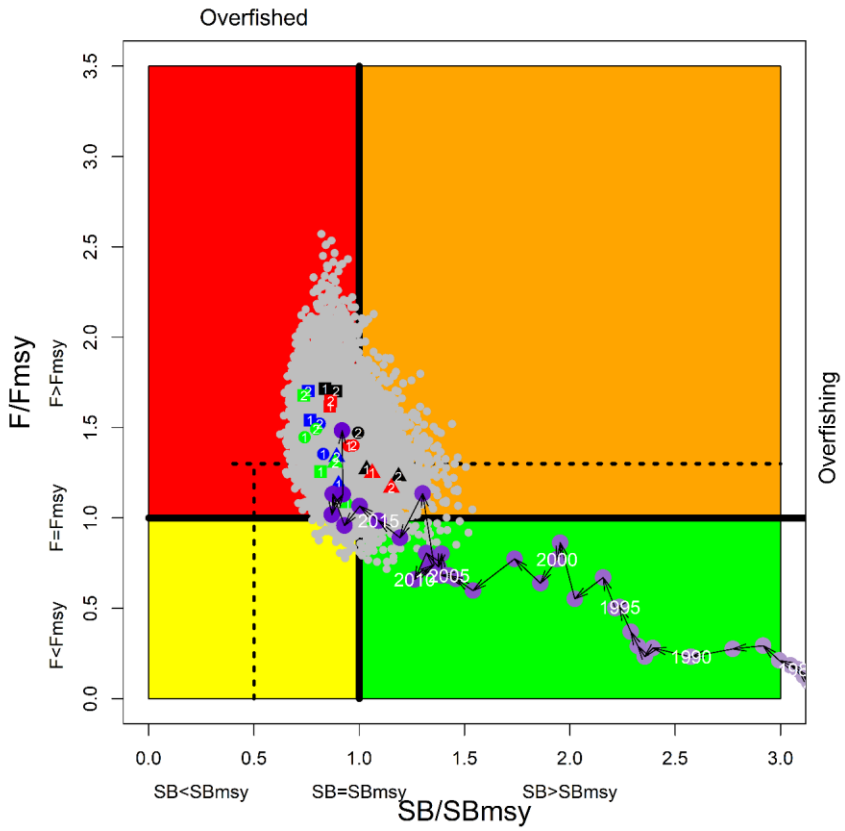


Fig. 3. Bigeye tuna: SS3 Aggregated Indian Ocean assessment Kobe plot. The coloured points represent stock status estimates from the 24 model options. Coloured symbols represent Maximum posterior density (MPD) estimates from individual models: square, circle, and Triangles represents alternative steepness options; black, red, blue, and green represents alternative growth and natural mortality option combination; 1,2, represents alternative selectivity options. The purple dot and arrowed line represent estimates of the reference model (the last purple dot represents the terminal year of 2021). Grey dots represent uncertainty from individual models. The dashed lines represent limit reference points for IO bigeye tuna (SBlim = 0.5 SBMSY and Flim = 1.4 FMSY)

APPENDIX 10
EXECUTIVE SUMMARY: SKIPJACK TUNA (2023)

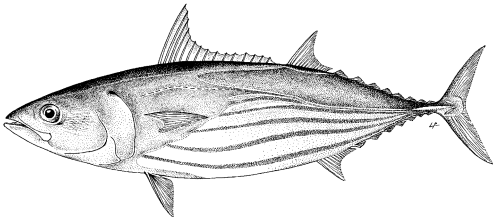


Table 1. Status of skipjack tuna (*Katsuwonus pelamis*) in the Indian Ocean

Area[1]	Indicators		2023 stock status determination[3]
Indian Ocean	Catch 2022[2] (t)	666,408	**70%***
	Mean annual catch 2018-2022 (t)	613,061	
	$E_{40\%SB0}$ [4] (80% CI)	0.55 (0.48–0.65)	
	SB_0 (t) (80% CI)	2 177 144 (1 869 035–2 465 671)	
	SB_{2022} (t) (80% CI)	1 142 919 (842 723–1 461 772)	
	SB_{2022} / SB_0 80% CI)	0.53 (0.42–0.68)	
	SB_{2022} / $SB_{40\%SB0}$ (80% CI)	1.33 (1.04–1.71)	
	SB_{2022} / $SB_{20\%SB0}$ (80% CI)	2.67 (2.08–3.42)	
	SB_{2022} / SB_{MSY} (80% CI)	2.30 (1.57–3.40)	
	F_{2022} / F_{MSY} (80% CI)	0.49 (0.32–0.75)	
	F_{2022} / $F_{40\%SSB0}$ (80% CI)	0.90 (0.68–1.22)	
	MSY (t) (80% CI)	584 774 (512 228–686 071)	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2022 catch fully or partially estimated by IOTC Secretariat: 18.1%
[3]2022 is the final year that data were available for this assessment.
[4] $E_{40\%SB0}$ 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 21/03. Note that Resolution 23/03 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 plot (defined in resolution 21/03 and shown below), derived from the confidence intervals associated with the current stock status

Table 2. Probability of stock status with respect to each of four quadrants of the Kobe plot. Percentages are calculated as the proportion of model terminal values that fall within each quadrant with model weights taken into account, as defined in resolution 21/03

	Stock overfished (SB_{2022} / $SB_{40\%SB0}$<1)	Stock not overfished (SB_{2022} / $SB_{40\%SB0}$≥ 1)
Stock subject to overfishing (F_{2022} / $F_{40\%SB0}$≥ 1)	8%	21%
Stock not subject to overfishing (F_{2022} / $F_{40\%SB0}$≤ 1)	1%	70%
Not assessed / Uncertain / Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new stock assessment was carried out for skipjack tuna in 2023 using Stock Synthesis with data up to 2022. The outcome of the 2023 stock assessment model is more optimistic than the previous assessment (2020) despite the high catches recorded in the period 2021-2022, which exceeded the catch limits established in 2020 for this period.

The final assessment indicates that:

i) The stock is above the adopted target for this stock (40%SB_0) and the current exploitation rate is below the target exploitation rate with the probability of 70%. Current spawning biomass relative to unexploited levels is estimated at 53%.
ii) The spawning biomass remains above SB_{MSY} and the fishing mortality remains below F_{MSY} with a probability of 98.4 %
iii) Over the history of the fishery, biomass has been well above the adopted limit reference point (20%SB_0).

Subsequently, based on the weight-of-evidence available in 2023, the skipjack tuna stock is determined to be **not overfished** and **not subject to overfishing**.

Outlook.

There has been a substantial increase of fishery dependent abundance index in recent years: the CPUE from the Pole and line fishery increased by 75% from 2019 to 2022, and the PSLS also increased by over 30% between 2019 and 2021. Total catches in 2022 were 30% larger than the resulting catch limit from the skipjack HCR for the period 2021-2023 (513,572 t). The increase in abundance despite catches exceeding the recommended limits was primarily driven by an increase in recent recruitment which was estimated to be well above the long-term average. Environmental conditions (such as sea surface productivity (chlorophyll)) are believed to significantly influence recruitment of skipjack tuna and can produce high variability in recruitment levels between years. The high recruitment anomaly estimated in 2022 appears to be supported by the strong increasingly positive phase of sea surface productivity which began from a below average level in 2015. Climate model predictions suggest that the positive productivity phase will end by the start of 2024 resulting in a period of lower productivity. There is also considerable uncertainty in the stock assessment models due to the potential caveats of using PL and PSLS CPUE as index of basin-level abundance and uncertainty in stock productivity parameters of skipjack tuna (e.g., steepness and growth, natural mortality). The model runs analyzed illustrate a wide range of stock status (SB_{2022} / SB_0) to be between 35% and 78%.

Management advice. The catch limit calculated applying the HCR specified in Resolution 21/03 is [628, 606t] for the period 2024-2026. 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 in recent years and a higher stock level relative to the target reference point, possibly due to skipjack life history characteristics and favorable environmental conditions. Noting that the environmental conditions are predicted to enter a less favorable period, it is important that the Commission ensures that catches of skipjack tuna during this period do not exceed the agreed limit, as occurred in recent years. In addition, the SC recognizes the potential impact on other associated stocks (bigeye and yellowfin) of exceeding the catch limits of skipjack. 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 (superseded by Resolution 21/03)*.
- **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 as per Resolution 16/02 (**Fig. 2**).
- **Main fisheries (mean annual catch 2018-2022):** skipjack tuna are caught using purse seine (54.4%), followed by baitboat (19.2%) and gillnet (17.9%). The remaining catches taken with other gears contributed to 8.6% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2018-2022):** the majority of skipjack tuna catches are attributed to vessels flagged to Indonesia (19.6%) followed by Maldives (17.6%) and EU (Spain) (16.9%). The 31 other fleets catching skipjack tuna contributed to 45.8% of the total catch in recent years (**Fig. 2**).

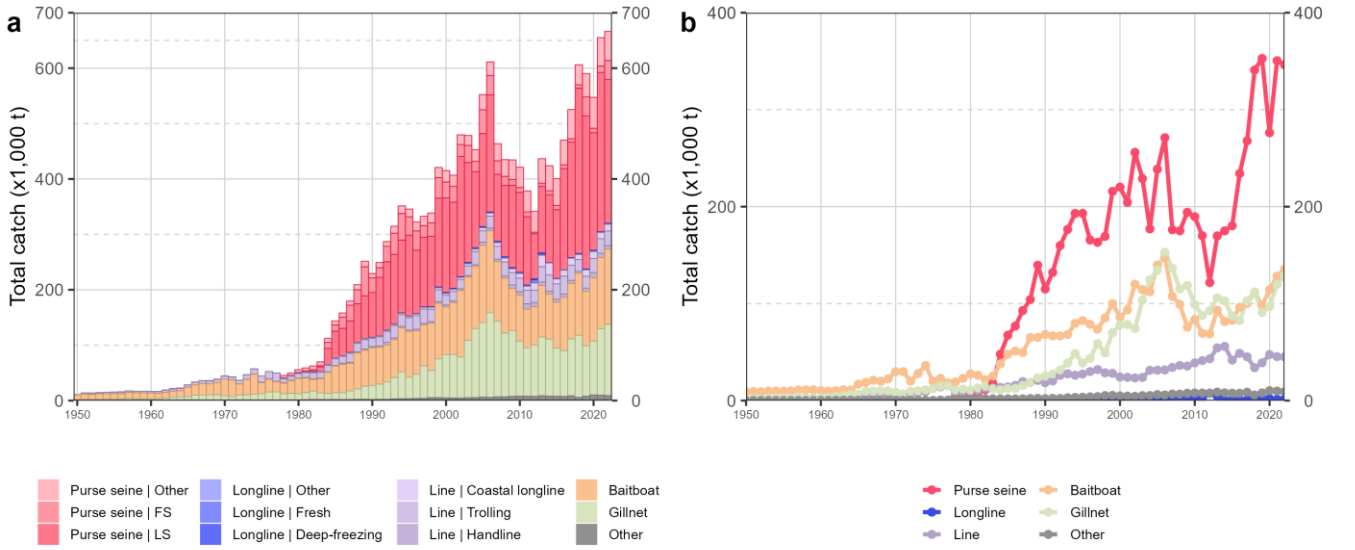


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tonnes; t) by fishery and (b) individual nominal catches (metric tonnes; t) by fishery group for skipjack tuna during 1950-2022. FS = free-swimming school; LS = school associated with drifting floating objects. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

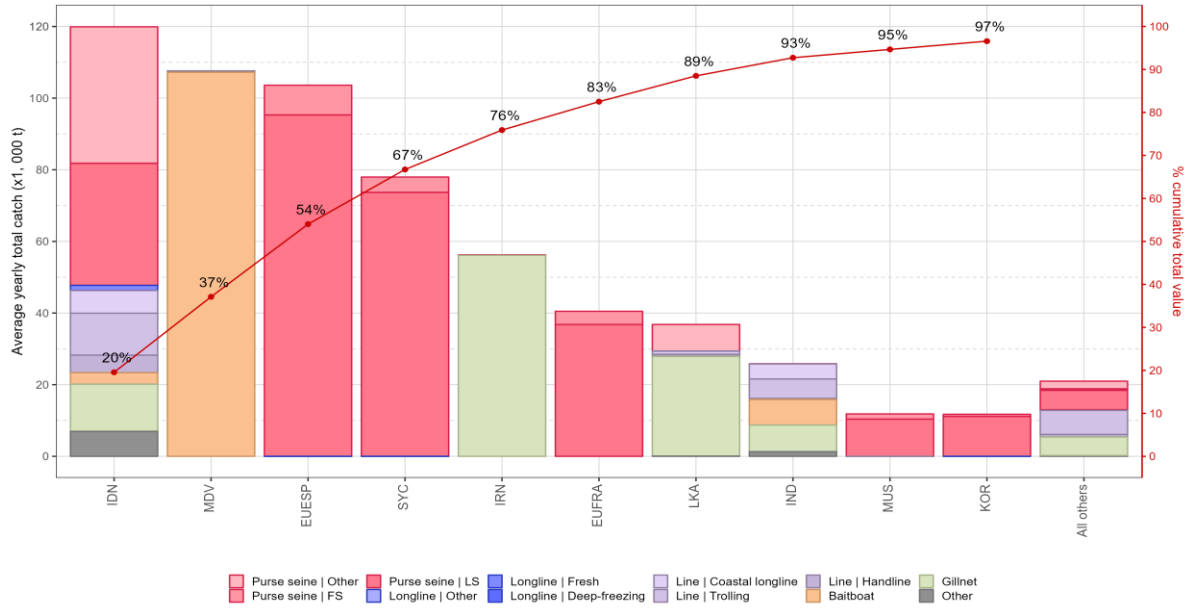


Fig. 2. Mean annual catches (metric tonnes; t) of skipjack tuna by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet. FS = free-swimming school; LS = school associated with drifting floating objects. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

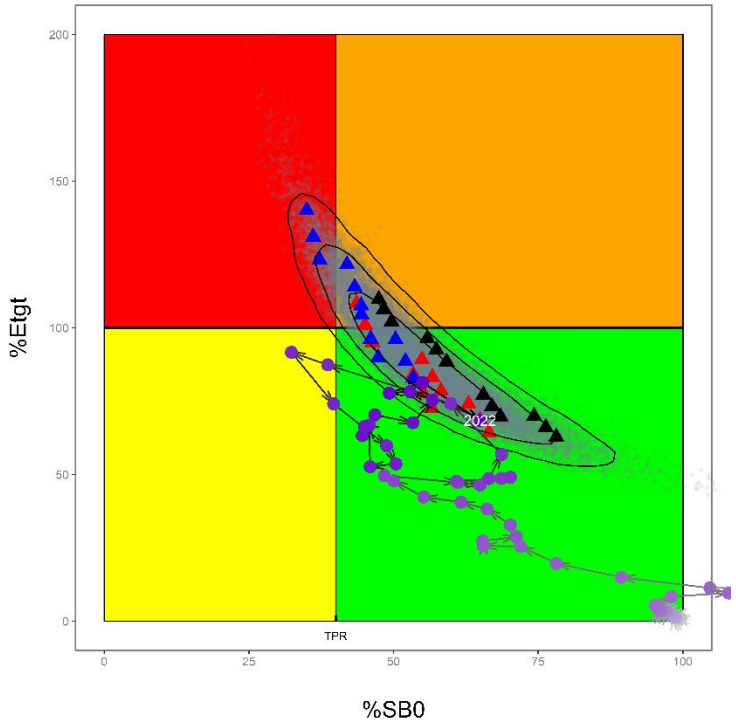


Fig. 3. Skipjack tuna: SS3 Aggregated Indian Ocean assessment Kobe plot of the 2023 uncertainty grid. Left - current stock status, relative to SB0 and F (x-axis) and $F_{40\%B0}$ (y-axis) reference points for the final model grid.. TPR indicates 40% B0; Triangles represent MPD estimates from individual models (black, models based on PL index; red, models based on PSLS index; blue, models based on and both PSLS and ABBI index). Grey dots represent uncertainty from individual models. The arrowed line represents time series of historical stock trajectory for model PSLS. Contours represents 50, 80, and 90% confidence region.

APPENDIX 11
EXECUTIVE SUMMARY: YELLOWFIN TUNA (2023)

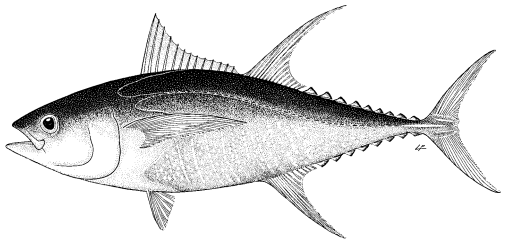


Table 1. Status of yellowfin tuna (*Thunnus albacares*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch 2022[2] (t)	410,332	68%*
	Mean annual catch 2018-2022 (t)	429,421	
	MSY (1,000 t) (80% CI)	349 (286-412)	
	F_{MSY} (80% CI)	0.18 (0.15-0.21)	
	SB_{MSY} (1,000 t) (80% CI)	1,333 (1,018-1,648)	
	F_{2020} / F_{MSY} (80% CI)	1.32 (0.68-1.95)	
	SB_{2020} / SB_{MSY} (80% CI)	0.87 (0.63-1.10)	
	SB_{2020} / SB_0 (80% CI)	0.31 (0.24-0.38)	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2]Proportion of 2022 catch fully or partially estimated by IOTC Secretariat: 17.2%

[3]2020 is the final year that data were available for this assessment

Colour key	Stock overfished (SB_{2020} / SB_{MSY}<1)	Stock not overfished (SB_{2020} / SB_{MSY}≥ 1)
Stock subject to overfishing (F_{2020} / F_{MSY}≥ 1)	68%	2%
Stock not subject to overfishing (F_{2020} / F_{MSY}≤ 1)	13%	17%
Not assessed / Uncertain / Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was carried out for yellowfin tuna in 2023 and so the advice is based on the 2021 assessment. The 2021 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 2021 is based on the model developed in 2018 with a series of revisions that were noted during the WPTT in 2018, 2019 and 2020. The model uses four types of data: catch, size frequency, tagging and CPUE indices. The proposed final assessment model options correspond to a combination of model configurations, including alternative assumptions about the spatial structure (2 options), longline CPUE catchability (2 options on the effect of piracy), weighting of the tagging dataset (lambda = 0.1 or 1), steepness values (0.7, 0.8, and 0.9), natural mortality values (2 options), and growth parameters (2 options). The model ensemble (a total of 96 models) encompasses a range of stock dynamics.

A number of sensitivity runs were conducted to address additional uncertainty, including two new natural mortalities (based on maximum age of 10.9 and 18, respectively), a new growth curve (based on the most recent aging study), an assumed longline catchability increase (1% per year), as well as a model that includes only the Japanese size data for the Longline fishery. The results of these models generally indicate a more pessimistic stock status and would lower the estimated median biomass if included in the final grid of models. However, the results from the sensitivity runs were within the range of uncertainty estimated by the model grid. The sensitivity models still require further exploration to ensure uncertainty is being captured appropriately and models are not mis-specified. Other key uncertainties (for example, catch levels) were not explored and should be in the future.

The new model grid represents a marked improvement over the previous results available in 2018 and incorporates a far wider range of uncertainty. According to the information available in 2021, the total catch has remained above the estimated MSY since 2012 (i.e., between 399,000 t and 448,642 t), with the 2019 catch (448,642 t) being the largest since 2010 (for details see WPTT23 report).

Overall stock status estimates do not differ substantially from the previous assessment. Spawning biomass in 2020 was estimated to be 31% on average of the unfished (1950) levels (**Table 1**). Spawning biomass estimates have been generally declining over time and particularly since 2011 (**Fig. 3)**. Spawning biomass in 2020 was estimated to be 87% of the level that supports the maximum sustainable yield (SB_{2020}/SB_{MSY} = 0.87). Current fishing mortality is estimated to be 32% higher than F_{MSY} (F_{2020}/F_{MSY} = 1.32). The probability of the stock being in the red Kobe quadrant in 2020 is estimated to be 68%. On the weight-of-evidence available since 2018, the yellowfin tuna stock is determined to remain **overfished** and **subject to overfishing** (**Table 1** and **Fig. 4**).

It is noted that the estimated productivity of the stock (MSY) was very low for some of the scenarios of the reference grid. Their plausibility and reasons for this low productivity are yet to be fully investigated. It is noted that there is also considerable uncertainty in the reported catches by some fisheries. In particular, several artisanal fisheries have increased their catches substantially in recent years, the implication of which should be further investigated. There was a lack of information to explain this sharp increase in catch. Inconsistencies in the biomass trend by region also remain unresolved and this also deserves further investigation.

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 critical errors in the projections and estimations for computing probabilities in the K2SM developed in 2018 have been addressed and the updated projections no longer suffer from the issues previously experienced.

Management advice

For each catch scenario, the probability of the biomass being below the SB_{MSY} level and the probability of fishing mortality being above F_{MSY} were determined over the projection horizon using the delta-MVLN estimator (Walter & Winker 2020), based on the variance-covariance derived from estimates of SB/SB_{MSY} and F/F_{MSY} across the model grid. According to the K2SM (**Table 3**),

- if catches are reduced to < 80% of 2020 levels there is a >50% probability of being above SB_{MSY} in 2030.
- if catches are reduced to less than 80% of 2020 levels there would be a >50% probability of ending overfishing ($F<F_{MSY}$) by 2030.
- The probability of breaching the biological limit reference point ($0.4SB_{MSY}$) with 2020 catches is 64% by 2030. The probability of breaching the F limit reference point ($1.4\ F_{MSY}$) with 2020 catch is 78% by 2030.

The catches in 2021 and 2022 exceeded the levels required to recover the stock, with > 50% probability, to a not overfished state by 2030 (Table 3 - K2SM results). Subsequently, the level of catch reduction required to recover the stock to a not overfished state by 2030, with > 50% probability, may now be higher than estimated by the K2SM.

The Commission has an interim plan for the rebuilding the yellowfin stock, with catch limitations based on 2014/2015 levels (Resolution 21/01 which superseded 19/01, 18/01 and 17/01). Some of the fisheries subject to catch reductions have achieved a decrease in catches in 2021 in accordance with the levels of reductions specified in the Resolution; however, these reductions were offset by increases in the catches from CPCs exempt from and some CPCs subject to limitations on their catches of yellowfin tuna.

The following key points should also be noted:

- Maximum Sustainable Yield (MSY): estimate for the Indian Ocean stock is 349,000 t with a range between 286,000-412,000 t (**Table 1**). The 2018-2022 average catches (429,421 t) were above the estimated MSY level. Although catch in 2021 reduced by 4% compared to the 2020 level, the last year catch remained 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**: 2020 fishing mortality is considered to be 32% above the interim target reference point of F_{MSY}, and below the interim limit reference point of $1.4*F_{MSY}$ (**Fig. 4**).
- **Biomass**: 2020 spawning biomass is considered to be 13 % below the interim target reference point of SB_{MSY} and above the interim limit reference point of $0.4*SB_{MSY}$ (**Fig. 4**).

- **Catch data uncertainty:** the overall quality of the nominal catches of yellowfin tuna shows some large variability between 1950 and 2020. In some years, a large portion of the nominal catches of yellowfin tuna had to be estimated, and catches reported using species or gear aggregates had to be further broken down. The data quality was particularly poor between 1994 and 2002 when less than 70% of the nominal catches were fully or partially reported, with most reporting issues coming from coastal fisheries. The reporting rate has generally improved over the last decade however detailed information on data collection procedures, which determines the quality of fishery statistics, is still lacking.
- **Main fisheries (mean annual catch 2018-2022)**: yellowfin tuna are caught using line (38.1%), followed by purse seine (32.5%) and gillnet (16.5%). The remaining catches taken with other gears contributed to 12.9% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2018-2022)**: the majority of yellowfin tuna catches are attributed to vessels flagged to Sultanate of Oman (13.2%) followed by I. R. Iran (11.5%) and EU (Spain) (10.2%). The 33 other fleets catching yellowfin tuna contributed to 65% of the total catch in recent years (**Fig. 2**).

References

Walter, J., Winker, H., 2020. Projections to create Kobe 2 Strategy Matrices using the multivariate log-normal approximation for Atlantic yellowfin tuna. Collect. Vol. Sci. Pap. ICCAT, 76(6): 725-739

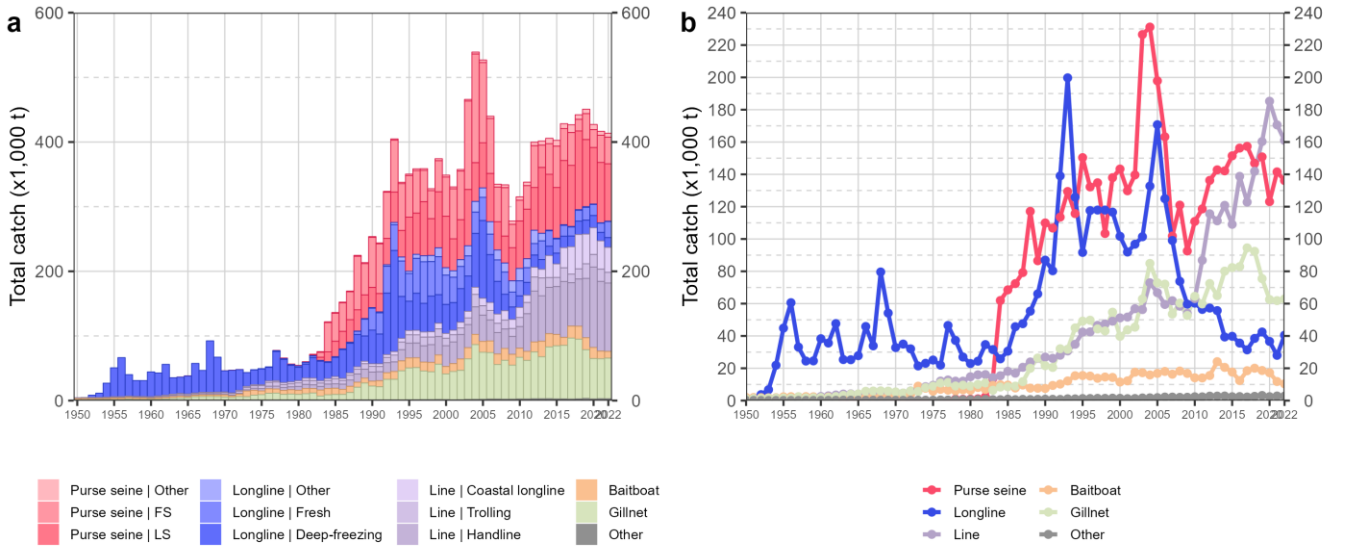


Fig. 3. Annual time series of (a) cumulative nominal catches (metric tonnes; t) by fishery and (b) individual nominal catches (metric tonnes; t) by fishery group for yellowfin tuna during 1950-2022. FS = free-swimming school; LS = school associated with drifting floating objects. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

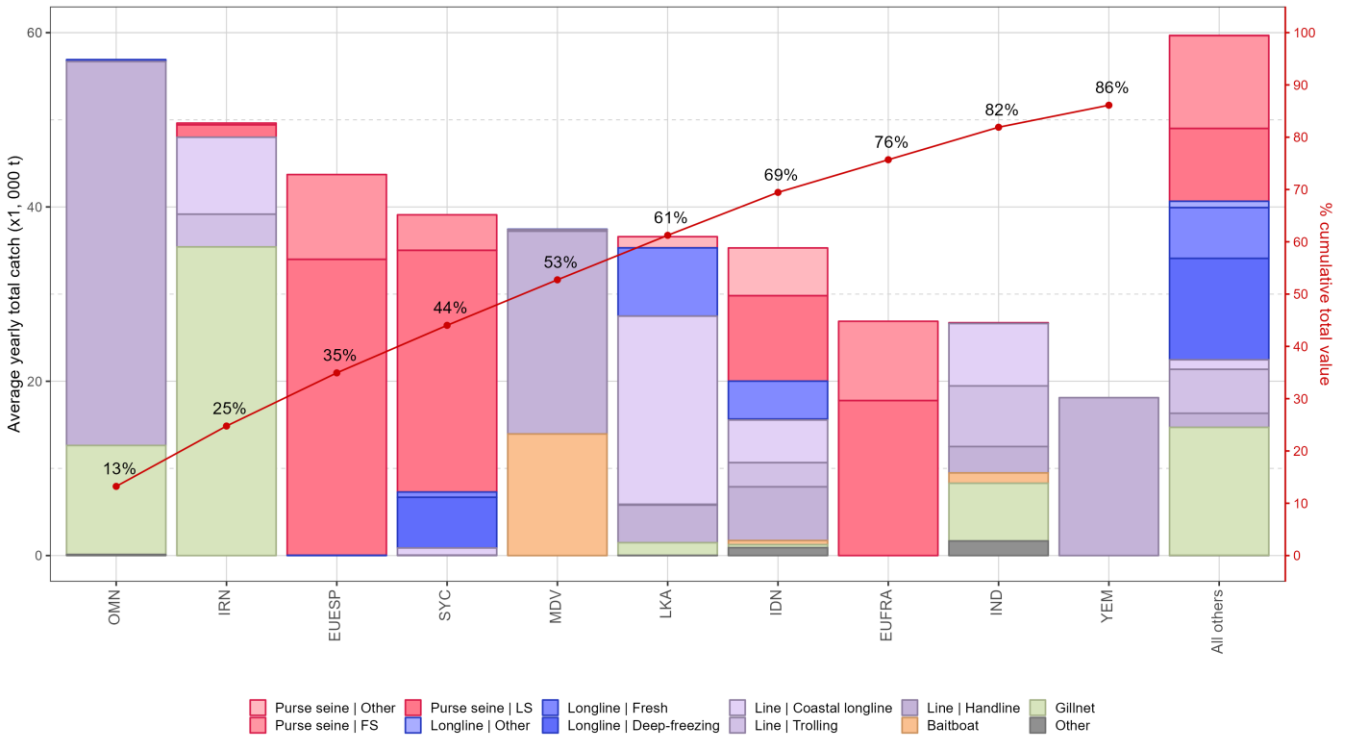


Fig. 4. Mean annual catches (metric tonnes; t) of yellowfin tuna by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet. FS = free-swimming school; LS = school associated with drifting floating objects. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

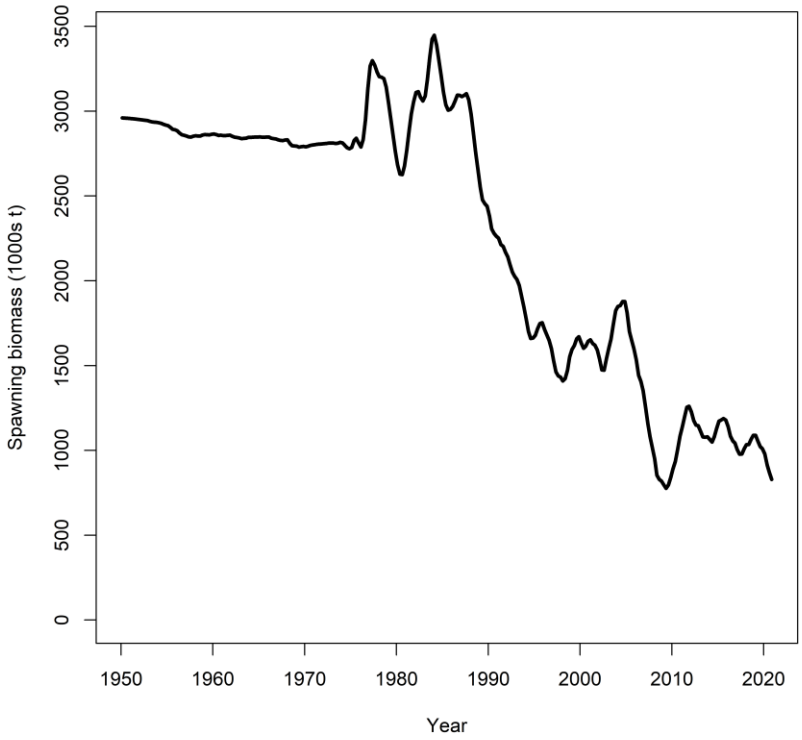


Fig 3. Estimated time series (1950-2020) of total spawning biomass of yellowfin tuna (left) from the reference model of the 2020 assessment.

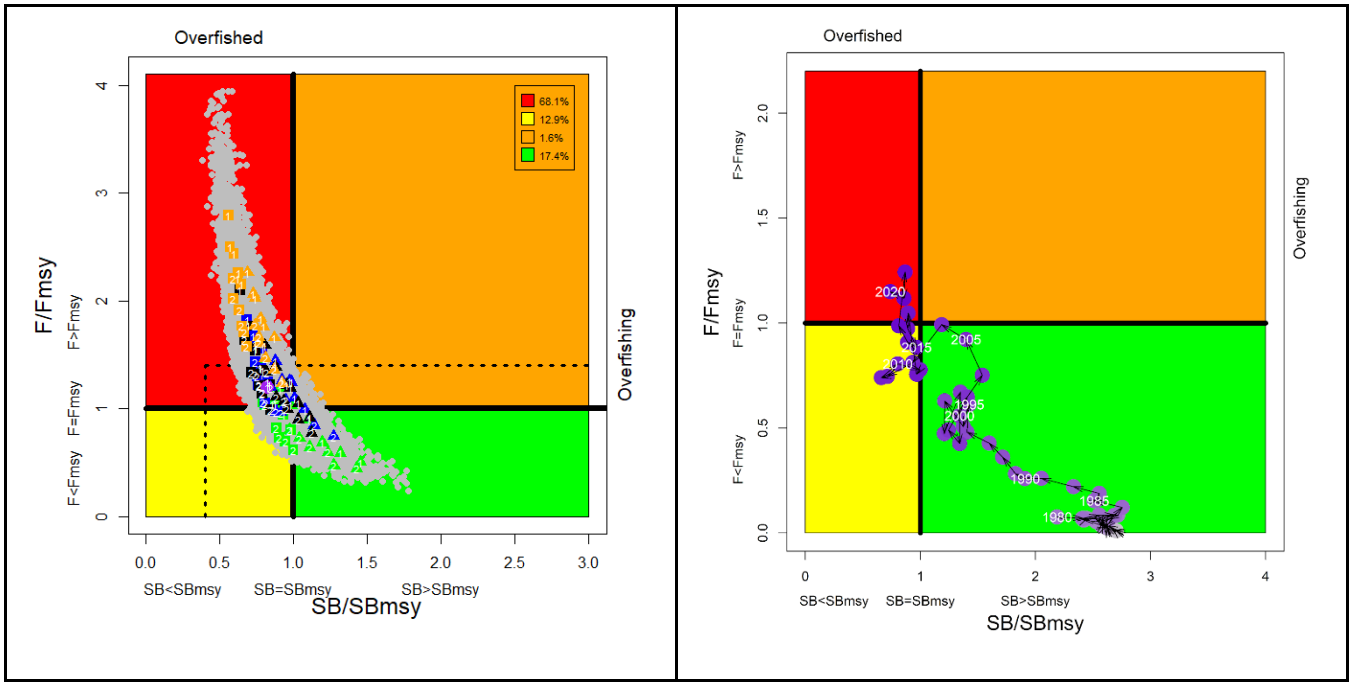


Fig. 4. Yellowfin tuna: SS3 Indian Ocean assessment Kobe plot: (left): current (2020) stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the final model options. Coloured symbols represent Maximum posterior density (MPD) estimates from individual models: square and Triangles and represents LL CPUE catchability options q1 and q2 respectively; green, blue, black, and orange represents growth and natural mortality option combination Gbase_Mbase, GDortel_Mbase, Gbase_Mlow, and GDortel_Mlow respectively; 1,2, represents spatial structure option io and sp respectively. The purple dot represents the base model. Grey dots represent uncertainty from individual models. The dashed lines represent limit reference points for IO yellowfin tuna (SBlim = 0.4 SB_{MSY} and Flim = 1.4 F_{MSY}); (right) stock trajectory from the base model

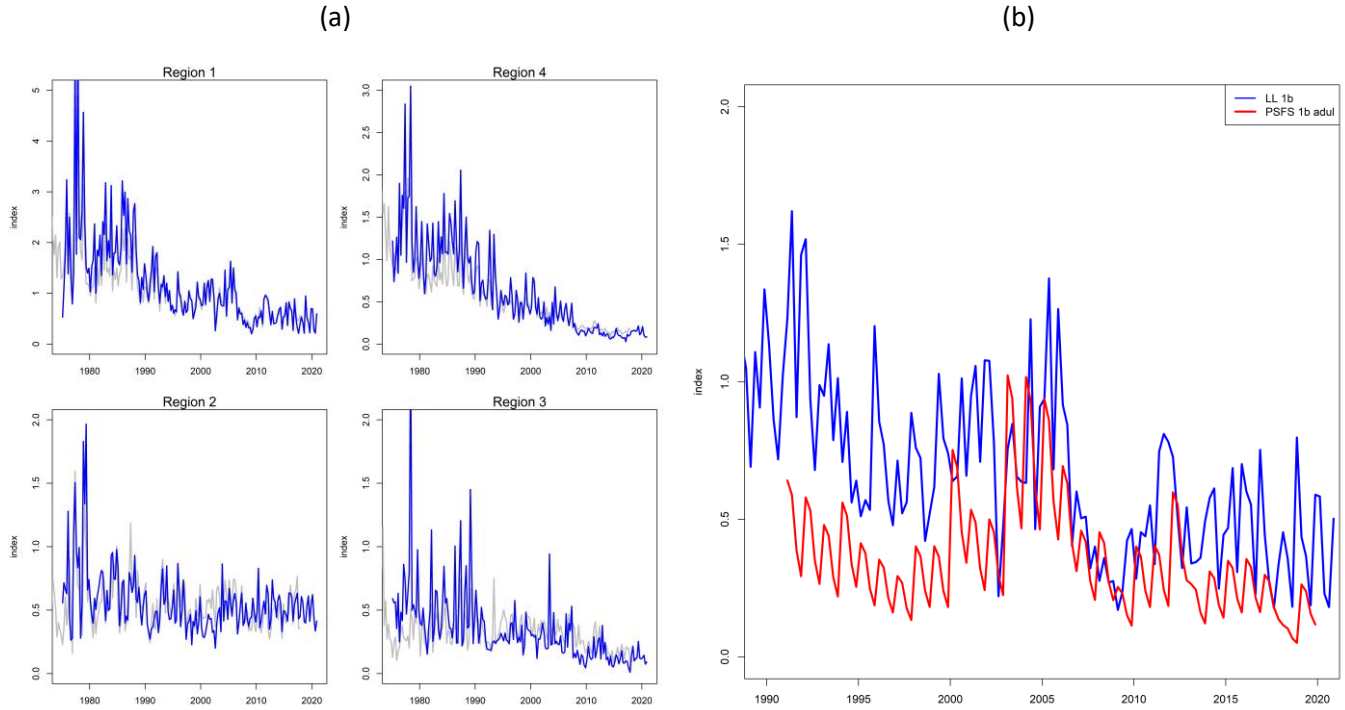


Fig 5. Standardised CPUE indices used in the final assessment models: (a) Joint longline CPUE indices by region 1975-2020 (The grey lines are indices used in 2018 assessment 1972 – 2017), and (b) EU Purse seine free school CPUE on adults (≥10 kg) (overlaid with the longline CPUE in region 1

TABLE 3. Yellowfin tuna: Stock synthesis assessment Kobe II Strategy Matrix. Probability of violating the MSY-based target (top) and limit (bottom) reference points for constant catch projections (relative to the catch level from 2020 -40%, - 30%, -20%, -10%, 0%, +10%, +20%) projected for 3 and 10 years

Alternative catch projections (relative to the catch level from 2020) and probability of violating MSY-based target reference points ($SB_{targ} = SB_{MSY}$; $F_{targ} = F_{MSY}$)							
Reference point and projection timeframe	60%	70%	80%	90%	100%	110%	120%
$SB_{2023} < SB_{MSY}$	0.45	0.56	0.68	0.74	0.76	0.82	0.88
$F_{2023} > F_{MSY}$	0.13	0.30	0.53	0.63	0.72	0.82	0.91
$SB_{2030} < SB_{MSY}$	0.1	0.33	0.54	0.76	0.93	0.99	1
$F_{2030} > F_{MSY}$	0.07	0.31	0.49	0.69	0.84	0.97	0.99
Alternative catch projections (relative to the catch level from 2020) and probability of violating MSY-based limit reference points ($SB_{lim} = 0.4\ SB_{MSY}$; $F_{Lim} = 1.4\ F_{MSY}$)							
Reference point and projection timeframe	60%	70%	80%	90%	100%	110%	120%
$SB_{2023} < SB_{Lim}$	0	0	0	0.05	0.07	0.1	0.16
$F_{2023} > F_{Lim}$	0.03	0.11	0.25	0.43	0.52	0.63	0.78
$SB_{2030} < SB_{Lim}$	0	0	0.01	0.18	0.64	1	1
$F_{2030} > F_{Lim}$	0.02	0.19	0.33	0.60	0.78	0.98	0.98

APPENDIX 12
EXECUTIVE SUMMARY: BULLET TUNA (2023)

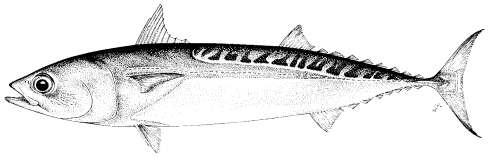


TABLE 1. Status of bullet tuna (*Auxis rochei*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch 2022[2] (t) Mean annual catch (2018-2022) (t)	23,447 24,258	**Unknown**
	MSY (1,000 t) (80% CI) F_{MSY} (80% CI) B_{MSY} (1,000 t) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI) $B_{current}/B_0$ (80% CI)	Unknown	

[1]Stock boundaries defined as the IOTC area of competence;
[2]Proportion of catch fully or partially estimated for 2022: 49.2%;
[3]2019 is the final year that data were available for this assessment

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 / Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was conducted in 2023 and so the results are based on the results of the assessment carried out in 2021 using the data-limited techniques (CMSY and LB-SPR), however the catch data for bullet tuna are very uncertain given the high percentage of the catches that had to be estimated due to a range of reporting issues. 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. Annual catches of bullet tuna have steadily increased from around 2,000 t in the early 1990s to around 13,000 t in 2015-2017. In 2018, catches sharply increased to 33,000 t – mostly due to an increase in catches reported by Indonesian industrial purse seine fisheries (**Fig. 1**). In 2019, the catches of bullet tuna decreased to less than 24,000 t despite a major increase in the number of Indonesian industrial purse seiners in operation. There is considerable uncertainty around bullet tuna catches and insufficient information to evaluate the effect that these catch levels may have on the resource. Research emphasis should be focused on improving the data collection and reporting systems in place and 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 and seerfish in the 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 (8,590 t). This catch advice should be maintained until an assessment of bullet tuna is available. Considering that MSY-based reference points for assessed species can change over time, the stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice.

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 2022 catches (reference year 2021), 50.3% of the total catches was 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.

Fisheries overview.

- **Main fisheries (mean annual catch 2018-2022)**: bullet tuna is caught using purse seine (63.1%), followed by line (16.9%) and gillnet (12.8%). The remaining catches taken with other gears contributed to 7.1% of the total catches in recent years (**Fig. 1**);
- **Main fleets (mean annual catch 2018-2022)**: the majority of bullet tuna catches are attributed to vessels flagged to Indonesia (37.3%) followed by India (29.6%) and Thailand (26.1%). The 13 other fleets catching bullet tuna contributed to 6.9% of the total catch in recent years (**Fig. 2**).

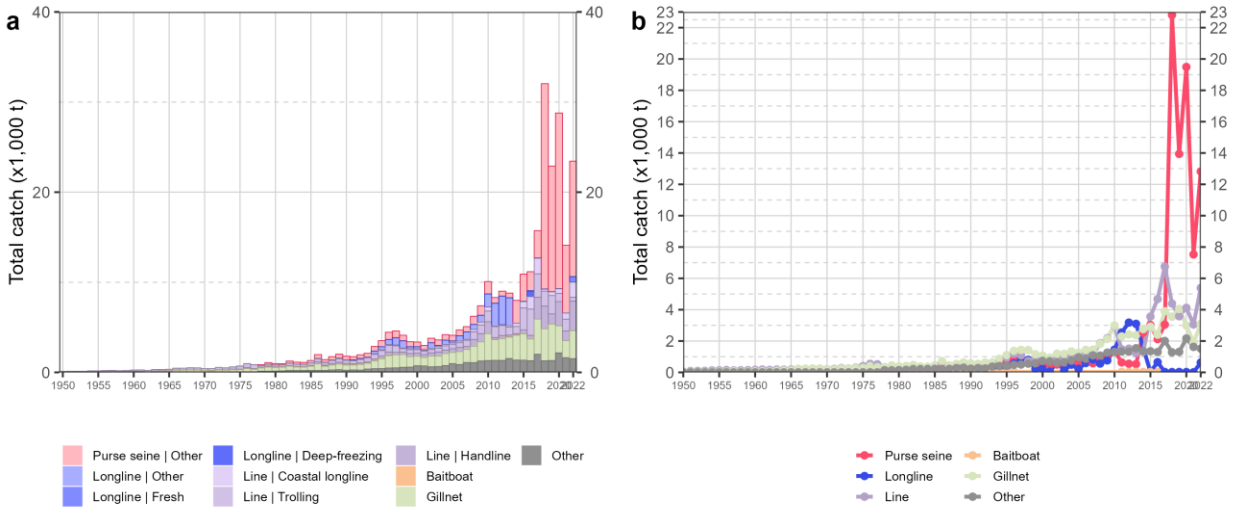


Fig. 1. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for bullet tuna during 1950-2022

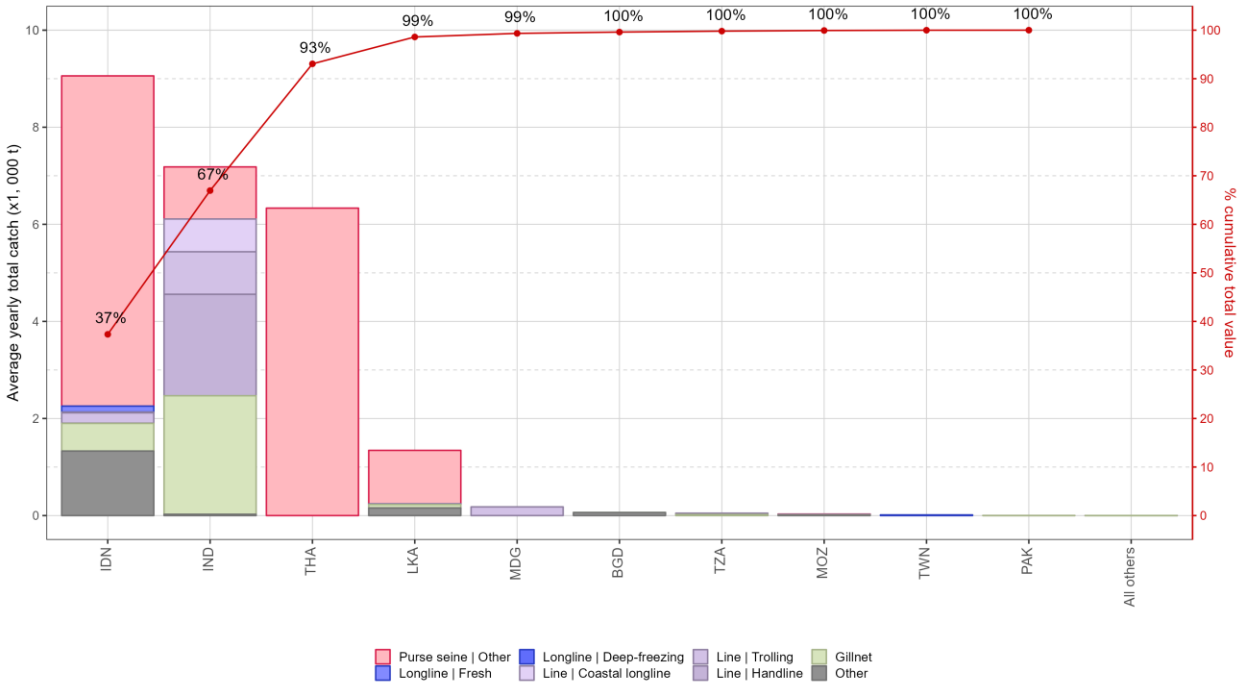


Fig. 2. Mean annual catches (t) of bullet tuna by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet.

APPENDIX 13
EXECUTIVE SUMMARY: FRIGATE TUNA (2023)

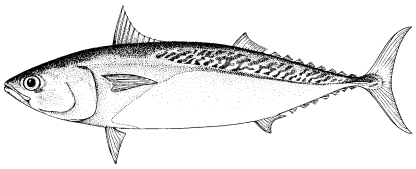


TABLE 1. Status of frigate tuna (*Auxis thazard*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch (2022) (t)[2]	153,996	Unknown
	Mean annual catch (2018-2022) (t)	115,170	
	MSY (1,000 t) (80% CI)	Unknown	
	F_{MSY} (80% CI)		
	B_{MSY} (1,000 t) (80% CI)		
	$F_{current}/F_{MSY}$ (80% CI)		
	$B_{current}/B_{MSY}$ (80% CI)		
	$B_{current}/B_0$ (80% CI)		

[1]Stock boundaries defined as the IOTC area of competence;
[2]Proportion of catch fully or partially estimated for 2022: 57.7%; [3]2019 is the final year that data were available for this assessment

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 / Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new assessment was conducted in 2023 therefore the results are based on the assessment conducted in 2021 using the data-limited techniques (CMSY and LB-SPR), however the catch data for frigate tuna are very uncertain given the high percentage of the catches that had to be estimated due to a range of reporting issues. 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 t in the late-1980s, to between 51,000 and 58,000 t 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 t, rising to the highest levels recorded, although catches have since decline marginally to between 90,000 – 102,000 t 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 (101,260 t). The reference period (2009-2011) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available under the assumption that also for frigate tuna MSY was reached between 2009 and 2011. This catch advice should be maintained until an assessment of frigate tuna is available. Considering that MSY-based reference points for assessed species can change over time, the stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice.

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean stock is unknown;
- Limit reference points: the Commission has not adopted limit reference points for any of the neritic tunas under its mandate;
- Further work is needed to improve the reliability of the catch series, such as verification or estimation based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods;
- Research emphasis 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 2022 catches (reference year 2021), 80% 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.

Fisheries overview.

- **Main fisheries (mean annual catch 2018-2022)**: frigate tuna is caught using gillnet (37.6%), followed by line (31.1%) and purse seine (17.4%). The remaining catches taken with other gears contributed to 13.8% of the total catches in recent years (**Fig. 1**);
- **Main fleets (mean annual catch 2018-2022)**: the majority of frigate tuna catches are attributed to vessels flagged to Indonesia (58%) followed by Pakistan (8.5%) and I. R. Iran (8.2%). The 24 other fleets catching frigate tuna contributed to 25.3% of the total catch in recent years (**Fig. 2**).

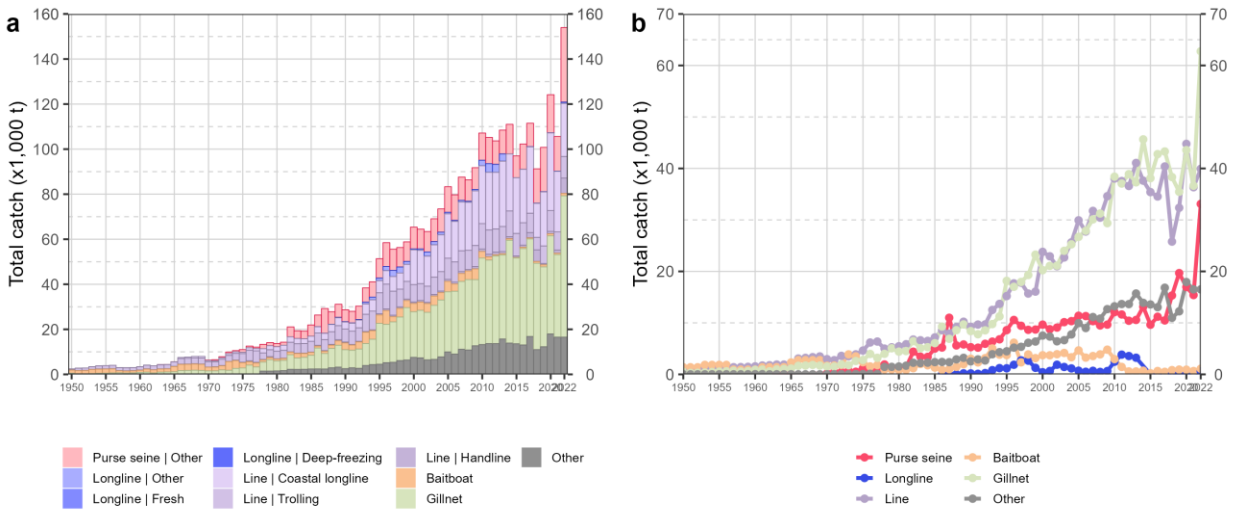


Fig. 1. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for frigate tuna during 1950-2022

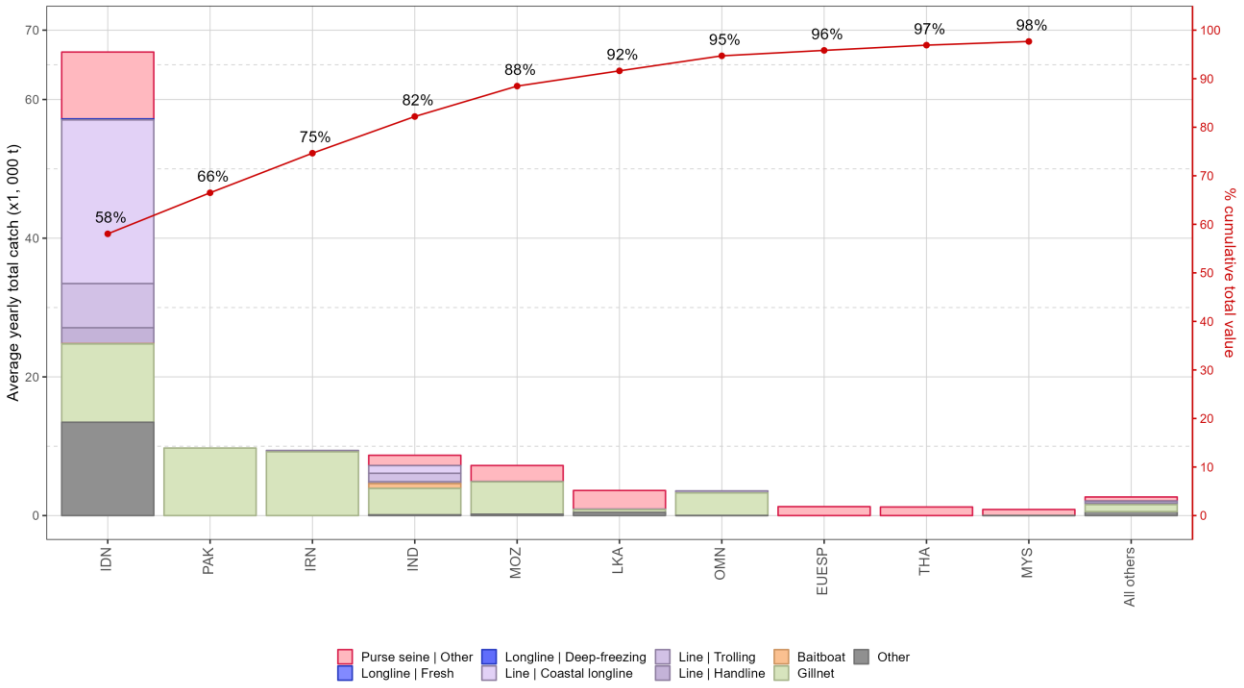


Fig. 2. Mean annual catches (t) of frigate tuna by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet

APPENDIX 14
EXECUTIVE SUMMARY: KAWAKAWA (2023)

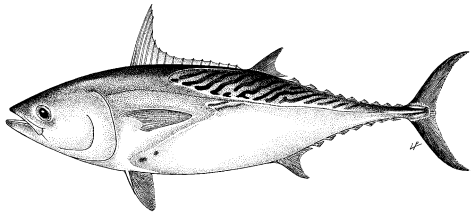


TABLE 1. Status of kawakawa (*Euthynnus affinis*) in the Indian Ocean

Area[1]	Indicators		2023 stock status determination[3]
Indian Ocean	Catch 2022[2] (t) Mean annual catch 2018-2022 (t)	157,423 155,982	**27%**
	MSY (t) (80% CI) F_{MSY} (80% CI) B_{MSY} (t) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	154,000 (122,000 – 193,000) 0.60 (0.48 – 0.74) 258,000 (185 – 359) 0.98 (0.82–2.20) 0.99 (0.45 – 1.20)	

[1]Stock boundaries defined as the IOTC area of competence;
[2]Proportion of catch fully or partially estimated for 2022: 65.5%;
[3]2021 is the final year that data were available for this assessment.

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)	25%	23%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	27%	25%
Not assessed/Uncertain / Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new assessment was conducted for kawakawa in 2023 which examined a number of data-limited methods include C-MSY, OCOM, and JABBA models (based on data up to 2021). These models produced stock estimates that are not drastically divergent because they shared similar dynamics and assumptions. The C-MSY model has been explored more fully and therefore is used to obtain estimates of stock status. The C-MSY model indicated that the fishing mortality F was very close to F_{MSY} (F/F_{MSY}=0.98) and the current biomass B was also very close to B_{MSY} (B/B_{MSY}=0.99). The estimated probability of the stock currently being in yellow quadrant of the Kobe plot is about 27%. The analysis using OCOM model is more pessimistic and using JABBA incorporating gillnet CPUE indices is more optimistic. Due to the quality of the data being used, the simple modelling approach employed in 2020 and 2023, 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 most years since 2011. Based on the weight-of-evidence available, the kawakawa stock for the Indian Ocean is classified as **overfished** but **not subject to overfishing** (**Table 1**, **Fig. 1**). However, the assessment using catch-only method is subjected to high uncertainty and is highly influenced by several prior assumptions.

Outlook. There is considerable uncertainty about stock structure and the estimate of total catches. Due to the uncertainty associated with catch data (e.g., 65.5% of catches partially or fully estimated by the IOTC Secretariat for 2022) 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.).

Management Advice. The assessment models rely on catch data, which are considered to be highly uncertain. The catch in 2022 was just 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 for the Indian Ocean is estimated to be 154,000 t with a range between 122,000 t and 193,000 t and so catch levels should be reduced in future to bring the stock back into the green quadrant;
- 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 65.5% of the catches of kawakawa (in 2022), 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.

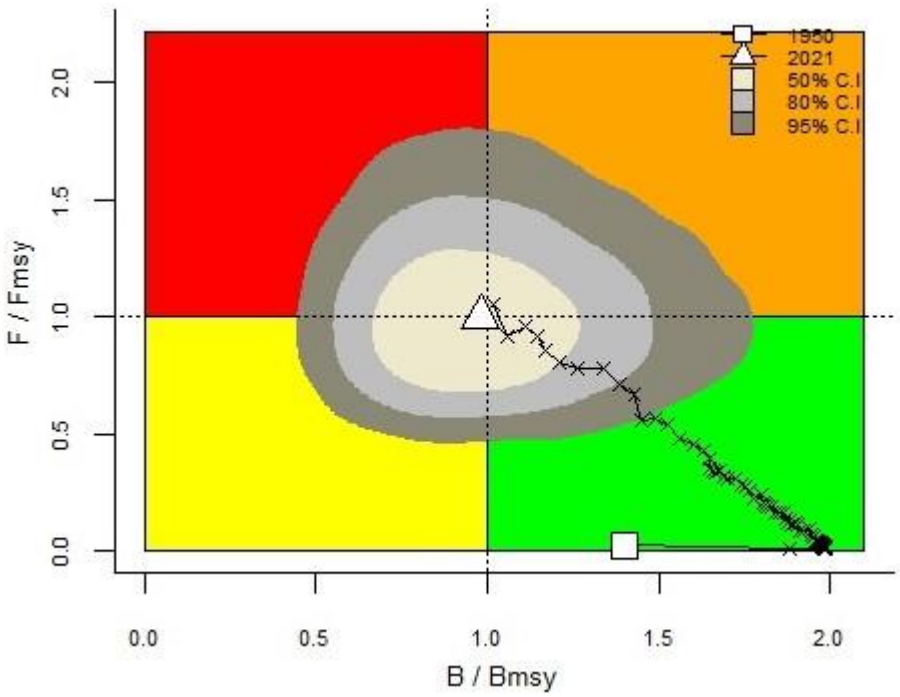


Fig. 1. C-MSY Indian Ocean assessment Kobe plot for kawakawa. The Kobe plot presents the trajectories (median) for the range of plausible model trajectories included in the formulation of the final management advice. The shaded contour lines represent 50%, 80%, and 95% confidence intervals of estimated stock status in 2021

Fisheries overview.

- **Main fisheries (mean annual catch 2018-2022)**: kawakawa are caught using gillnet (48.7%), followed by purse seine (29.6%) and line (16.5%). The remaining catches taken with other gears contributed to 5.1% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2018-2022)**: the majority of kawakawa catches are attributed to vessels flagged to Indonesia (31.1%) followed by I. R. Iran (23.3%) and India (21.9%). The 32 other fleets catching kawakawa contributed to 23.5% of the total catch in recent years (**Fig. 3**).

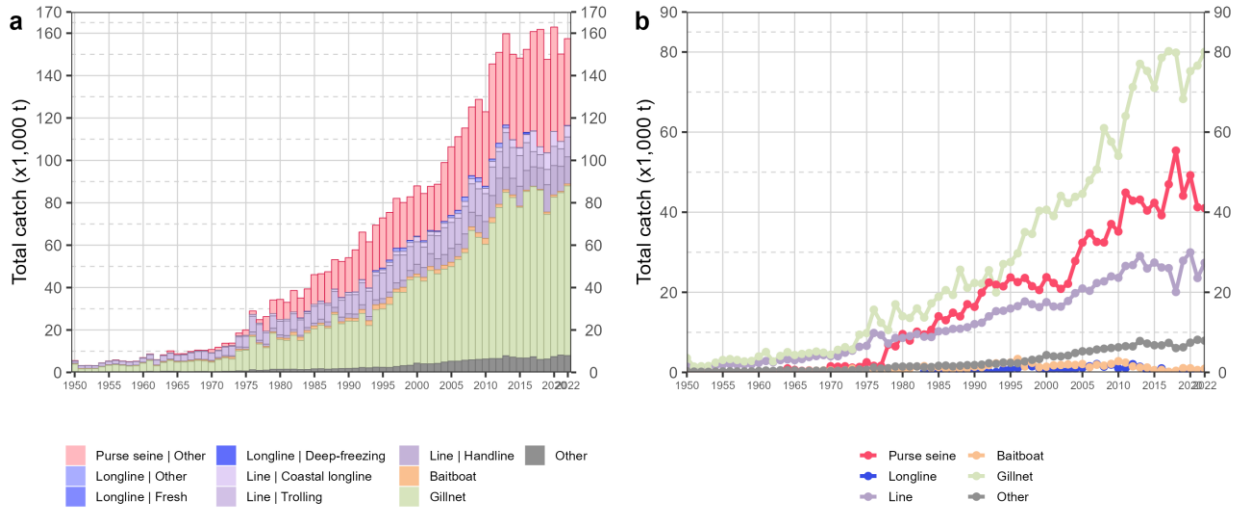


Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for kawakawa during 1950-2022

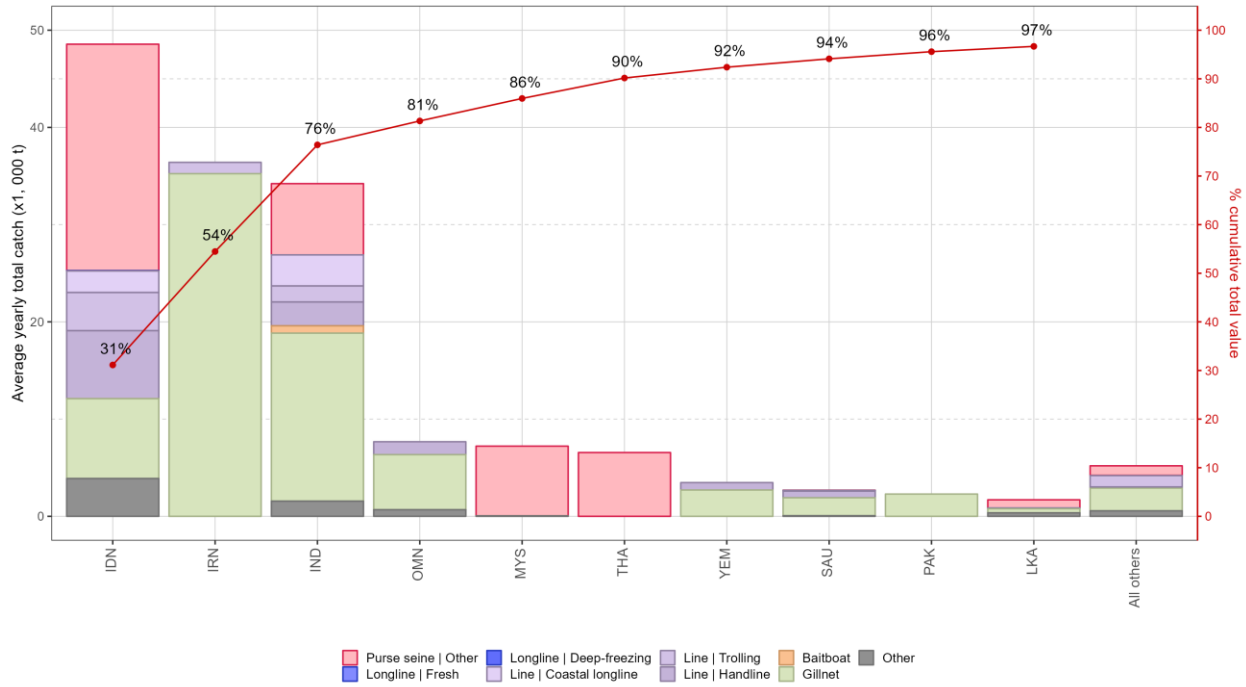


Fig 3. Mean annual catches (t) of kawakawa by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet

APPENDIX 15
EXECUTIVE SUMMARY: LONGTAIL TUNA (2023)

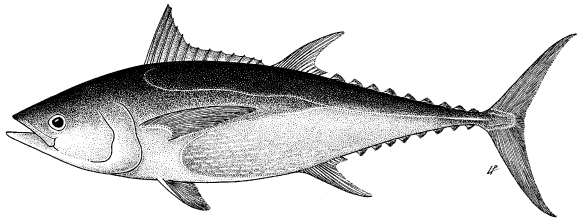


TABLE 1. Status of longtail tuna (*Thunnus tonggol*) in the Indian Ocean

Area[1]	Indicators		2023 stock status determination[3]
Indian Ocean	Catch 2022[2] (t)	136,271	35%
	Mean annual catch (2018-2022) (t)	131,320	
	MSY (t) (80% CI)	133,000 (108 –165)	
	F_{MSY} (80% CI)	0.31 (0.22 – 0.44)	
	B_{MSY} (t) (80% CI)	433,000 (272,000 – 690,000)	
	$F_{current}/F_{MSY}$ (80% CI)	1.05 (0.84 – 2.31)	
	$B_{current}/B_{MSY}$ (80% CI)	0.96 (0.44 – 1.19)	

[1]Stock boundaries defined as the IOTC area of competence;
[2]Proportion of catch fully or partially estimated for 2022: 30.4%;
[3]2021 is the final year that data were available for this assessment

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)	35%	25%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	23%	17%
Not assessed/Uncertain/Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new assessment was conducted for longtail tuna in 2023 which examined a number of data-limited methods including C-MSY, OCOM, and JABBA models (based on data up to 2021). These models produced stock estimates that are not drastically divergent because they shared similar dynamics and assumptions. The C-MSY model has been explored more fully and therefore is used to obtain estimates of stock status. The C-MSY analysis 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} (35% of plausible models runs) (**Fig. 2**). Catches between 2017 and 2021 were slightly above MSY but steadily declined from 2012 to less than 113,000 t in 2019, (**Fig. 1**). The F_{2021}/F_{MSY} ratio is lower than previous estimates and the B_{2021}/B_{MSY} ratio was higher than in previous years. The analysis using the OCOM model is more pessimistic and using JABBA incorporating gillnet CPUE indices is more optimistic. The JABBA model, however, is unable to estimate carrying capacity with a fair degree of certainty without additional prior constraints, indicating the fact that the CPUE is either not informative or is conflicting with catch data. While the precise stock structure of longtail tuna remains unclear, recent research (IOTC-2020-SC23-11_Rev1) provides strong evidence of population structure of longtail tuna within the IOTC area of competence, with at least 3 genetic populations identified. This increases the uncertainty in the assessment, which currently assumes a single stock of longtail tuna. Based on the C-MSY assessment, the stock is considered to be both **overfished** and **subject to overfishing** (**Table 1**; **Fig. 1**). However, the assessment using catch-only method is subjected to high uncertainty and is highly influenced by several prior assumptions.

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, exploring alternative approaches for estimating abundance (e.g., close-kin mark-recapture), and gaining a better understanding of stock structure and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).

Management advice. The catch in 2022 was above the estimated MSY and 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 being fished above 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 for the Indian Ocean is estimated to be 133,000t with a range of 108,000 –165,000t and so catch levels should be reduced in future to bring the stock back into the green quadrant;
- 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, Sultanate of 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 2022 catches 30.4% of the total catches of longtail 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.

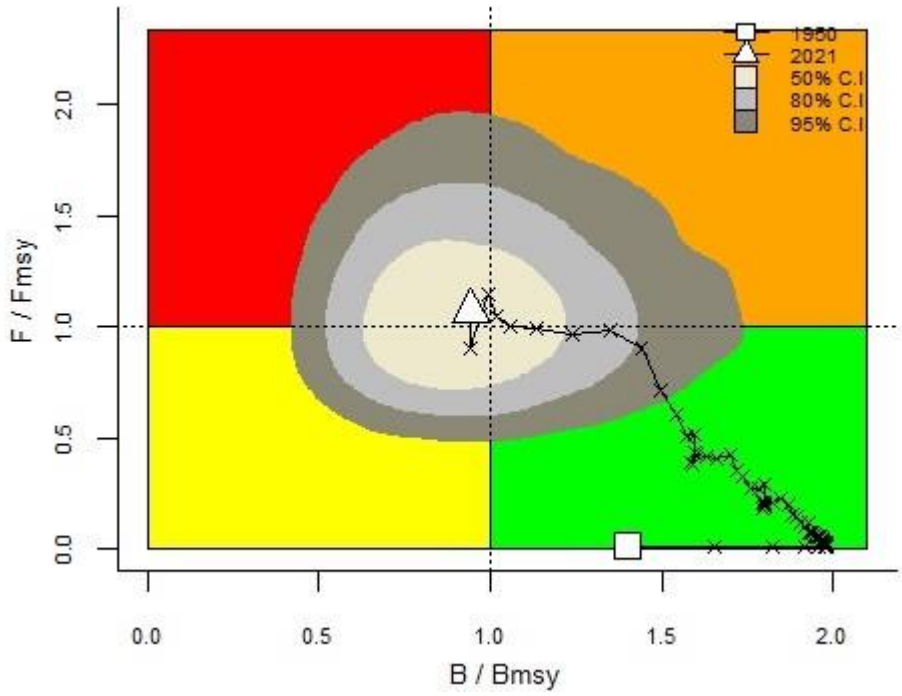


Fig. 1. Longtail tuna C-MSY Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (median) for the range of plausible model trajectories included in the formulation of the final management advice. The shaded contour lines represent 50%, 80%, and 95% confidence intervals of estimated stock status in 2021 (

Fisheries overview.

- **Main fisheries (mean annual catch 2018-2022)**: longtail tuna are caught using gillnet (65.4%), followed by line (16.6%) and 'other' gears (9.3%). The remaining catches taken with purse seine, longline and pole-and-line contributed to 8.7% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2018-2022)**: the majority of longtail tuna catches are attributed to vessels flagged to I. R. Iran (40.6%) followed by Indonesia (22.2%) and Sultanate of Oman (18.3%). The 21 other fleets catching longtail tuna contributed to 18.8% of the total catch in recent years (**Fig. 3**).

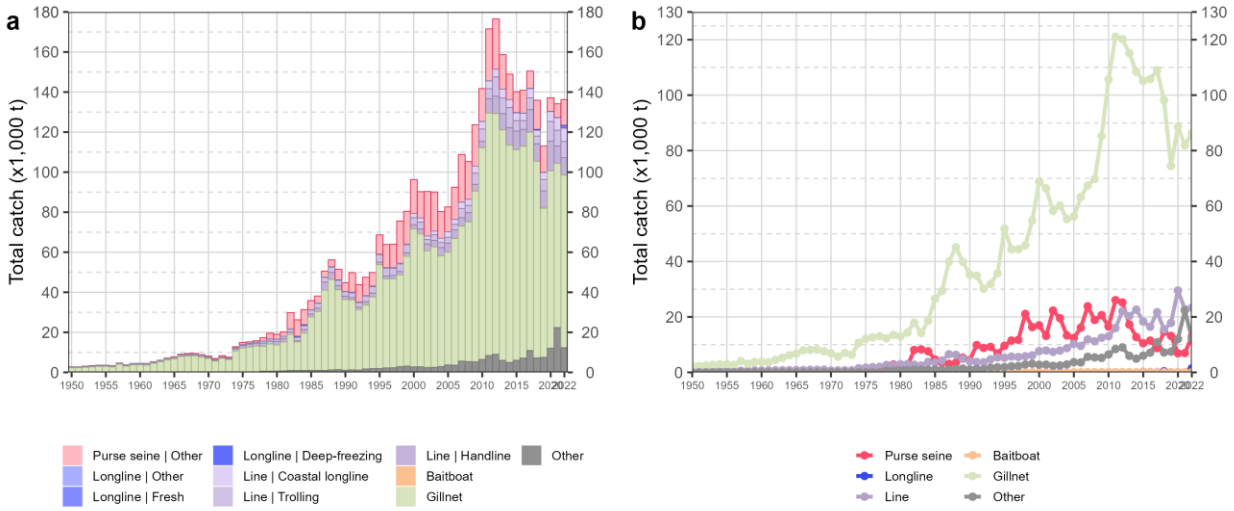


Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for longtail tuna during 1950-2022

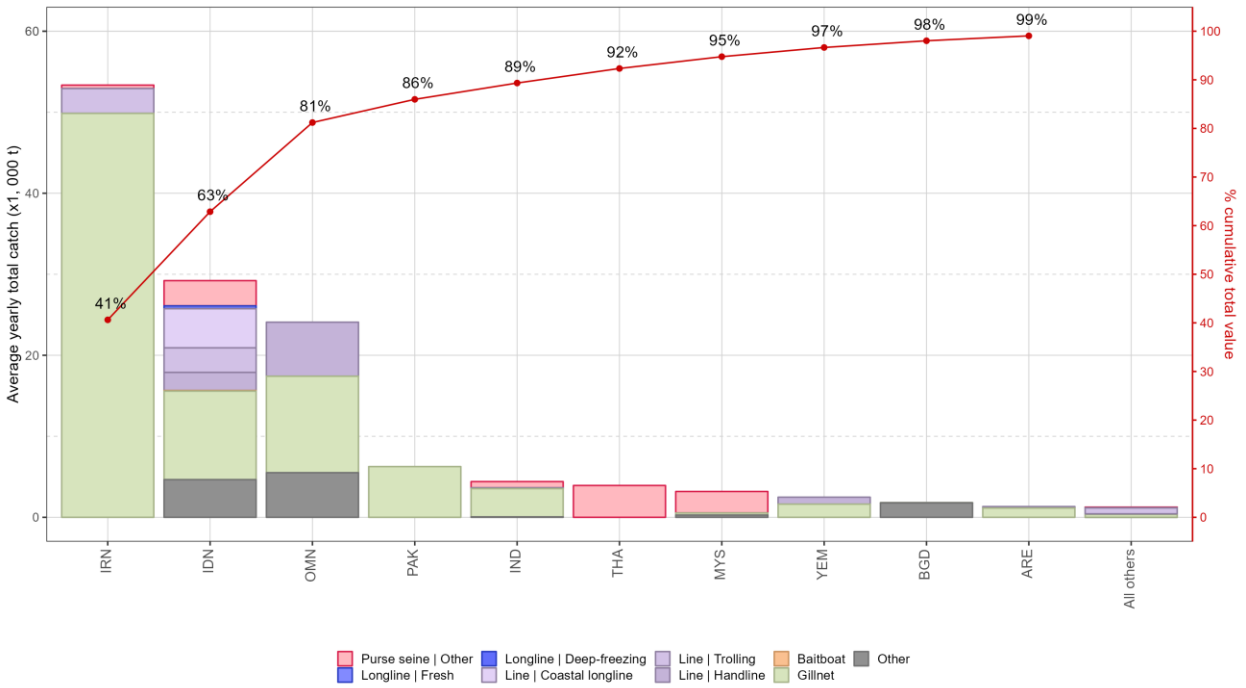


Fig. 3. Mean annual catches (t) of longtail tuna by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet.

APPENDIX 16
EXECUTIVE SUMMARY: INDO-PACIFIC KING MACKEREL (2023)

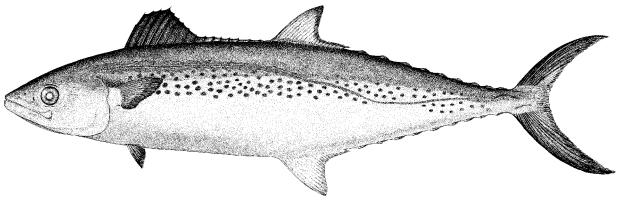


TABLE 1. Status of Indo-Pacific king mackerel (*Scomberomorus guttatus*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch (2022) (t)[2]	45,594	**35%**
	Mean annual catch (2018-2022) (t)	43,224	
	MSY (1,000 t)	46.9 (37.7–58.4)	
	F_{MSY}	0.74 (0.56–0.99)	
	B_{MSY} (1,000 t)	63.2 (42–94)	
	$F_{current}/F_{MSY}$	0.90 (0.78–2.01)	
	$B_{current}/B_{MSY}$	1.03 (0.46–1.19)	
	$B_{current}/B_0$	0.51 (0.23–0.60)	

[1]Stock boundaries defined as the IOTC area of competence;
[2]Proportion of catch fully or partially estimated for 2022: 76.1%;
[3]2019 is the final year that data were available for this assessmen

Colour key	Stock overfished ($SB_{year}/SB_{MSY}< 1$)	Stock not overfished ($SB_{year}/SB_{MSY}\geq 1$)
Stock subject to overfishing ($F_{year}/F_{MSY}> 1$)	16%	19%
Stock not subject to overfishing ($F_{year}/F_{MSY}\leq 1$)	30%	35%
Not assessed/Uncertain/Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new assessment was conducted in 2023 so results are based on the assessment conducted in 2021 using the data-limited techniques (CMSY and LB-SPR) (using data up to 2019). Analysis using the catch only method CMSY indicates the stock is being exploited at a rate that is below F_{MSY} in recent years and that the stock appears to be above B_{MSY}, although the estimates would be more pessimistic if the stock productivity is assumed to be less resilient. The analysis using the length-based approach (LB-SPR) was also undertaken in 2021 and the results are not conflicting with CMSY in terms of status. The catch-only model has provided a more defensible approach in addressing the uncertainty of key parameters and the currently available catch data for the Indo-Pacific king mackerel appear to be of sufficient quality. Based on the weight-of-evidence currently available, the stock is considered to be **not overfished and not subject to overfishing** (**Table 1; Fig. 1**).

Outlook. Total annual catches for Indo-Pacific king mackerel have increased steadily over time, reaching a peak of 51,600 t in 2009 and have since fluctuated between around 40,000 t and 48,000 t. 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 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. Reported catches of Indo-Pacific king mackerel in the Indian Ocean has increased considerably since the late 2000s with recent catches fluctuating around estimated MSY, although the catch in 2021 was below the estimated MSY. This suggests that the stock is close to being fished at MSY levels and that higher catches may

not be sustained despite the substantial uncertainty associated with the assessment, a precautionary approach to management is recommended.

The following should be also noted:

- The Maximum Sustainable Yield for the Indian Ocean is estimated to be 46,900 t with a range between 37,700–58,400 t
- 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 2022 catches 76.1% of the total catches of Indo-Pacific king mackerel was 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.

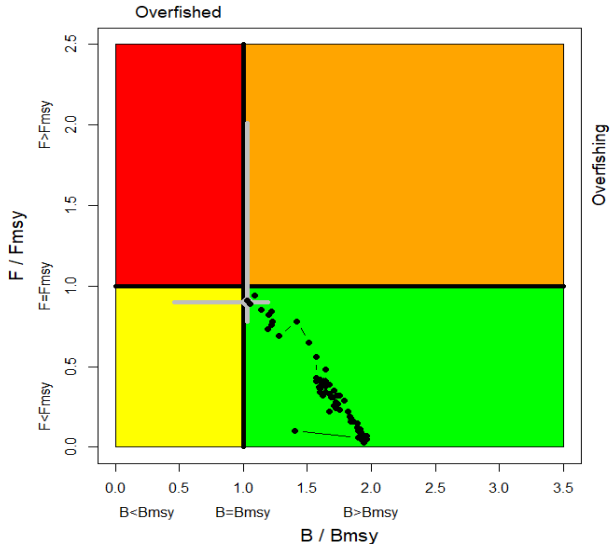


Fig. 1 Kobe plot of the CMSY assessment for the Indian Ocean spotted kingfish. The Kobe plot shows the trajectories (geometric mean) of the range of plausible model options included in the formulation of the final management advice. The grey cross represents the estimated stock status in 2021 (median and 80% confidence interval).

Fisheries overview.

- **Main fisheries (mean annual catch 2018-2022)**: Indo-Pacific king mackerel are caught using gillnet (66%), followed by other (20.8%) and line (10.2%). The remaining catches taken with other gears contributed to 3% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2018-2022)**: the majority of Indo-Pacific king mackerel catches are attributed to vessels flagged to Indonesia (32.7%) followed by India (28.7%) and I. R. Iran (23.6%). The 12 other fleets catching Indo-Pacific king mackerel contributed to 14.9% of the total catch in recent years (**Fig. 3**).

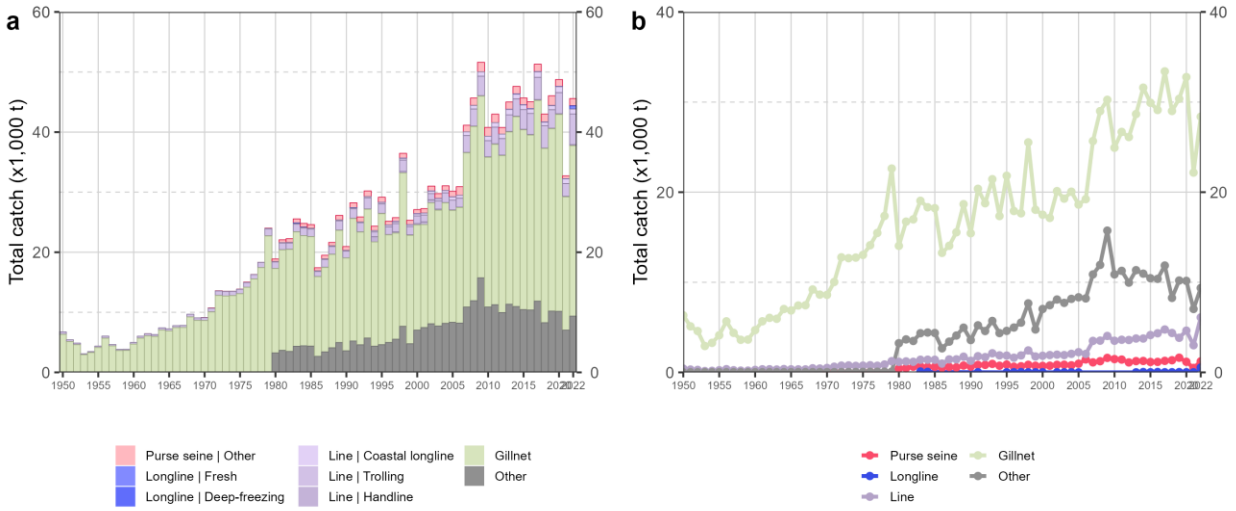


Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for Indo-Pacific king mackerel during 1950-2022

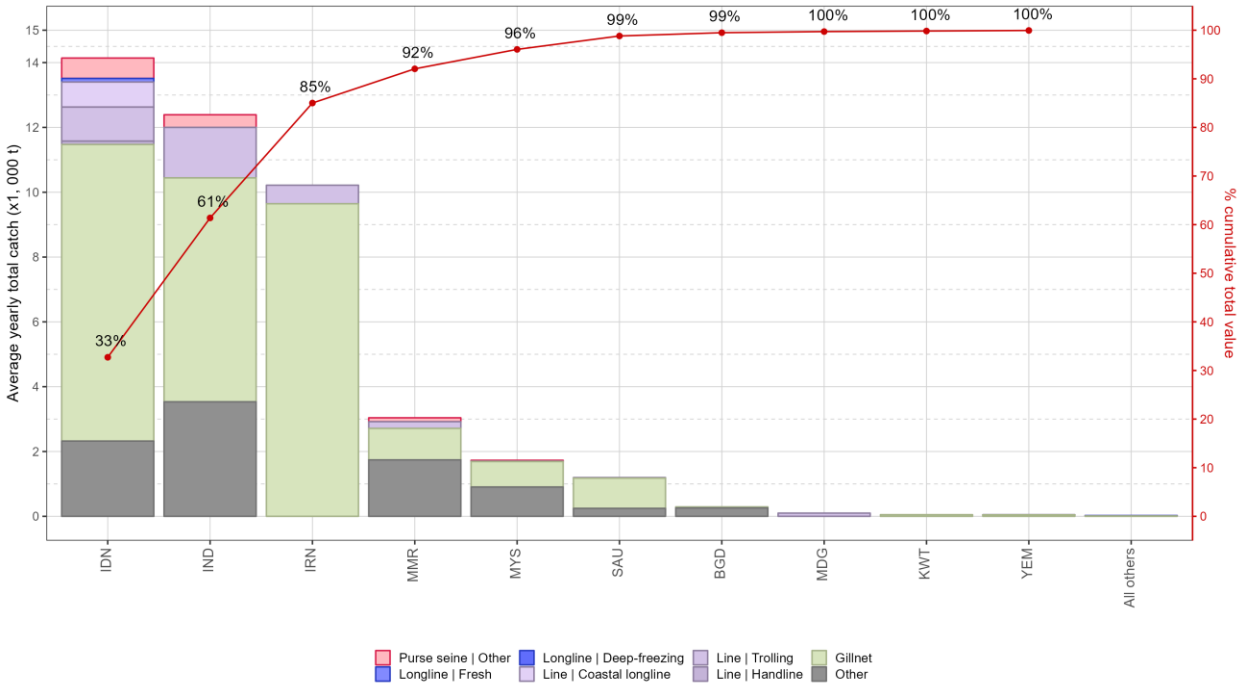


Fig. 3. Mean annual catches (t) of Indo-Pacific king mackerel by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet.

APPENDIX 17
EXECUTIVE SUMMARY: NARROW-BARRED SPANISH MACKEREL (2023)

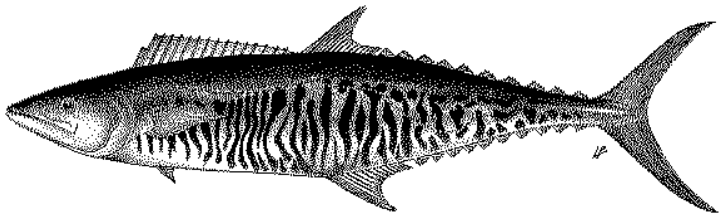


TABLE 1. Status of narrow-barred Spanish mackerel (*Scomberomorus commerson*) in the Indian Ocean

Area[1]	Indicators		2023 stock status determination[3]
Indian Ocean	Catch (2022)[2] (t) Mean annual catch (2018-2022) (t)	178,403 161,269	31%
	MSY (t) (80% CI) F_{MSY} (80% CI) B_{MSY} (t) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	161,000 (132,000 – 197,000) 0.60 (0.48–0.74) 271,000 (197,000 – 373,000) 1.07 (0.88 – 2.38) 0.98 (0.44 – 1.19)	

[1]Stock boundaries defined as the IOTC area of competence;
[2]Proportion of catch fully or partially estimated for 2022: 69.6%;
[3]2021 is the final year that data were available for this assessment

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)	31%	28%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	21%	19%
Not assessed/Uncertain/Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new assessment was conducted for narrow-barred Spanish mackerel in 2023 which examined a number of data-limited methods including C-MSY, OCOM, and JABBA models (based on data up to 2021). These models produced stock estimates that are not drastically divergent because they shared similar dynamics and assumptions. The C-MSY model has been explored more fully and therefore is used to obtain estimates of stock status. The C-MSY analysis 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} (31% of plausible models runs). The analysis using OCOM model is more pessimistic and using JABBA incorporating gillnet CPUE indices is more optimistic. The JABBA model, however, is unable to estimate carrying capacity with a fair degree of certainty without additional prior constraints, indicating that the CPUE is either not informative or is conflicting with catch data. 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[1]. While the precise stock structure of Spanish mackerel remains unclear, recent research (IOTC-2020-SC23-11_Rev1) provides strong evidence of population structure of Spanish mackerel within the IOTC area of competence, with at least 4 genetic populations identified. This increases the uncertainty in the assessment, which currently assumes a single stock of Spanish mackerel. Based on the C-MSY assessment, the stock appears to be **overfished** and **subject to overfishing** (**Table 1**, **Fig. 1**). However, the assessment using catch-only method is subjected to high uncertainty and is highly influenced by several prior assumptions.

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.

[1] IOTC-2013-WPNT03-27

Management advice. The catch in 2022 was above the estimated MSY and the available gillnet CPUE shows a somewhat increasing trend in recent years although the reliability of the index as an abundance index remains unknown. Despite the substantial uncertainties, the stock is being fished above MSY levels and higher catches may not be sustained.

The following should also be noted:

- Maximum Sustainable Yield for the Indian Ocean stock was estimated at 161,000 t (ranging between 132,000 t and 197,000 t, with catches for 2022 (178,403 t) exceeding this level;
- Limit reference points: the Commission has not adopted limit reference points for any of the neritic species 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;
- Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions, exploring alternative approaches for estimating abundance (e.g., close-kin mark-recapture), and gaining a better understanding of stock structure 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 2022 catches, 69.6% of the total catches of narrow-barred Spanish mackerel 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.

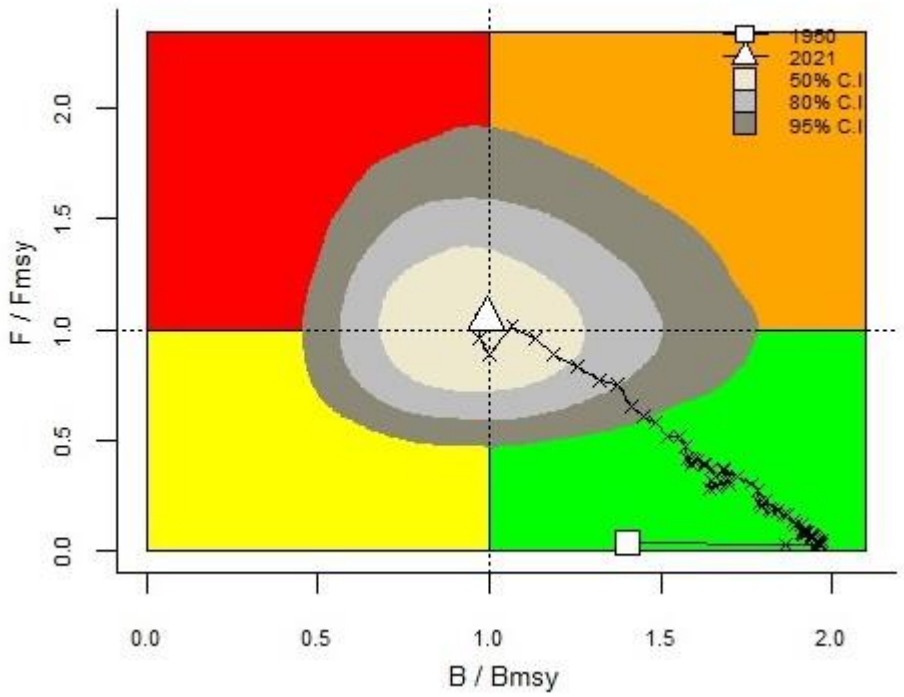


Fig. 1. Narrow-barred Spanish Mackerel OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (median) for the range of plausible model trajectories included in the formulation of the final management advice. The shaded contour lines represent 50%, 80%, and 95% confidence intervals of estimated stock status in 2021

Fisheries overview.

- **Main fisheries (mean annual catch 2018-2022)**: narrow-barred Spanish mackerel are caught using gillnet (58.5%), followed by line (19%) and other (16.6%). The remaining catches taken with other gears contributed to 5.9% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2018-2022)**: the majority of narrow-barred Spanish mackerel catches are attributed to vessels flagged to Indonesia (28.4%) followed by India (18.4%) and I. R. Iran (15.8%). The 27 other fleets catching narrow-barred Spanish mackerel contributed to 37.2% of the total catch in recent years (**Fig. 3**).

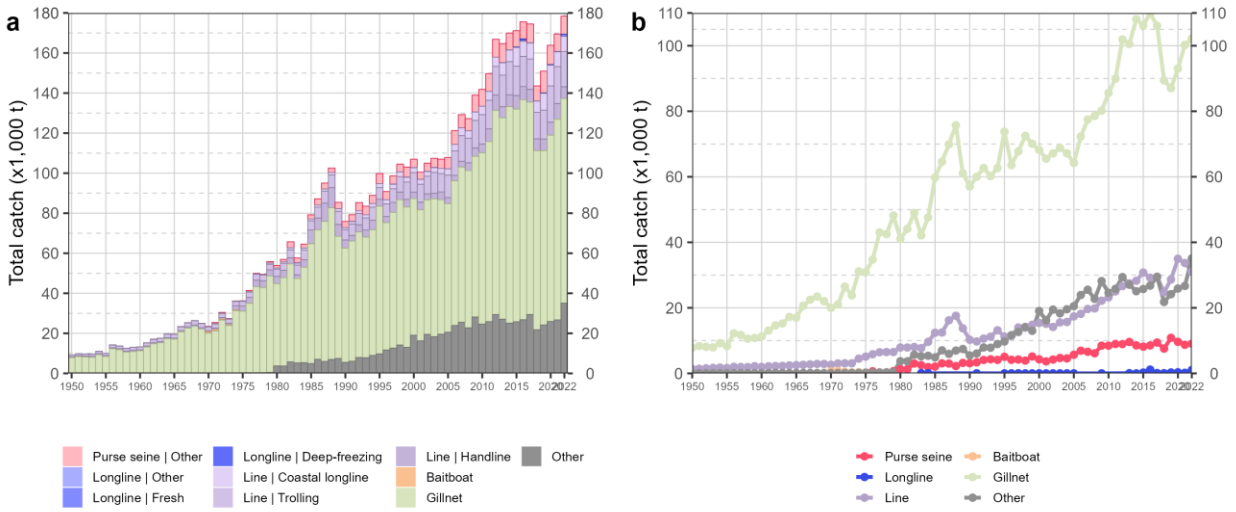


Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for narrow-barred Spanish mackerel during 1950-2022

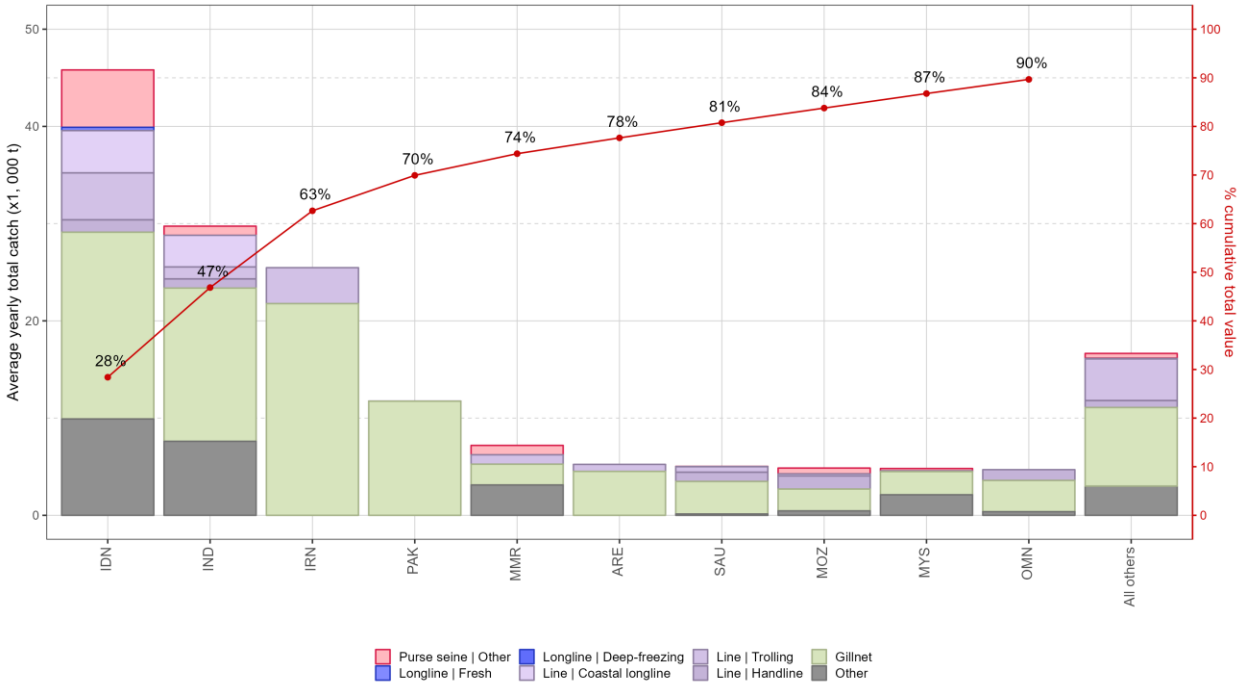


Fig. 3. Mean annual catches (t) of narrow-barred Spanish mackerel by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet

APPENDIX 18
EXECUTIVE SUMMARY: BLACK MARLIN (2023)

TABLE 1. Status of black marlin (*Istiompax indica*) in the Indian Ocean.

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch 2022 (t)[2]	25,521	Uncertain
	Average catch 2018–2022 (t)	17,962	
	MSY (1,000 t) (95% CI)	17.30 (11.00 – 35.02)	
	F_{MSY} (95% CI)	0.20 (0.12 - 0.34)	
	B_{MSY} (1,000 t) (95% CI)	87.39 (53.82-167.70)	
	F_{2019}/F_{MSY} (95% CI)	0.53 (0.22 – 1.05)	
	B_{2019}/B_{MSY} (95% CI)	1.98 (1.42 – 2.57)	
	B_{2019}/B_0 (95% CI)	0.73 (0.53 – 0.95)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2022 catch fully or partially estimated by the IOTC Secretariat: 23.3%
[3] 2019 is the final year that data were available for this assessment

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/Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was carried out for black marlin in 2023, thus the stock status is determined on the basis of the 2021 assessment based on JABBA, a Bayesian state-space production model (using data up to 2019). The relative point estimates for this assessment are F/FMSY=0.53 (0.22-1.05) and B/BMSY=1.98 (1.42-2.57). The Kobe plot (Fig. 3) indicated that the stock is not subject to overfishing and is currently not overfished (Table 1; Fig. 3), however these status estimates are subject to a high degree of uncertainty. The recent sharp increases in total catches (e.g., from 13,000 t in 2012 to over 22,000 t by 2016), and conflicts in information between CPUE and catch data lead to large uncertainties in the assessment outputs. Similar uncertainties were observed in the 2018 assessment of black marlin, which caused the point estimate of the stock status to change from the red (2016) to the green (2018) zone of the Kobe plot without any evidence of a rebuilding trend. Since 2018, there has been no discernable improvement in the data available for black marlin and the subsequent assessment outputs remain uncertain and should be interpreted with caution. As such, there is no reasonable justification to change the stock status from "**Not assessed/Uncertain**".

Outlook. While the recent high catches seem to be mainly due to developing coastal fisheries operating in the core habitat of the species (mainly IR.Iran, India and Sri Lanka), the CPUE indicators are from industrial fleets operating mostly offshore on the edges of the species' distribution. The outlook is likely to remain uncertain in the absence of CPUE indices from gillnet and coastal longline fleets to inform stock assessment models. Moreover, catches remain substantially higher than the limits stipulated in Res 18/05 and are a cause for concern as this will likely continue to drive the population towards overfished status.

Management advice. The catch limits as stipulated in Resolution 18/05 have been exceeded for three consecutive years since 2020. Thus, it is recommended that the Commission review the implementation and effectiveness of

the measures contained in this Resolution and consider the adoption of additional conservation and management measures. The Commission should provide mechanisms to ensure that catch limits are not exceeded by all concerned fisheries.

The following key points should be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the whole Indian Ocean is 17,300 t.
- **Provisional reference points**: Although the Commission adopted reference points for swordfish in Resolution 15/10 *on target and limit reference points and a decision framework*, no such interim reference points nor harvest control rules have been established for black marlin.
- **Main fisheries** (mean annual catch 2018-2022): black marlin are caught using gillnet (63.1%), followed by line (24.9%) and longline (7.1%). The remaining catches taken with other gears contributed to 4.9% of the total catches in recent years (**Fig. 1**).
- **Main fleets** (mean annual catch 2018-2022): the majority of black marlin catches are attributed to flagged to I. R. Iran (43.4%) followed by India (19.5%) and Sri Lanka (12.4%). The 25 other fleets catching black marlin contributed to 24.6% of the total catch in recent years (**Fig. 2**).

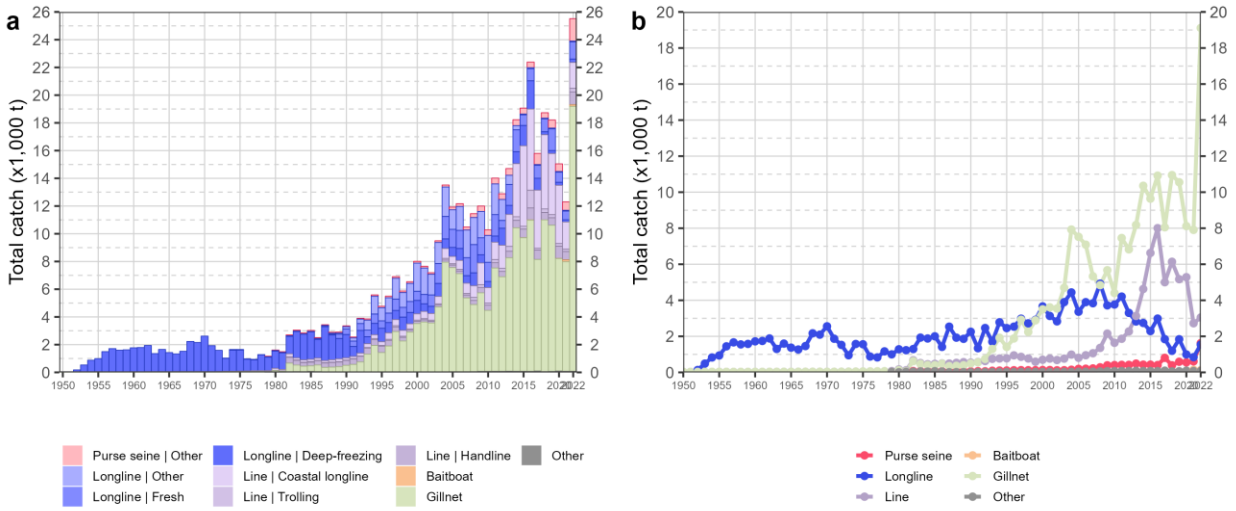


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tons; t) by fishery and (b) individual nominal catches (metric tons; t) by fishery group for black marlin during 1950-2022. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

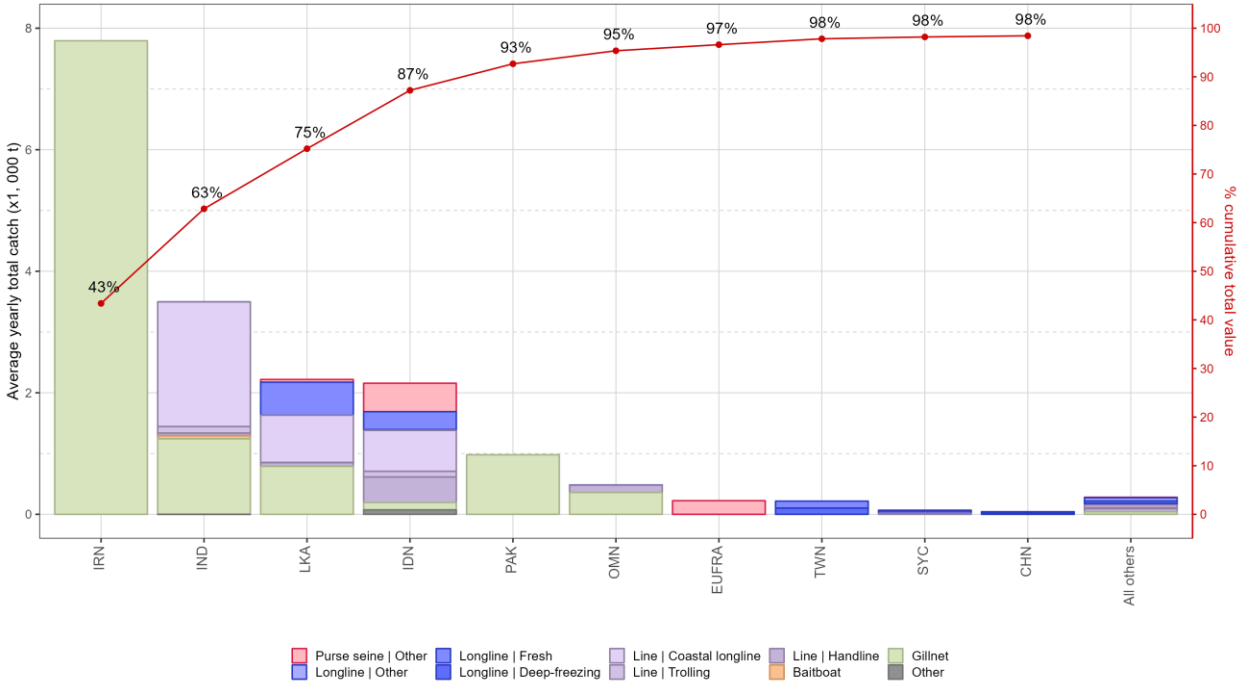


Fig. 2. Mean annual catches (metric tons; t) of black marlin by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

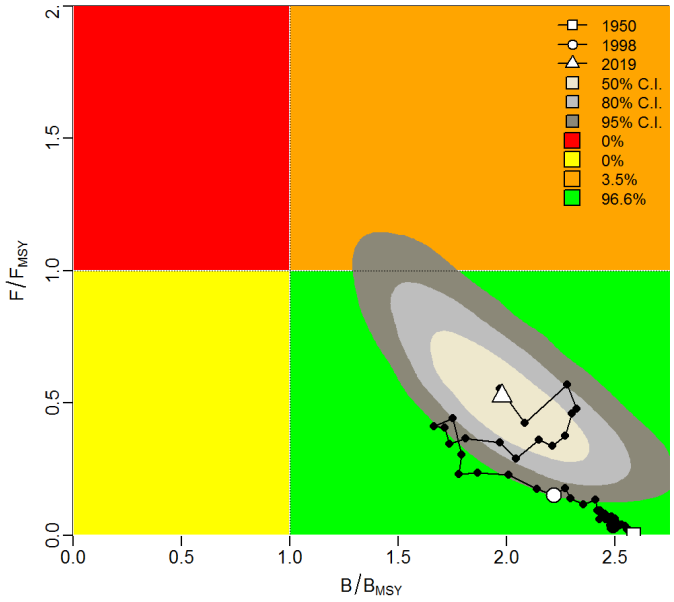


Fig. 3. JABBA Indian Ocean assessment Kobe plots for black marlin (contours are the 50, 80 and 95 percentiles of the 2019 estimate). Black line indicates the trajectory of the point estimates for the total biomass ratio (B/B_{MSY}) and fishing mortality ratio (F/F_{MSY}) for each year 1950–2019.

APPENDIX 19
EXECUTIVE SUMMARY: BLUE MARLIN (2023)

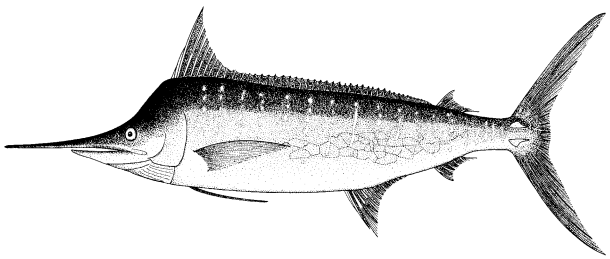


Table 1. Status of blue marlin (*Makaira nigricans*) in the Indian Ocean

Area[1]	Indicators		2022 stock status determination[3]
Indian Ocean	Catch 2022[2] (t) Average catch 2018-2022 (t)	5,067 7,045	72%*
	MSY (1,000 t) (80% CI) F_{MSY} (80% CI) B_{MSY} (1,000 t) (80% CI) F_{2020}/F_{MSY} (80% CI) B_{2020}/B_{MSY} (80% CI) B_{2020}/B_0 (80% CI)	8.74 (7.14 –10.72) 0.24 (0.14 – 0.39) 35.8 (22.9 – 60.3) 1.13 (0.75 – 1.69) 0.73 (0.51 – 0.99) 0.36 (0.26 – 0.50)	

[1] Boundaries for the Indian Ocean are defined as the IOTC area of competence
[2] Proportion of 2022 catch estimated or partially estimated by IOTC Secretariat: 32.5%
[3]2020 is the final year that data were available for this assessment
* 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 ($B_{year}/B_{MSY} \geq 1$)
Stock subject to overfishing ($F_{year}/F_{MSY} > 1$)	**72%**	**0%**
Stock not subject to overfishing ($F_{year}/F_{MSY} \leq 1$)	**26%**	**2%**
Not assessed/Uncertain/Unknown		

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 blue marlin in 2023, thus the stock status is determined on basis of the 2022 assessment which was based on two different models: JABBA, a Bayesian state-space production model (age-aggregated); and SS3, an integrated model (age-structured) (using data up to 2020). Uncertainty in the biological parameters is still evident and as such the JABBA model (B2020/BMSY = 0.73, F2020/FMSY =1.13) was selected as the base case. Both models were consistent with regards to stock status. On the weight-of-evidence available in 2022, the stock is determined to be ***overfished*** and ***subject to overfishing*** (**Table 1** and **Fig. 3**).

Outlook. The B/B_{MSY} trajectory declined from the mid-1980s to 2007. A short-term increase in B/B_{MSY} occurred from 2007 to 2012, which is thought to be linked to the NW Indian Ocean Piracy period. Thereafter, the B/B_{MSY} trajectory again declines to the current estimate **of 0.73**. F/F_{MSY} increased since the mid-1980s and despite a recent decline, F/F_{MSY} remains above 1. The majority of CPUE indices have shown a declining trend since 2015.

Management advice. The current catches of blue marlin (average of 7,045 t in the last 5 years, 2018-2022) are lower than MSY (8,740 t). The stock is currently overfished and subject to overfishing. According to K2SM calculated (Table 2), a reduction of 20% of catches (5,700 t.) compared to 2020 catches (7,126t.) would recover the stock to the green quadrant by 2030 with a probability of 79% and if the catches are reduced by 10% (6,413 t.) the probability would be 67%. The Commission should note that the current catch limit for blue marlin in Resolution 18/05 (11,930 t, which was established as the MSY value estimated in 2016 stock assessment) is 36% higher than the new MSY estimated by the latest stock assessment in 2022 (8,740 t).

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the Indian Ocean blue marlin stock is 8,740 t (estimated range 7,140–10,720 t).
- **Provisional reference points**: although the Commission adopted reference points for swordfish in Resolution 15/10 *on target and limit reference points and a decision framework*, no such interim reference points, nor harvest control rules have been established for blue marlin.
- **Main fisheries (mean annual catch 2018-2022)**: blue marlin are caught using longline (51.3%), followed by line (25.2%) and gillnet (22%). The remaining catches taken with other gears contributed to 1.5% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2018-2022)**: the majority of blue marlin catches are attributed to vessels flagged to Taiwan,China (26.3%) followed by Sri Lanka (22.9%) and India (16.5%). The 22 other fleets catching blue marlin contributed to 34.2% of the total catch in recent years (Fig. 2).

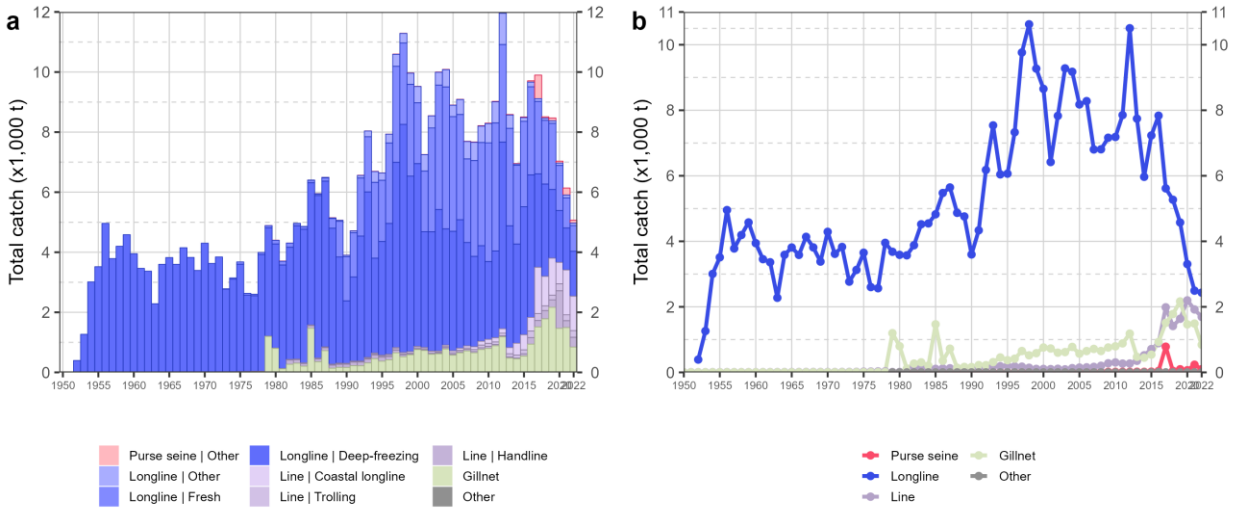


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tons; t) by fishery and (b) individual nominal catches (metric tons; t) by fishery group for blue marlin during 1950-2022. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

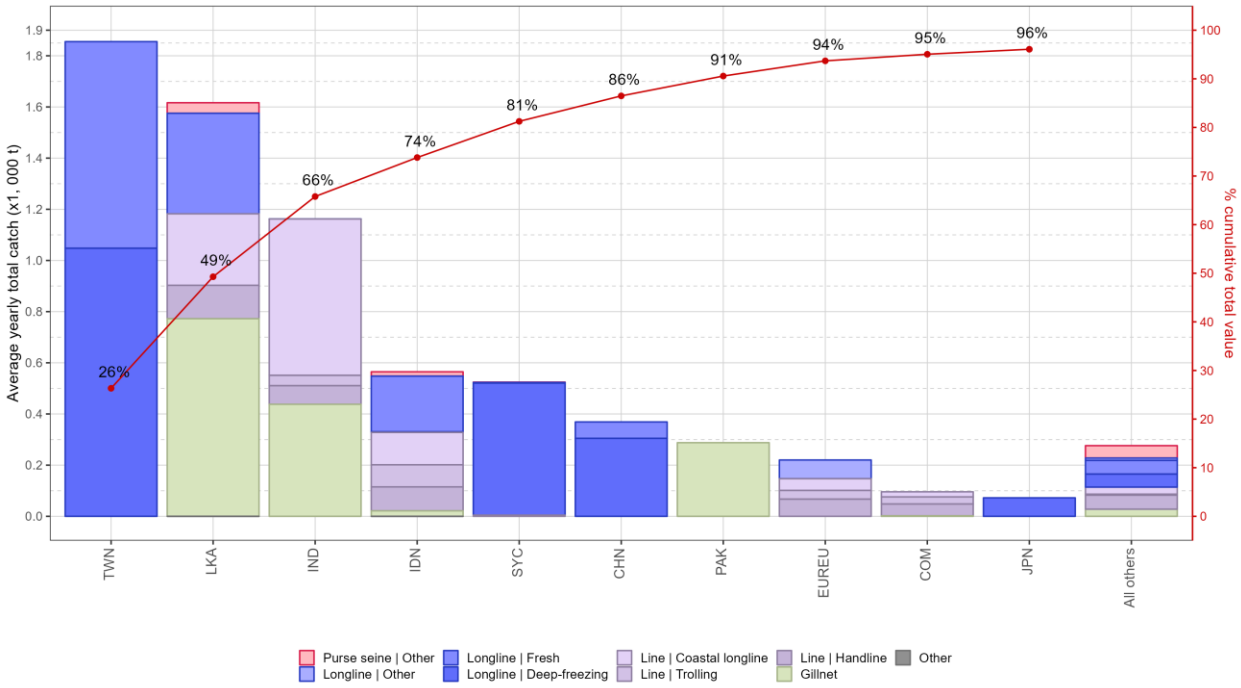


Fig. 2. Mean annual catches (metric tons; t) of blue marlin by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

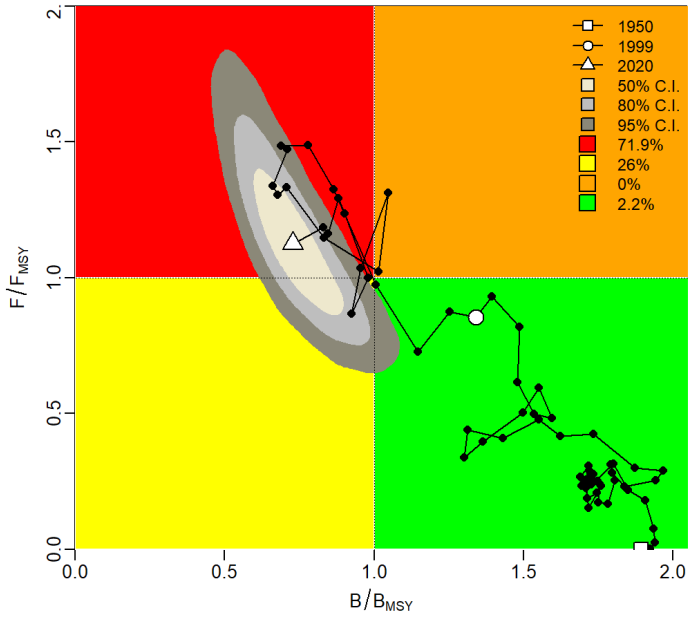


Fig. 3. Kobe stock status plot for the Indian Ocean stock of blue marlin, from the final JABBA base case (the black line traces the trajectory of the stock over time). Contours represent the smoothed probability distribution for 2020 (isopleths are probability relative to the maximum).

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 2020 catch level (7,126 t)

TAC (t) | Year	2023	2024	2025	2026	2027	2028	2029	2030
2137	65	81	90	94	96	98	99	99
2850	59	76	85	91	94	96	97	98
3563	54	70	80	87	90	93	95	96
4275	48	63	73	80	86	89	91	93
4998	42	55	65	72	78	82	85	88
5700	36	47	56	63	69	73	77	79
6413	30	40	46	53	57	61	65	67
7126	25	32	37	41	45	48	51	53
7838	21	24	28	31	33	35	37	38

APPENDIX 20
EXECUTIVE SUMMARY: STRIPED MARLIN (2023)

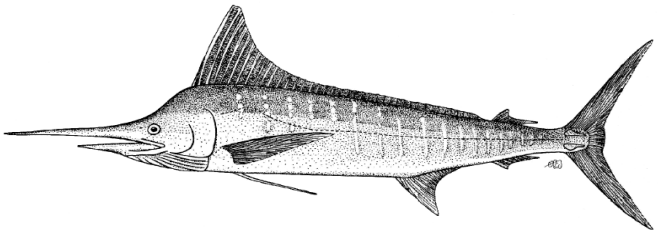


Table 1. Status of striped marlin (*Kajikia audax*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[5]
Indian Ocean	Catch 2022[2] (t)	3,431	100%*
	Average catch 2018-2022 (t)	2,898	
	MSY (1,000 t) (JABBA)	4.60 (4.12 - 5.08)[3]	
	MSY (1,000 t) (SS3)	4.82 (4.48 - 5.16)	
	F_{MSY} (JABBA)	0.26 (0.20–0.33)	
	F_{MSY} (SS3)	0.23 (0.23 - 0.23)	
	F_{2019}/F_{MSY} (JABBA)	2.04 (1.35 - 2.93)	
	F_{2019}/F_{MSY} (SS3)	3.93 (2.30 - 5.31)	
	B_{2019}/B_{MSY} (JABBA)	0.32 (0.22 - 0.51)	
	SB_{2019}/SB_{MSY} (SS3)[4]	0.47 (0.35 - 0.63)	
	B_{2019}/B_0(JABBA)	0.12 (0.10 – 0.19)	
	SB_{2019}/SB_0 (SS3)	0.06 (0.05 - 0.08)	

[1] Boundaries for the Indian Ocean are defined as IOTC area of competence
[2] Proportion of 2022 catch estimated or partially estimated by IOTC Secretariat: 39.6%
[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}
[5] 2019 is the final year that data were available for this assessment
* 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)	100%	0.0%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	0.0%	0.0%
Not assessed/Uncertain/Unknown		

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 striped marlin in 2023, thus the stock status is determined on the basis of the 2021 assessment based on two different models: JABBA, a Bayesian state-space production model (age-aggregated); and SS3, an integrated model (age-structured) (using data up to 2019). Both models were generally consistent with regards to stock status and confirmed the results from 2012, 2013, 2015, 2017 and 2018 assessments, indicating that the stock is subject to overfishing ($F>F_{MSY}$) and is overfished, with the biomass being below the level which would produce MSY ($B<B_{MSY}$) for over a decade. On the weight-of-evidence available in 2021, the stock status of striped marlin is determined to be ***overfished*** and ***subject to overfishing*** (**Table 1**; **Fig. 3**).

Outlook. Biomass estimates of the Indian Ocean striped marlin stock have likely been below BMSY since the late 90's – the stock has been severely depleted (B/B_0 = 0.12; JABBA model). The outlook is pessimistic, and a substantial decrease in fishing mortality is required to ensure a reasonable chance of stock recovery in the foreseeable future (**Table 2**). It should be noted that point estimates from SS3 indicate that F_{curr}/F_{MSY} are higher than those estimated by JABBA.

Management advice. Current or increasing catches have a very high risk of further decline in the stock status. The 2022 catches (3,431 t) are lower than MSY (4,601 t) but are slightly above the limit set by Resolution 18/05 for that year which may be a concern if this trend continues.

The stock has been overfished for more than a decade 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 as per Resolution 18/05, it needs to provide mechanisms to ensure the maximum annual catches remain between 900 t – 1,500 t (**Table 3**).

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 4,120 - 5,160 t. However, the current biomass is well below the B_{MSY} reference point and fishing mortality is in excess of F_{MSY} at recent catch levels.
- **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 fisheries (mean annual catch 2018-2022)**: striped marlin are caught using gillnet (66.5%), followed by longline (20%) and line (11.9%). The remaining catches taken with other gears contributed to 1.6% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2018-2022)**: the majority of striped marlin catches are attributed to vessels flagged to I. R. Iran (36%) followed by Pakistan (26.2%) and Indonesia (16.9%). The 24 other fleets catching striped marlin contributed to 20.8% of the total catch in recent years (**Fig. 2**).

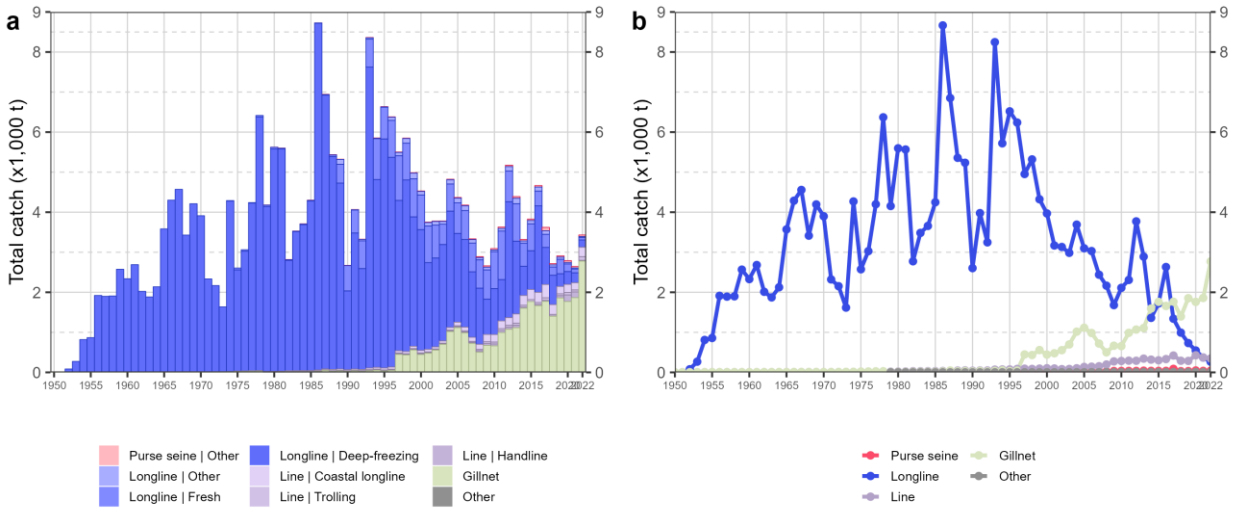


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tons; t) by fishery and (b) individual nominal catches (metric tons; t) by fishery group for striped marlin during 1950-2022. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

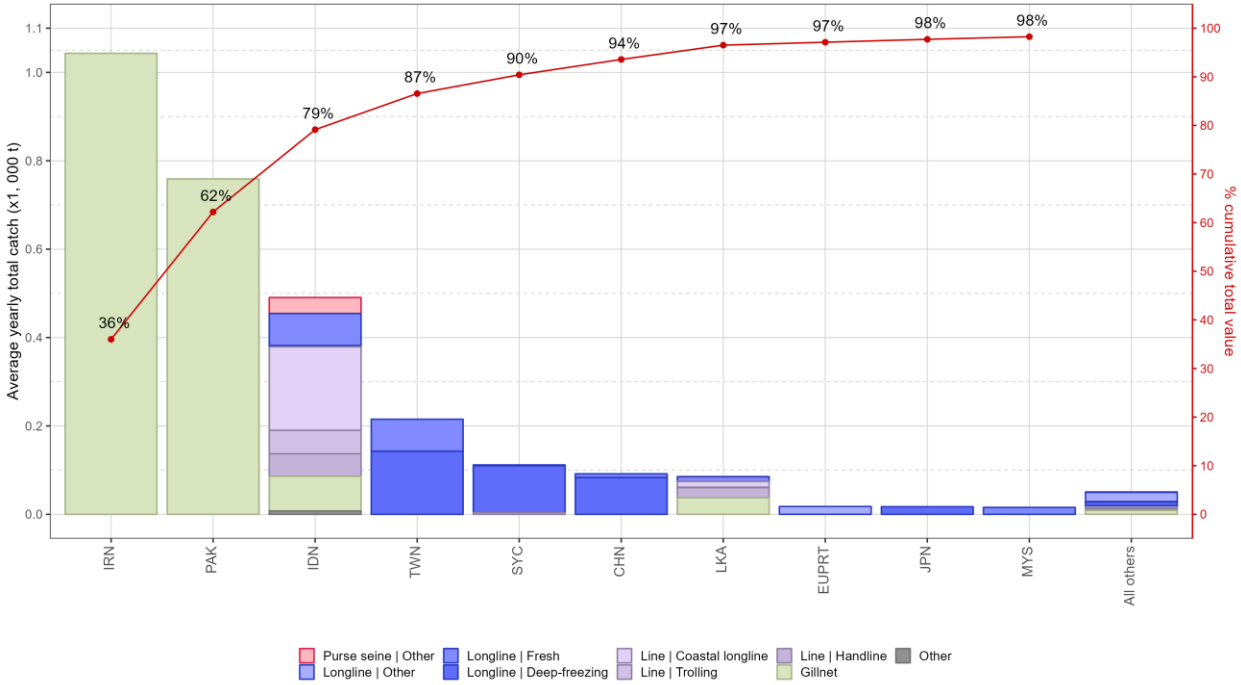
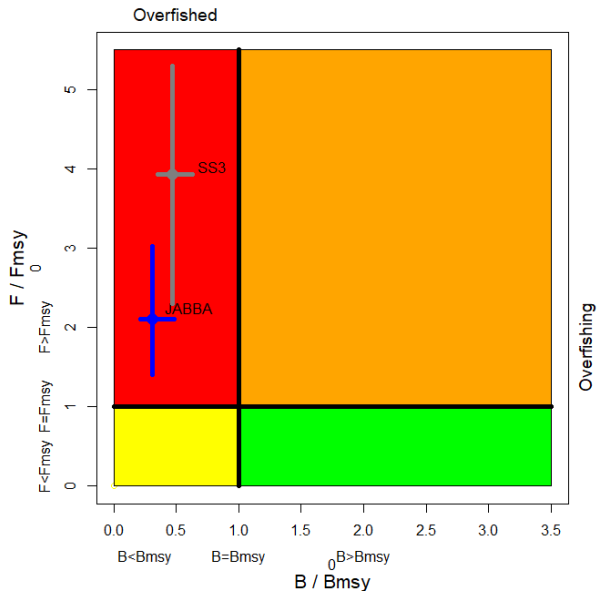


Fig. 2. Mean annual catches (metric tons; t) of striped marlin by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

(a) Stock status (JABBA and SS3 models)



(b) JABBA B/B_{MSY} and F/F_{MSY} trajectories

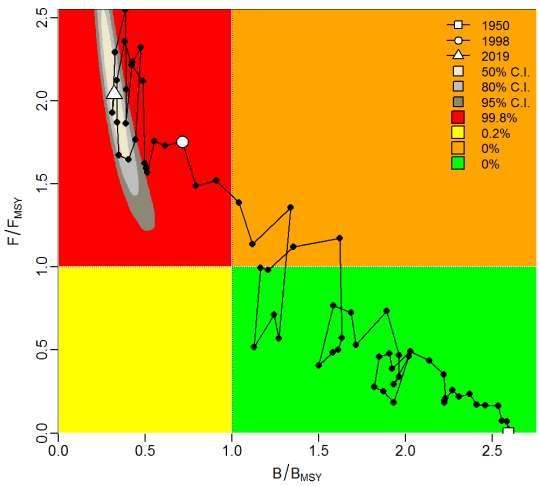


Fig. 3. (a) Striped marlin: Stock status from the Indian Ocean assessment JABBA (Bayesian State Space Surplus Production Model) and SS3 models with the confidence intervals (left); (b) Trajectories (1950-2019) of B/B_{MSY} *and* F/F_{MSY} from the JABBA model. NB: SS3 refers to SB/SB_{MSY} while the 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 2019 catch level (3,001 t)*, ± 10%, ± 20%, ± 30% ± 40%) projected for 3 and 10 years.

Reference point and projection timeframe	**Alternative catch projections (relative to the 2019 catch of 3,001 t) and probability (%) of violating MSY-based target reference points (Btarg = B_{MSY}; Ftarg = F_{MSY})**								
	60% (1,801 t)	**70%** (2,101 t)	**80%** (2,401 t)	**90%** (2,701 t)	**100%** (3,001 t)	**110%** (3,301 t)	**120%** (3,602 t)	**130%** (3,902 t)	**140%** (4,202 t)
$B_{2022} < B_{MSY}$	100	100	100	100	100	100	100	100	100
$F_{2022} > F_{MSY}$	21	49	75	90	97	99	100	100	100
$B_{2029} < B_{MSY}$	6	18	39	62	82	93	98	100	100
$F_{2029} > F_{MSY}$	0	2	9	29	57	81	94	99	100

Table 3. Striped marlin: Probability (percentage) of achieving the KOBE green quadrat from 2022-2029 for a range of constant catch projections (JABBA).

TAC (t) | Year	2022	2023	2024	2025	2026	2027	2028	2029
300	4	31	75	95	99	100	100	100
600	2	22	62	89	98	100	100	100
900	1	15	48	79	94	98	100	100
1201	1	9	33	65	87	96	99	100
1501	1	6	22	49	73	89	96	98
1801	0	3	13	42	55	75	87	94
2101	0	2	7	19	37	55	71	82
2401	0	1	3	10	21	35	49	61
2701	0	0	2	5	10	18	28	38
3001	0	0	1	2	4	8	13	18

APPENDIX 21
EXECUTIVE SUMMARY: INDO-PACIFIC SAILFISH (2023)

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

Area[1]	Indicators		2022 stock status determination[3]
Indian Ocean	Catch 2022[2] (t)	31,873	54%
	Average catch 2018-2022 (t)	32,386	
	MSY (1,000 t) (80% CI)	25.9 (20.8 – 34.2)	
	F_{MSY} (80% CI)	0.19 (0.15 - 0.24)	
	B_{MSY} (1,000 t) (80% CI)	138 (108–186)	
	F_{2019}/F_{MSY} (80% CI)	0.98 (0.65 – 1.42)	
	B_{2019}/B_{MSY} (80% CI)	1.17 (0.94 – 1.42)	
	B_{2019}/B_0 (80% CI)	0.58 (0.47 – 0.71)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2022 catch estimated or partially estimated by IOTC Secretariat: 38.5%
[3]2019 is the final year that data were available for this assessment

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)	7%	39%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	0%	54%
Not assessed/Uncertain/Unknown		

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 Indo-Pacific Sailfish in 2023, thus the stock status is determined on basis of the 2022 stock assessment based on JABBA (using data up to 2019). Data poor methods (C-MSY and SFA) applied to Indo-Pacific Sailfish in 2019 rely on catch data only, which is highly uncertain for this species, and resulted in the stock status determined to be uncertain. To overcome the lack of abundance indices for this species, this assessment incorporated length-frequency data to estimate annual Spawning Potential Ratio (SPR). Normalised annual estimates of SPR were assumed to be proportional to biomass and incorporated as an index of relative abundance in the JABBA model (assuming no trends in annual recruitment in the long term). This is a novel technique applied to overcome the paucity of abundance data for SFA. The results indicate that there has been a 41% decline in SPR since 1970. B/B_{MSY} declined consistently from the early-1980s, while F/F_{MSY} gradually increased from 1980, peaking in 2018 at 1.1. The latest (2019) estimate of B/B_{MSY} was 1.17, while the F/F_{MSY} estimate was 0.98. On the weight-of-evidence available in 2022, the stock status of Indo-Pacific sailfish is determined to be ***not overfished nor subject to overfishing*** (**Table 1**; **Fig. 3**).

Outlook. Catches have exceeded the estimated MSY since 2013 and the current catches (average of 32,386 t in the last 5 years, 2018-2022) are substantially higher than the current MSY estimate of 25,905 t. This increase in coastal gillnet longline 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 the 2020, 2021 and 2022 catches exceed the catch limit prescribed in Resolution 18/05 (25,000 t).

Management advice. The catch limits as stipulated in Resolution 18/05 have been exceeded for three consecutive years since 2020. In spite of the Kobe green status of the stock, it is recommended that the Commission review the implementation and effectiveness of the measures contained in this Resolution and consider the adoption of additional conservation and management measures. 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 coastal gillnet and longline fisheries, and further exploration of stock assessment approaches for data poor fisheries are warranted. Given the limited data being reported for coastal 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 25,905 t.
- **Provisional reference points:** although the Commission adopted reference points for swordfish in Resolution 15/10 on target and limit reference points and a decision framework, no such interim reference points have been established for Indo-Pacific sailfish.
- **Main fisheries (mean annual catch 2018-2022):** Indo-Pacific sailfish are using gillnet (71.4%), followed by line (24.4%) and longline (3.2%). The remaining catches taken with other gears contributed to 1% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2018-2022)**: the majority of Indo-Pacific sailfish catches are attributed to vessels flagged to I. R. Iran (41.6%) followed by India (23%) and United republic of Tanzania (6.7%). The 31 other fleets catching Indo-Pacific sailfish contributed to 28.7% of the total catch in recent years (**Fig. 2**).

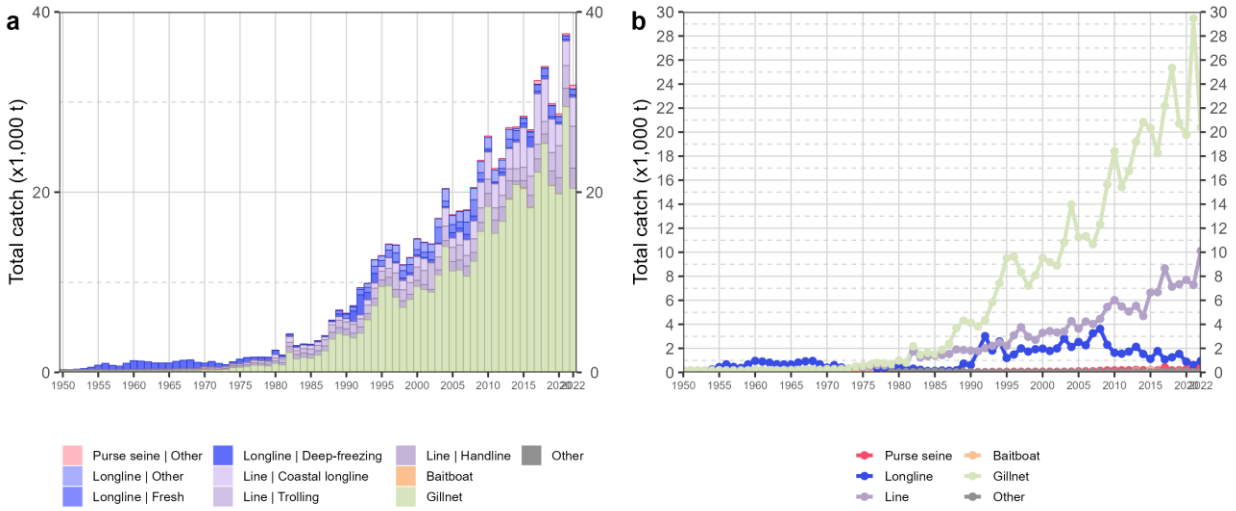


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tons; t) by fishery and (b) individual nominal catches (metric tons; t) by fishery group for Indo-Pacific sailfish during 1950-2022. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

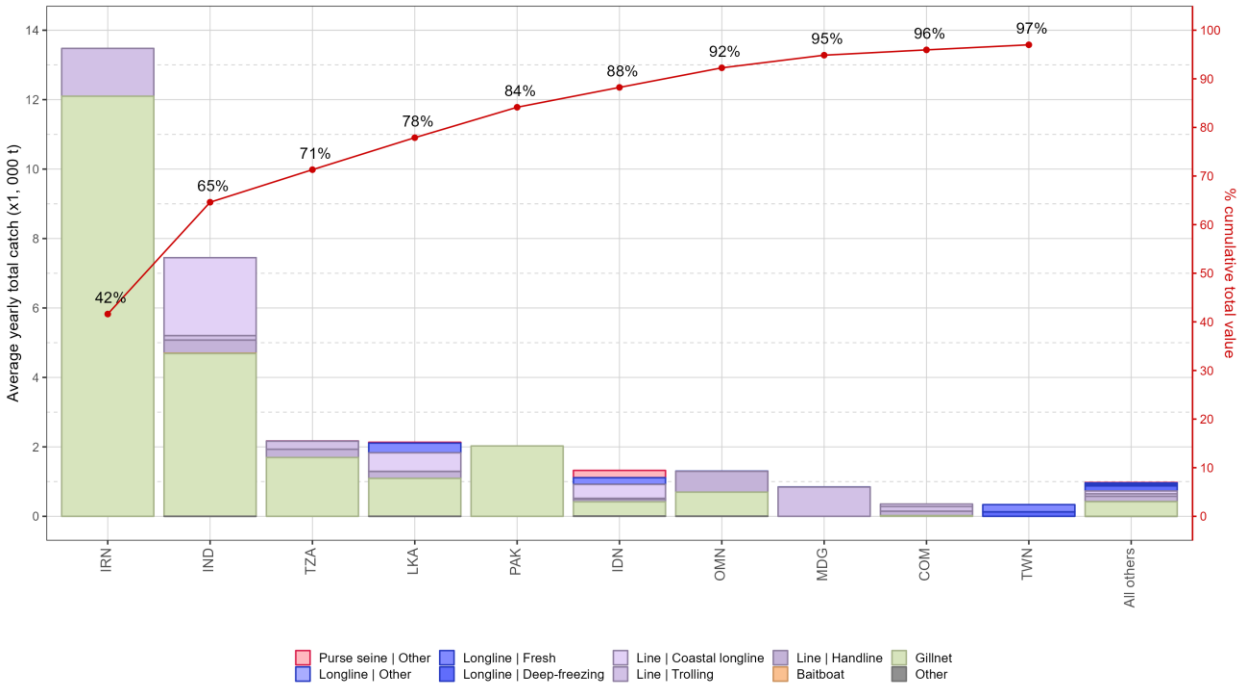


Fig. 2. Mean annual catches (metric tons; t) of Indo-Pacific sailfish by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

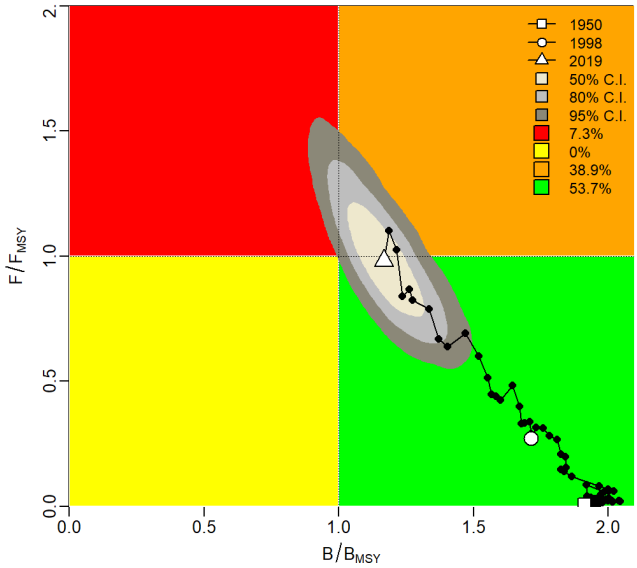


Fig. 3. Indo-Pacific sailfish: Kobe plot showing estimated trajectories (1950-2019) of B/B_{MSY} and F/F_{MSY}. Different grey shaded areas denote the 50%, 80%, and 95% credibility interval for the terminal assessment year. The probability of terminal year points falling within each quadrant is indicated in the figure legend.

APPENDIX 22
EXECUTIVE SUMMARY: SWORDFISH (2023)

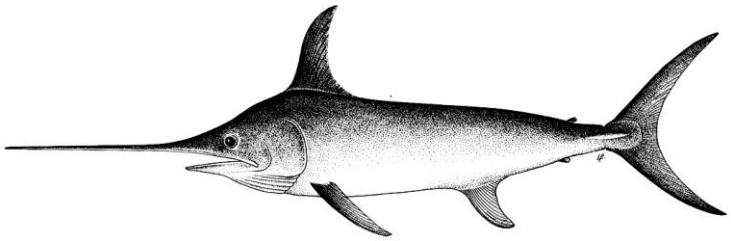


TABLE 1. Status of swordfish (*Xiphias gladius*) in the Indian Ocean.

Area[1]	Indicators		2023 stock status determination
Indian Ocean	Catch 2022[2] (t)	23,597	**97%**
	Average catch 2018-2022 (t)	28,994	
	MSY (1,000 t) (80% CI)	30 (26–33)	
	F_{MSY} (80% CI)	0.16 (0.12–0.20)	
	SB_{MSY} (1,000 t) (80% CI)	55 (40–70)	
	F_{2021}/F_{MSY} (80% CI)	0.60 (0.43–0.77)	
	SB_{2021}/SB_{MSY} (80% CI)	1.39 (1.01–1.77)	
	SB_{2021}/SB_{1950} (80% CI)	0.35 (0.32–0.37)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2022 catch estimated or partially estimated by IOTC Secretariat: 20%
[3]2021 is the final year that data were available for this assessment

Colour key	Stock overfished ($SB_{year}/SB_{MSY}< 1$)	Stock not overfished ($SB_{year}/SB_{MSY}\geq 1$)
Stock subject to overfishing ($F_{year}/F_{MSY}> 1$)	0.2%	0
Stock not subject to overfishing ($F_{year}/F_{MSY}\leq 1$)	3%	97%
Not assessed/Uncertain/Unknown		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. In 2023 a new stock assessment was carried out for Swordfish in the IOTC area of competence to update the stock assessment undertaken in 2020. Two models were applied to the swordfish stock (ASPIC and Stock Synthesis (SS3)), with the SS3 stock assessment selected to provide scientific advice (as done previously). An update of the JABBA model was also conducted during the WPB meeting. The reported SS3 stock status is based on a grid of 48 model configurations designed to capture the uncertainty relating to steepness of the stock recruitment relationship (0.7, 0.8, and 0.9), recruitment variability (two levels), CPUE series (2 options), growth (2 options) and weighting of length composition data (two options). A number of the options included in the final grid were selected from a range of additional sensitivity runs that were conducted to explore uncertainties. Median spawning biomass in 2021 was estimated to be 35% (80% CI: 32-37%) of the unfished levels (**Table 1**) and 1.39 times (80% CI: 1.01-1.77) the level required to support MSY. Median fishing mortality in 2021 was estimated to be 60% (80% CI 43%-77%) of the FMSY level, and catch in 2021 (23,237 t) was well below the estimated MSY level of 29,856 t (80% CI: 26,319-33,393t). Taking into account the characterized uncertainty, and on the weight-of-evidence available in 2023, the swordfish stock is determined to be ***not overfished*** and ***not subject to overfishing*** (**Table 1**, **Fig. 3**).

Outlook. The significant decrease in recent longline catch and effort from 2019 to 2022 (a 33% reduction from 35,256t to 23,597t) substantially lowered the pressure on the Indian Ocean stock as a whole, and current fishing mortality is not expected to reduce the population to an overfished state over the next decade. (**Table 1**). The estimated recent recruitment (2010-2020) was above the long-term average although this appears to be mainly driven by the sharp increase in the Japanese longline CPUE in the northern region. The WPB expressed concern over whether that CPUE index represents the change of abundance in that region which may require further

investigation. Further, the South-western regions, which is one of the sub-regions used in the model, exhibit a declining biomass trend which indicate higher depletion in this region, compared to other regions.

***Management advice*.** The 2021 catches (23,237t at the time of the assessment) were significantly lower than the estimated MSY level (29,856 t). Under those levels of catches, the spawning biomass was projected to likely increase, with a high probability of maintaining at or above the SB_{MSY} for the longer term. There is a very low risk of exceeding MSY-based reference points by 2031 if catches are maintained at 2021 levels (<1% risk that $SB_{2031} < SB_{MSY}$, and <1% risk that $F_{2021} > F_{MSY}$). The projections indicate that an increase of 40% or more from 2021 catch levels will not likely result in the biomass dropping below the SB_{MSY} level for the longer term (with a 15% probability). Catches in 2022 (23,597t) were still lower than the estimated MSY. Nevertheless, the Commission should consider monitoring the catches to ensure that the probability of exceeding the SB_{MSY} target reference points in the long term remains minimal. Taking into account the differential CPUE and biomass trends between regions, the WPB noted that there is recurring evidence for localised depletion in the South Western region (which appears to be more depleted than other regions) 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 29,856 t.
- **Provisional reference points**: noting that the Commission in 2015 agreed to Resolution 15/10 *on target and limit reference points and a decision framework*, the following should be noted:
    a. **Fishing mortality**: current fishing mortality is considered to be below the provisional target reference point of F_{MSY} and below the provisional limit reference point of $1.4*F_{MSY}$ (**Fig. 2**).
    b. **Biomass**: current spawning biomass is considered to be above the target reference point of SB_{MSY}, and therefore above the limit reference point of $0.4*SB_{MSY}$ (**Fig. 2**).
- **Main fisheries (mean annual catch 2018-2022)**: swordfish are caught using longline (53.6%), followed by line (30.1%) and gillnet (15.8%). The remaining catches taken with other gears contributed to 0.5% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2018-2022)**: the majority of swordfish catches are attributed to vessels flagged to Sri Lanka (27.4%) followed by Taiwan,China (17%) and Yemen (6.2%). The 25 other fleets catching swordfish contributed to 49.5% of the total catch in recent years (**Fig. 2**).

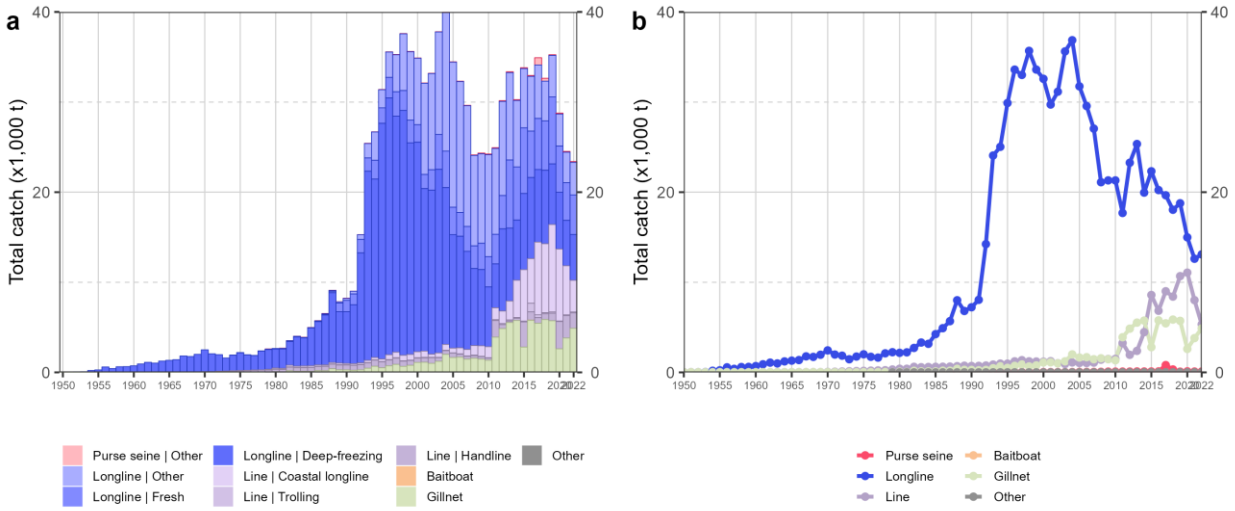


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tons; t) by fishery and (b) individual nominal catches (metric tons; t) by fishery group for swordfish during 1950–2022. Longline|Other: swordfish and sharks-targeting longlines; Other: all remaining fishing gears

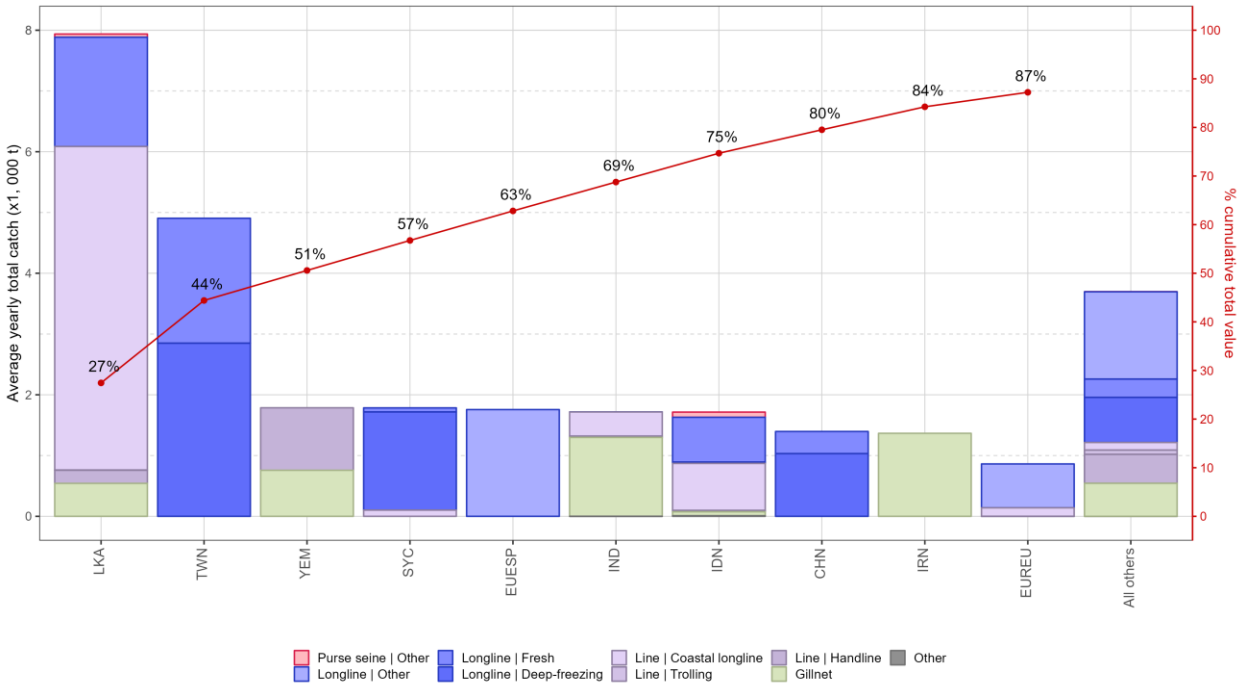


Fig. 2. Mean annual catches (metric tons; t) of swordfish by fleet and fishery between 2018 and 2022, with indication of cumulative catches by fleet. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

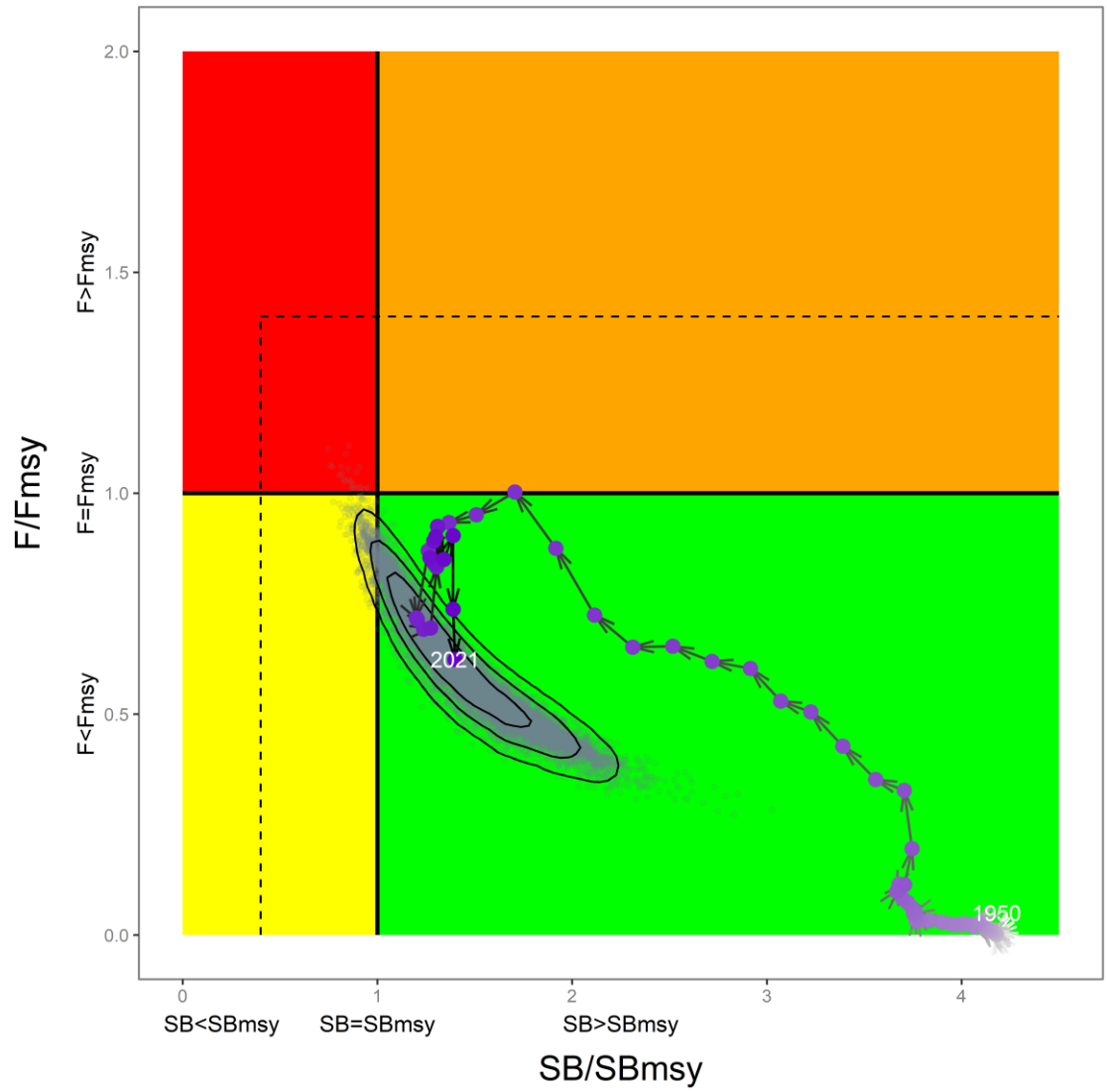


Fig. 3. Swordfish: 2021 stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the final model grid. Grey dots represent uncertainty from individual models with 50%, 80% and 95% contours lines. The arrowed line represents the time series of stock trajectory from the reference model. 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 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 2021 catch level (23 237 t)*, 0%, ± 20%, ± 40%) projected for 3 and 10 years.

Reference point and projection timeframe	**Alternative catch projections (relative to the 2019 catch of 3,001 t) and probability (%) of violating MSY-based target reference points (Btarg = B_{MSY}; Ftarg = F_{MSY})**				
	60% (13 942 t)	**80%** (18 590 t)	**100%** (23 237 t)	**120%** (27 884 t)	**140%** (32 532 t)
$B_{2024} < B_{MSY}$	0	0	1	1	2
$F_{2024} > F_{MSY}$	0	0	0	5	24
$B_{2031} < B_{MSY}$	0	0	0	3	15
$F_{2031} > F_{MSY}$	0	0	0	8	30

APPENDIX 23
EXECUTIVE SUMMARY: BLUE SHARK (2023)

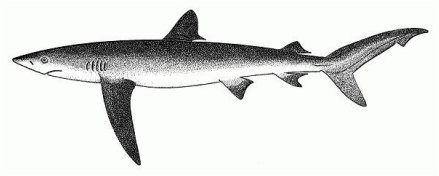


Table 1. Status of blue shark (*Prionace glauca*) in the Indian Ocean

Area	Indicators		2021 stock status determination[5]
Indian Ocean	Reported catch 2022 (t)	24,424	99.9%
	Estimated catch 2019 (t)[4]	43,240	
	Not elsewhere included (nei) sharks[1] 2022 (t)	32,558	
	Average reported catch 2018-22 (t)	25,275	
	Average estimated catch 2015-19 (t)[4]	48,781	
	Avg. not elsewhere included (nei) sharks[1] 2018-22 (t)	31,303	
	MSY (1,000 t) (80% CI)[2]	36.0 (33.5 - 38.6)	
	F_{MSY} (80% CI) [2]	0.31 (0.306 - 0.31)	
	SB_{MSY} (1,000 t) (80% CI) [2,3]	42.0 (38.9 - 45.1)	
	F_{2019}/F_{MSY} (80% CI) [2]	0.64 (0.53 - 0.75)	
	SB_{2019}/SB_{MSY} (80% CI) [2,3]	1.39 (1.27 - 1.49)	
	SB_{2019}/SB_0 (80% CI) [2,3]	0.46 (0.42 - 0.49)	

Boundaries for the Indian Ocean are defined as the IOTC area of competence

[1]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SKH: Various sharks nei; RSK: Requiem sharks nei; AG38: Blue shark, shortfin mako, oceanic whitetip shark)

[2]Estimates refer to the base case model using estimated catches

[3]Refers to fecund stock biomass

[4]Catch estimated for stock assessment purposes only (doc IOTC-2021-WPEB17(AS)-14_Rev1). Proportion of 2022 catch estimated or partially estimated by IOTC Secretariat: 70.8%

[5]2019 is the final year that data were available for this assessment

Colour key	Stock overfished ($SB_{2019}/SB_{MSY}< 1$)	Stock not overfished ($SB_{2019}/SB_{MSY}\geq 1$)
Stock subject to overfishing($F_{2019}/F_{MSY}> 1$)	0%	0.1%
Stock not subject to overfishing ($F_{2019}/F_{MSY}\leq 1$)	0%	99.9%
Not assessed/Uncertain/Unknown		

Table 2. Blue shark: IUCN threat status of blue shark (*Prionace glauca*) in the Indian Ocean.

Common name	Scientific name	IUCN threat status[3]		
		Global status	WIO	EIO
Blue shark	*Prionace glauca*	Near Threatened	–	–

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, Rigby et al 2019

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was carried out for blue sharks in 2023 and so the results are based on the assessment carried out in 2021 using an integrated age-structured model (SS3) (**Fig. 1**) (using data up to 2019). Uncertainty in data inputs and model configuration were explored through sensitivity analysis. All models produced similar results suggesting the stock is currently not overfished nor subject to overfishing, but with the trajectories showing consistent trends towards the overfished and subject to overfishing quadrant of the Kobe plot (**Fig. 1**). A base case model was selected based on the best Indian Ocean biological data, consistency of CPUE standardized relative abundance series, model fits and spatial extent of the data (**Fig. 1, Table 1**). In particular, the base case model used the GAM-based catch history estimates and CPUE series from South Africa, EU-Portugal, EU-France (Reunion), EU-Spain, Taiwan and Japan. The major sources of uncertainty 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, however the ratio-based and nominal catches were considered unrealistic. If the alternative CPUE groupings were used, then the stock status was somewhat less positive. 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 2**). Information available on this species has been improving in recent years. Blue sharks are commonly taken by a range of fisheries in the Indian Ocean and in some areas they are fished in their nursery grounds. Because of their life history characteristics – they live until at least 25 years, mature at 4–6 years, and have 25–50 pups every year – they are considered to be the most productive of the pelagic sharks. On the weight-of-evidence available in 2021, the stock status is determined to be **not overfished** and **not subject to overfishing** (**Table 1**).

Outlook. The Kobe II Strategy Matrix (**Table 3**) provides the probability of exceeding reference levels in the short (3 years) and long term (10 years) given a range of percentage changes in catch.

Management advice. Target and limit reference points have not yet been specified for pelagic sharks in the Indian Ocean. The 2021 assessment indicates that Indian Ocean blue shark are not overfished nor subject to overfishing (**Table 3**). If the catches are increased by over 20%, the probability of maintaining spawning biomass above MSY reference levels ($SB>SB_{MSY}$) over the next 10 years will be decreased (**Table 3).** The stock should be closely monitored. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission, so as to better inform scientific advice in the future.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the Indian Ocean stock is approximately 36,000 t.
- **Reference points**: The Commission has not adopted reference points or harvest control rules for any shark species.
- **Main fishing gear** (2018–22): coastal longline; longline (deep-freezing); longline targeting swordfish; gillnet.
- **Main fleets** (2018–22): Indonesia; Taiwan,China; EU-Spain; Seychelles; EU-Portugal

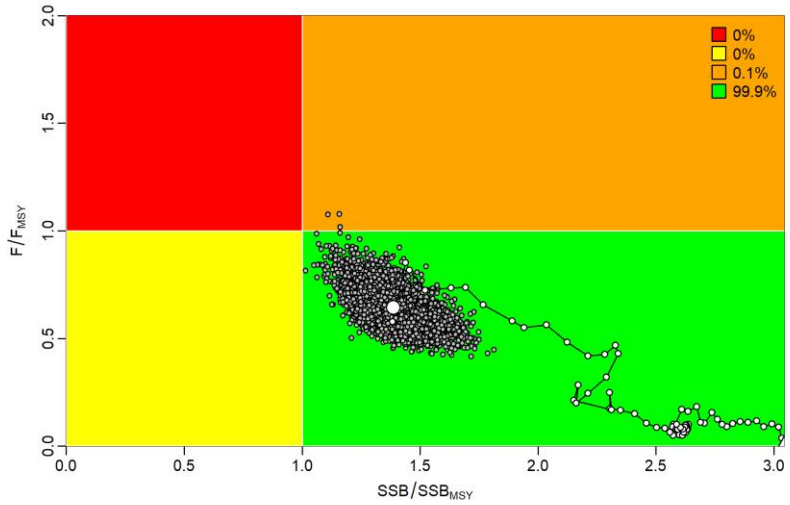


Fig. 1. Blue shark: Aggregated Indian Ocean stock assessment Kobe plot for the 2021 assessment (base case model with trajectory and uncertainty in the terminal year).

Table 3. Blue shark: Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based reference points for nine constant catch projections using the base case model (catch level from 2019* (43,240 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 2019) and probability (%) of exceeding MSY-based reference points**								
Catch Relative to 2019	60%	70%	80%	90%	100%	110%	120%	130%	140%
Catch (t)	(25,944)	(30,267)	(34,592)	(38,916)	(43,240)	(47,564)	(51,888)	(56,212)	(60,535)
$SB_{2022} < SB_{MSY}$	0%	0%	0%	0%	0%	0%	0%	0%	0%
$F_{2022} > F_{MSY}$	0%	0%	0%	0%	0%	1%	5%	16%	36%
$SB_{2029} < SB_{MSY}$	0%	0%	0%	0%	0%	2%	9%	25%	48%
$F_{2022} > F_{MSY}$	0%	0%	0%	0%	1%	13%	44%	75%	90%

*: average catch level and respective % changes refer to the estimated catch series used in the final base case model (IOTC-2021-WPEB17(AS)-15)

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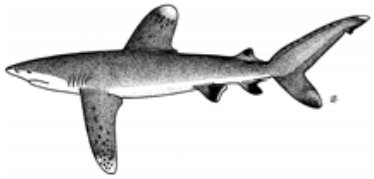
APPENDIX 24
EXECUTIVE SUMMARY: OCEANIC WHITETIP SHARK (2023)



CITES APPENDIX II species

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

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2022 (t)[3]	41 t	Unknown
	Not elsewhere included (nei) sharks[2] 2022	32,558 t	
	Average reported catch 2018-22	35 t	
	Av. not elsewhere included 2018-2022 (nei) sharks[2]	31,303 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., SKH: Various sharks nei; RSK: Requiem sharks nei; AG38: Blue shark, shortfin mako, oceanic whitetip shark)
[3]Proportion of catch fully or partially estimated for 2022: 0% All catches within the database were reported by CPCs

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/Unknown		

Table 2. Oceanic whitetip shark: IUCN threat status of oceanic whitetip shark (*Carcharhinus longimanus*) in the Indian Ocean.

Common name	Scientific name	IUCN threat status[3]		
		Global status	WIO	EIO
Oceanic whitetip shark	*Carcharhinus longimanus*	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, Rigby et al 2019
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 1**). 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 2**). There is a paucity of information available on this species in the Indian Ocean and this situation is not expected to improve in the short to medium term. Oceanic whitetip sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived, mature at 4–5 years, and have 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 1**).

Outlook. Maintaining or increasing effort with associated fishing mortality can result in declines in biomass, productivity and CPUE. Piracy in the western Indian Ocean resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into certain areas in the southern and eastern Indian Ocean. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort on oceanic whitetip sharks declined in the southern and eastern areas and may have resulted in localised depletion there.

Management advice. A cautious approach to the management of oceanic whitetip shark should be considered by the Commission, noting that recent studies suggest that longline mortality at haulback is high (50%) in the Indian Ocean (IOTC-2016-WPEB12-26), while mortality rates for interactions with other gear types such as purse seines and gillnets may be higher.

Mitigation measures should be taken to reduce at-vessel and post release mortality, including consideration of potential gear modifications in longline fleets targeting tuna and swordfish. Noting that a recent study (Bigelow et al. 2021) concluded in WCPFC that banning both shark lines and wire leaders has the potential to reduce fishing mortality by 40.5% for oceanic whitetip shark.

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** (2018-22): gillnet, line; Longline.
- **Main fleets** (2018-22): I.R. Iran; Comoros; China, Indonesia, Seychelles, (Reported as discarded/released alive by China, EU-France, Mauritius, Tanzania, Sri Lanka, EU-Spain).

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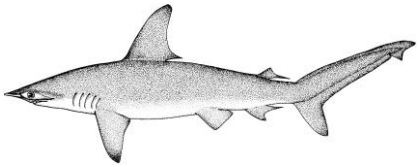
APPENDIX 25
EXECUTIVE SUMMARY: SCALLOPED HAMMERHEAD SHARK (2023)



CITES APPENDIX II species

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

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2022 (t)[3]	670	Unknown
	Not elsewhere included (nei) sharks[2] 2022 (t)	33,949	
	Average reported catch 2018-22 (t)	198	
	Av. not elsewhere included 2018-2022 (nei) sharks[2] (t)	33,612	
	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., SKH: Various sharks nei; SPN: Hammerhead sharks nei).

[3]Proportion of catch fully or partially estimated for 2022: 0% All catches within the database were reported by CPCs

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/Unknown		

Table 2. IUCN threat status of scalloped hammerhead shark (*Sphyrna lewini*) in the Indian Ocean.

Common name	Scientific name	IUCN threat status[3]		
		Global status	WIO	EIO
Scalloped hammerhead shark	*Sphyrna lewini*	Critically Endangered	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, Rigby et al 2019

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 'Critically Endangered' (**Table 2**). 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** (Error! Reference source not found.**1**).

Outlook. 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** (2018-2022): Handline, Ringnet; Gillnet; longline-coastal; and offshore gillnet.
- **Main fleets** (2018-22): Sri Lanka; Kenya; Malaysia; Tanzania (report as released alive/discarded by United Kingdom, EU-France, South Africa,).

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APPENDIX 26
EXECUTIVE SUMMARY: SHORTFIN MAKO SHARK (2023)

CITES APPENDIX II species

Table 1. 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 2022 (t)[3]	666	Unknown
	Catches reported to MAK in 2022 (t)	1,947	
	Average catches reported to MAK 2018-2022 (t)	2,057	
	Catches in 2022 (MAK, SMA, LMA) (t)	2,627	
	Average catches 2018-2022 (MAK, SMA, LMA) (t)	3,081	
	Not elsewhere included (nei) sharks[2] 2022 (t)	34,248	
	Average reported catch 2018-22 (t)	1,013	
	Av. Not elsewhere included (nei) sharks[2] 2018-22 (t)	33,072	
	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., SKH: Various sharks nei; MSK: Mackerel sharks,porbeagles nei; MAK: Mako sharks; AG38: Blue shark, shortfin mako, oceanic whitetip shark).

[3]Proportion of 2022 catch estimated or partially estimated by IOTC Secretariat: 32.2%

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/Unknown		

Table 2. Shortfin mako shark: IUCN threat status of shortfin mako shark (*Isurus oxyrinchus*) in the Indian Ocean.

Common name	Scientific name	IUCN threat status[3]		
		Global status	WIO	EIO
Shortfin mako shark	*Isurus oxyrinchus*	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, Rigby et al 2019

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty about the relationship between abundance, the standardised CPUE series, and total catches over the past decade (**Table 1**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 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 2**). 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 year–) - 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. 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** (2018-22): Longline targeting swordfish; gillnet; and line. .
- **Main fleets** (2018-22): EU,Spain; Pakistan; South Africa; EU,Portugal; Japan; United Kingdom; Indonesia; China; Sri Lanka; (Reported as discarded/released alive: EU-Spain, Australia, EU,France, Indonesia, Korea, South Africa).

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APPENDIX 27
EXECUTIVE SUMMARY: SILKY SHARK (2023)

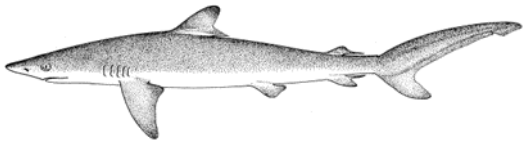

Table 1. Status of silky shark (*Carcharhinus falciformis*) in the Indian Ocean

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2022 (t)[3] Not elsewhere included (nei) sharks[2] 2022 (t) Average reported catch 2018-22 (t) Av. Not elsewhere included (nei) sharks[2] 2018-22 (t)	1,426 32,558 1,755 31,303	Unknown
	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., SKH: Various sharks nei; RSK: requiem sharks nei).
[3]Proportion of 2022 catch estimated or partially estimated by IOTC Secretariat: 26.4%

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/Unknown		

Table 2. Silky shark: IUCN threat status of silky shark (*Carcharhinus falciformis*) in the Indian Ocean.

Common name	Scientific name	IUCN threat status[3]		
		Global status	WIO	EIO
Silky shark	*Carcharhinus falciformis*	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, Rigby 2021

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty about the relationship between abundance and the nominal CPUE series from the main longline fleets, and about the total catches over the past decade (**Table 1**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 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 this species globally is 'Vulnerable' (**Table 2**). There is a paucity of information available on this species, but several studies have been carried out for this

species in the recent years. 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. 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.

Mitigation measures should be taken to reduce at-vessel and post release mortality, including consideration of potential gear modifications in longline fleets targeting tuna and swordfish. Noting that a recent study (Bigelow et al. 2021) concluded in WCPFC that banning both shark lines and wire leaders has the potential to reduce fishing mortality by 30.8% for silky shark.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Unknown.
- **Reference points**: Not applicable.
- **Main fishing gear** (2018-22): Gillnet; offshore gillnet; longline; longline (fresh), trolling
- **Main fleets** (2018-22): Sri Lanka, I.R. Iran; Pakistan, Taiwan,China; (reported as discarded/released alive by: China, EU-France, Mauritius, EU-Spain, Korea, Tanzania).

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APPENDIX 28
EXECUTIVE SUMMARY: BIGEYE THRESHER SHARK (2023)

Table 1. Status bigeye thresher shark (*Alopias superciliosus*) in the Indian Ocean

Area[1]	Indicators		Stock status determination
Indian Ocean	Reported catch 2022 (t) Not elsewhere included (nei) sharks[2] 2022 (t) Thresher sharks nei 2022 (t) Average reported catch 2018-22 (t) Av. Not elsewhere included (nei) sharks[2] 2018-22 (t) Av. Thresher sharks nei 2018-22 (t)	< 1 37,497 5,209 < 1 35,865 4,859	Unknown
	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., SKH: Various sharks nei;THR: Thresher sharks nei; MSK: Mackerel sharks,porbeagles 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 / Unknown		

Table 2. Bigeye thresher shark: IUCN threat status of bigeye thresher shark (*Alopias superciliosus*) in the Indian Ocean

Common name	**Scientific name**	**IUCN threat status[3]**		
		Global status	**WIO**	**EIO**
Bigeye thresher shark	*Alopias superciliosus*	Vulnerable	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean

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

Sources: IUCN Red List 2020, Rigby et al 2019

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty in the stock status due to lack of information necessary for assessment or for the development of other indicators of the stock (**Table 1**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 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 2**). There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. Bigeye thresher sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (+20 years), mature at 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*[2].The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2018–22): No report after 2012. (reported previously as discard from gillnet and longline).
- **Main reporting fleets** (2018–22): India; (reported as discarded/released alive by United Kingdom, South Africa, Indonesia, Korea, EU,France,).

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[2] 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 (2023)

Table 1. Status pelagic thresher shark (*Alopias pelagicus*) in the Indian Ocean

Area[1]	Indicators		Stock status determination
Indian Ocean	Reported catch 2022 (t)[3]	156	Unknown
	Not elsewhere included (nei) sharks[2] 2022 (t)	37,497	
	Thresher sharks nei 2022 (t)	5,209	
	Average reported catch 2018-22 (t)	217	
	Av. Not elsewhere included (nei) sharks[2] 2018-22 (t)	35,865	
	Av. Thresher sharks nei 2018-22 (t)	4,859	
	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., SKH: Various sharks nei;THR: Thresher sharks nei; MSK: Mackerel sharks,porbeagles nei).
[3]Proportion of 2022 catch estimated or partially estimated by IOTC Secretariat: 100%

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/Unknown		

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

Common name	Scientific name	IUCN threat status[3]		
		Global status	WIO	EIO
Pelagic thresher shark	*Alopias pelagicus*	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, Rigby et al 2019

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Stock status. There remains considerable uncertainty in the stock status due to lack of information necessary for assessment or for the development of other indicators (**Table 1**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 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 2**). There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term.

Pelagic thresher sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (+ 20 years), mature at 8–9 years, and have few offspring (2 pups every year–) - the pelagic thresher shark is vulnerable to overfishing. There is no quantitative stock assessment and limited basic fishery indicators 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*[3].

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2018-22): Gillnet, exploratory longline (reported as discard/ released from gillnet and longline).
- **Main fleets** (2018-22): Pakistan; reported as discarded/released alive by Korea, South Africa, Indonesia.

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[3]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 1. Marine turtles: IUCN threat status for all marine turtle species reported as caught in fisheries within the IOTC area of competence.

Common name	Scientific name	IUCN threat status[4]
Flatback turtle	*Natator depressus*	Data deficient
Green turtle	*Chelonia mydas*	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Critically Endangered
Leatherback turtle	*Dermochelys coriacea*	Vulnerable (Globally)
(N. East Indian Ocean subpopulation)		Data deficient
(S. West Indian Ocean subpopulation)		Critically Endangered
Loggerhead turtle	*Caretta caretta*	Vulnerable (Globally)
(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

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Stock status. No assessment has been undertaken by the IOTC WPEB for marine turtles due to the lack of data being submitted by CPCs. However, the current International Union for Conservation of Nature (IUCN) threat status for each of the marine turtle species reported as caught in IOTC fisheries to date is provided in **Table 1**. It is important to note that a number of international global environmental accords (e.g., Convention on Migratory Species (CMS), Convention on Biological Diversity (CBD), as well as numerous fisheries agreements obligate States to provide protection for these species. In particular, there are now 35 Signatories to the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA MoU). Of the 35 Signatories to the IOSEA MoU, 25 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 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

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

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 at-vessel and post-release mortality in IOTC fisheries and improve data collection and reporting for marine turtles. This may include alternative data collection mechanisms such as skipper-based reporting, port sampling and cost-effective electronic monitoring systems.

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APPENDIX 31
EXECUTIVE SUMMARY: SEABIRDS

Table 1. IUCN threat status for all seabird species reported as caught in fisheries within the IOTC area of competence.

Common name	Scientific name	IUCN threat status[5]
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

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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 1**. A number of international global environmental accords (e.g., Convention on Migratory Species (CMS), the Agreement on the Conservation of Albatrosses and Petrels (ACAP), Convention on Biological Diversity (CBD)), as well as numerous fisheries agreements obligate States to provide protection for these species. While the status of seabirds is affected by a range of factors such as degradation of nesting habitats and targeted harvesting of eggs, for albatrosses and large petrels, fisheries bycatch is generally considered to be the primary threat. The level of mortality of seabirds due to fishing gear in the Indian Ocean is poorly known, although where there has been rigorous assessment of impacts in areas south of 25 degrees (e.g., in South Africa), very high seabird incidental catches rates have been recorded in the absence of a suite of proven incidental catches mitigation measures.

Outlook. The level of compliance with Resolution 23/07 (*On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries)* and the frequency of use of each of the 4 measures (because vessels can choose two out of three possible

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

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 23/07 are not implemented.
- CPCs that have not fully implemented the provisions of the IOTC Regional Observer Scheme outlined in paragraph 3 of Resolution 22/04 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 23/07.

APPENDIX 32
EXECUTIVE SUMMARY: CETACEANS

Table 1. Cetaceans: IUCN Red List status and records of interaction (including entanglements and, for purse seines, encirclements) with tuna fishery gear types for all cetacean species that occur within the IOTC area of competence.

Family	Common name	Species	IUCN Red List status*	Interactions by Gear Type**
Balaenidae	Southern right whale	*Eubalaena australis*	LC	GN
Neobalaenidae	Pygmy right whale	*Caperea marginata*	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*	LC	-
	Blue whale	*Balaenoptera musculus*	EN	-
	Fin whale	*Balaenoptera physalus*	VU	-
	Omura's whale	*Balaenoptera omurai*	DD	-
	Humpback whale	*Megaptera novaeangliae*	LC***	GN, LL
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*	LC	-
	Southern bottlenose whale	*Hyperoodon planifrons*	LC	-
	Longman's beaked whale	*Indopacetus pacificus*	LC	GN
	Andrew's beaked whale	*Mesoplodon bowdoini*	DD	-
	Blainville's beaked whale	*Mesoplodon densirostris*	LC	-
	Ramari’s beaked whale	*Mesoplodon eueu*	DD	-
	Gray's beaked whale	*Mesoplodon grayi*	LC	-
	Hector's beaked whale	*Mesoplodon hectori*	DD	-
	Deraniyagala's beaked whale	*Mesoplodon hotaula*	DD	-
	Strap-toothed whale	*Mesoplodon layardii*	LC	-
	Spade-toothed whale	*Mesoplodon traversii*	DD	-
	Shepherd's beaked Whale	*Tasmacetus shepherdi*	DD	-
	Cuvier's beaked whale	*Ziphius cavirostris*	LC	GN
Delphinidae	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

	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
Delphinidae	Indo-Pacific humpback dolphin	*Sousa chinensis*	VU	GN
	Indian Ocean humpback dolphin	*Sousa plumbea*	EN	GN
	Australian humpback dolphin	*Sousa sahulensis*	VU	GN
	Pantropical spotted dolphin	*Stenella attenuata*	LC	PS, GN, LL
	Striped dolphin	*Stenella coeruleoalba*	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
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Downloaded on 16 September 2020.

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Stock status. The current[6] International Union for Conservation of Nature (IUCN) Red List status for each of the cetacean species reported in the IOTC Area of Competence is provided in Table 1. Information on their interactions with IOTC fisheries is also provided. It is important to note that a number of international global environmental accords (e.g., Convention on Migratory Species (CMS), Convention on Biological Diversity (CBD), International Whaling Commission (IWC)), as well as numerous fisheries agreements obligate States to provide protection for these species. The status of cetaceans is affected by a range of factors such as direct harvesting and habitat degradation, but the level of cetacean mortality due to capture in tuna drift gillnets is likely to be substantial and is also a major cause for concern (Anderson *et al.* 2020, Kiszka *et al.* 2021). Several 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 23/06 *On the conservation of cetaceans* highlights the concerns of the IOTC regarding the lack of accurate and complete data collection and reporting to the IOTC Secretariat of interactions and mortalities of cetaceans in association with tuna fisheries in the IOTC Area of Competence. In this resolution, the IOTC have agreed that CPCs shall prohibit their flagged vessels from intentionally setting a purse seine net around a cetacean if the animal is sighted prior to the commencement of the set. The IOTC also agreed that CPCs using other gear types targeting tuna and tuna-like species found in association with cetaceans shall report all interactions with cetaceans to the relevant authority of the flag State and that these will be reported to the IOTC Secretariat by 30 June of the following year. It is acknowledged that the impact on cetacean populations from fishing for tuna and tuna-like species may increase if fishing pressure increases (which is already clear for tuna gillnet fisheries from IOTC data) or

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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.
- Current reported interactions and mortalities are scattered but are most likely severely underestimated (Anderson *et al*., 2020, Kiszka *et al*., 2021).
- 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.
- Efforts should be undertaken to encourage CPCs to investigate means to reduce cetacean bycatch and at-vessel and post-release mortality in IOTC fisheries and improve data collection and reporting for cetaceans. This may include alternative data collection mechanisms such as skipper-based reporting, port sampling and cost-effective electronic monitoring systems.

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APPENDIX 33
STATUS OF YELLOWFIN TUNA CATCH LIMITS FOR 2023 AND 2024 PURSUANT TO RESOLUTIONS 19/01 AND 21/01

Table 1: calculated / estimated total catch limits for 2023 and 2024 for all CPCs bound to Resolution 21/01

YFT annual catch limits (t) for 2023 (calculated) and 2024 (estimated) as per Res. 21/01			
CPC	Base annual limit	Catch limits	
		2023	*2024*
AUS – Australia	2,000	2,000	*2,000*
BGD – Bangladesh	2,000	2,000	*2,000*
CHN – China	10,557	7,658	*7,642*
COM – Comoros	5,279	5,279	*5,279*
ERI – Eritrea	2,000	2,000	*2,000*
EU – European Union	73,078	72,091	*73,078*
FRA – France (territories)	500	500	*500*
GBR – United Kingdom	500	500	*500*
JPN – Japan	4,003	4,003	*4,003*
KEN – Kenya	3,654	3,654	*3,654*
KOR – Republic of Korea	9,056	9,056	*9,056*
LKA – Sri Lanka	33,245	33,245	*33,245*
MDV – Maldives	47,195	47,195	*47,195*
MOZ – Mozambique	2,000	2,000	*2,000*
MUS – Mauritius	10,490	10,490	*10,490*
MYS – Malaysia	2,000	2,000	*2,000*
PAK – Pakistan	14,468	14,468	*14,468*
PHL – Philippines	700	700	*700*
SDN – Sudan	2,000	2,000	*2,000*
SYC – Seychelles	39,577	36,587	*39,577*
THA – Thailand	2,000	2,000	*2,000*
TZA – Tanzania	3,905	3,905	*3,905*
YEM – Yemen	26,262	26,262	*26,262*
ZAF – South Africa	2,000	2,000	*2,000*
Totals	298,469	291,593	*295,024*

Table 2: Calculated / estimated catch limits for 2020-2023 and 2024 for industrial fisheries of all CPCs bound to Resolution 19/01

YFT annual catch limits (t) for 2020-2023 (calculated) and 2024 (estimated) as per Res. 19/01							
CPC	**Fishery**	**Base annual limit**	**Catch limits**				
			2020	**2021**	**2022**	**2023**	***2024***
IDN – Indonesia	**LL**	-	-	-	-	-	-
	PS	**4,833**	**4,833**	**4,095**	**3,961**	**4,136**	***4,833***
IND - India	**LL**	-	-	-	-	-	-
IRN – I.R. Iran	**GN**	**16,948**	**16,948**	**-12,490**	**-398**	**-16,798**	***-7,087***
	PS	-	-	-	-	-	-
MDG – Madagascar	**LL**	-	-	-	-	-	-
OMN – Oman	**LL**	-	-	-	-	-	-
SOM – Somalia	**IND**	-	-	-	-	-	-

APPENDIX 34
PROGRESS MADE ON THE RECOMMENDATIONS OF SC25

SC25 Report	SC recommendations	Update/Progress
SC25.08 Para. 30	***National Reports from CPCs*** The SC **RECOMMENDED** that the Compliance Committee and Commission note the lack of compliance by 5 Contracting Parties (Members) that did not submit a National Report to the Scientific Committee in 2022, **NOTING** that the Commission agreed that the submission of the annual reports to the Scientific Committee is mandatory.).	**Update:** Ongoing. (IOTC-2023-S27-R, Para 17) The Commission NOTED that 26 National Reports were submitted to the IOTC Secretariat in 2022 by CPCs and that this was an increase when compared with the 21 reports provided by CPCs in 2021.
SC25.09 Para.41	***Report Of The 12th Session of the Working Party 0n Neritic Tunas (WPNT12)*** The SC **NOTED** with concern the stock status of Longtail tuna and Narrow-barred Spanish Mackerel. The SC further **NOTED** that the stock statuses for these species have been in the red for at least the past 5 years with a high probability and are showing no sign of recovery. As such, the SC **RECOMMENDED** that the Commission take measures to reduce the catches (to at least MSY levels) of these species and develop management measures that will facilitate the recovery of these stocks.	**Update:** Ongoing. No new management measures have been adopted for neritic tuna species.
SC25.10 Para. 52	***Report of the 20th Session of the Working Party on Billfish (WPB20)*** The SC **NOTED** that reported catches of black marlin and Indo-Pacific sailfish have exceeded the limits set out in Resolution 18/05 for both 2020 and 2021. The SC further noted that catches of both species are predominantly taken by gillnet and as such, **RECOMMENDED** that any revision of Resolution 18/05 should focus mainly on gillnet fisheries, to be effective.	**Update:** Ongoing. No Revision to Resolution 18/05 has taken place.
SC25.11 Para. 53	The SC **NOTED** that striped marlin and blue marlin assessments indicate these species to be overfished and subject to overfishing, with 100% and 72% probability, respectively. The SC advised that projections and associated Kobe 2 Strategy Matrices (K2SM) are available for both species and **RECOMMENDED** that any revision of Resolution 18/05 catch limits with respect to these species should be based on projections as opposed to MSY estimates, given the need to rebuild these stocks.	**Update:** Ongoing. No Revision to Resolution 18/05 has taken place.
SC25.12 Para. 54	The SC **NOTED** that the current minimum size limit in Res 18/05 (60 cm LJFL) is unlikely to be effective for these species, with the possible exception of blue marlin, due to the high at-haul mortality and low post release survival of these species particularly when taken by gillnet. For blue marlin, it is **RECOMMENDED** that further management options relating to limiting retention, including the option of increasing the current minimum size limit, be considered.	**Update:** Ongoing. No new management measures for billfish species have been adopted.
SC25.13 Para. 62	***Report of the 18th Session of the Working Party on Ecosystems and Bycatch (WPEB18)*** The SC **NOTED** the evidence indicating the increased operation of squid fisheries in the high seas of the Indian Ocean, and particularly in fishing grounds which overlap with areas where tuna purse seine fleets operate, NOTING that this overlap results in bycatch of tuna and tuna-like species in the squid fishery. However, as these fisheries are not managed by IOTC, data on these	**Update:** Ongoing. The issue was not raised at the latest Commission meeting. Data submitted to the Compliance department at the Secretariat indicated that in most cases, only small pelagics and other non-IOTC species were being encountered by these vessels.

	catches of tuna and tuna-like species are not provided to the IOTC. Therefore, the SC **RECOMMENDED** that the Commission request that the CPCs report all catches of tuna to the IOTC regardless of the target species of the fishery. The SC further **REQUESTED** that the Commission seek more information on this fishery from the CPCs.	
SC25.14 Para. 63	The SC **NOTED** the evidence provided to the WPEB on the effectiveness of hook-shielding devices in reducing seabird bycatch mortality in pelagic longlines and further **NOTED** that the WCPFC included the hook-shielding devices in 2018 as an option to mitigate longline seabird bycatch. The SC **ACKNOWLEDGED** the potential operational difficulties and costs of utilising these devices as well as the potential limited number of manufacturers. However, based on the scientific evidence (supported by the ACAP guidelines) the SC **RECOMMENDED** that the Commission consider including hook-shielding devices as an additional option for seabird bycatch mitigation measures in Resolution 12/06. The SC **NOTED** that this had previously been recommended as a stand-alone measure in 2016 for the proposed revision of 12/06 (IOTC-2016-SC19-R para. 69).	**Update:** Completed. The Commission adopted Resolution 23/07 *On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries* which allows for the use of hook-shielding devices as a mitigation measure.
SC25.15 Para. 64	The SC **NOTED** the potential for using artificial lights (a visual deterrent) in gillnet fisheries as a potential bycatch mitigation device and the need to test this further via LED trials, which could also determine if such lights might attract unwanted bycatch. However, the SC **NOTED** that Resolution 16/07 prohibits Fishing vessels and other vessels including support, supply and auxiliary vessels to use, install or operate surface or submerged artificial lights for the purpose of aggregating tuna and tuna-like species. However, the SC **NOTED** that it is not clear if this also applies to gillnets. Therefore, the SC **RECOMMENDED** that the Commission provide clarification on whether Resolution 16/07 also applies to gillnet fisheries and/or to scientific studies as the current wording is somewhat ambiguous.	**Update:** Completed. (IOTC-2023-S27-R, para 32) The Commission **NOTED** in particular, SC Recommendation 15 that Resolution 16/07 On the use of artificial lights to attract fish (which prohibits using artificial lights for the purpose of aggregating tuna and tuna-like species) does not apply to scientific studies. NOTE: The Commission did not address the issue with regards to gillnet fisheries.
	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	
SC25.16 Para. 68	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. The SC chair presented 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 to the Commission in 2023.
	Other matters	
SC25.17 Para. 73	The SC **ACKNOWLEDGED** the proposed Cooperation Agreement between the IOSEA Marine Turtle MOU and IOTC and **NOTED** that this Agreement is based on the language used in the Agreement between IOTC and ACAP which has been accepted by the Commission. The SC **NOTED** this will facilitate better exchange of scientific information and data on sea turtles and their fishery interactions relevant to future commission discussions and decisions on this issue. The SC **RECOMMENDED** that the proposed Agreement is presented at the Commission for further consideration.	**Update:** Completed. The Commission approved the signature of a Collaboration Agreement with the IOSEA Marine Turtle MOU.

SC25.18 Para. 98 SC25.19 Para. 99	***Report of the 24th Session of the Working Party on Tropical Tunas (WPTT24)*** ***Bigeye tuna MP*** The SC **NOTED** that the application of the bigeye management procedure resulted in a recommended TAC of 80,583 t per year for 2024 and 2025, which requires a 15% catch reduction from the 2021 catch level. The SC **RECOMMEND** that the Commission endorse the calculated TAC for 2024 and 2025. Given average catch of BET in the past 5 years being above the calculated TAC for 2024 and 2025 and the lack of effective implementation of catch limits for other stocks in the IOTC, the SC **RECOMMENDED** that the Commission ensure effective implementation of the bigeye management procedure recommended TAC, especially taking into consideration the current overfished and subject to overfishing status of the stock. The SC **NOTED** that respecting the BET TAC is especially important when taking into consideration the multi-species nature of the Tropical tuna fisheries and especially taking into account the existing catch limit for YFT and TAC for SKJ.	**Update**: Completed. The Commission adopted **Resolution 23/04** *On Establishing Catch Limits for Bigeye Tuna in the IOTC Area of Competence*. This Resolution contains the endorsed TAC for bigeye, which is unchanged from the SC advice. **Update**: Ongoing. The implementation of the BET TAC is included in Res 23/04.
SC25.20 Para. 118 SC25.21 Para. 122 SC25.22 Para. 123	***Report of the 13th Session of the Working Party on Methods (WPM13)*** The SC **NOTED** that the 1-year time gap between the running of an MP by the SC and its actual implementation is less than ideal. The SC **NOTED**, however, that such a delay in the implementation has been MSE tested for the adopted BET MP and thus its effect on the performances has been already taken into account. The SC **RECOMMENDED** that the Commission identify and adopt a decision-making process to shorten the delay in the implementation of the MP output. ***Update on TCMP05*** The SC **QUERIED** whether it would be necessary to hold a virtual TCMP meeting early in the year if no MPs are considered ready for presentation to the TCMP that particular year. The SC **RECOMMENDED** that there is no need to organize a virtual TCMP as no candidate MPs will be ready for consideration for adoption in 2023. The SC however **CONSIDERED** that it is advisable to have focused dialogue with managers on those MSE which are more advanced such as that for SKJ. The SC **RECOMMENDED** that a virtual TCMP is tentatively convened early in 2024 with a special focus on MSE for SKJ.	**Update**: Ongoing. The Commission has not yet found a solution to the delay issue. **Update**: Completed. The Commission agreed to defer the February 2023 TCMP meeting until 2024.
	Report of the 18th Session of the Working Party on Data Collection and Statistics (WPDCS18) ***Updates to the workflow for the management and submission of statistical data to the IOTC*** SC25.23 (para. 130) The SC **RECOMMENDED** that the Commission **ENDORSE** the proposed improvements in the data submission process of fisheries statistics, including a) the new approach for the classification of IOTC fisheries, and b) the adoption of the new data submission forms**.** SC25.24 (para. 131) The SC **RECOMMENDED** that the Commission **ENDORSE** the mandatory reporting of fishing craft statistics and that this change is included in the next revision of Res. 15/02**.**	**Update**: Completed. The Commission endorsed the SC recommendations as its own. **Update**: Ongoing. Although a proposal was presented to the Commission to revise Res. 15/02, it was ultimately not adopted.

	SC25.25 (para. 132) The SC **RECOMMENDED** that, once the Commission adopts data requirements for IOTC fisheries, the Commission **DELEGATES** the adoption of data standards and submission forms to the SC to facilitate reporting by the CPCs.	**Update**: Completed. The Commission endorsed the SC recommendations as its own.
	SC25.26 (para. 133) The SC **NOTED** that some of the paragraphs in some of the Resolutions are either unclear or inconsistent and therefore the SC **RECOMMENDED** the Commission to **ENDORSE** the following changes for inclusion in the next revision of the relevant IOTC Resolutions: a. that silky shark (*Carcharhinus falciformis*) be included in the list of "*other*" species appearing in the gillnet table in Section 2.3 of Annex II of Res. 15/01; b. that the terms "*shall be submitted frequently*" appearing in para. 4.c of Res. 15/02 be further clarified and complemented by a clearer indication of the spatial-temporal stratification of the dataset concerned; c. that para. 4.c of Res. 15/02 be amended with the inclusion of the request that "*Documents describing the extrapolation procedures (including raising factors corresponding to the logbook coverage) shall also be submitted routinely*" that already appears in both para. 4.a and 4.b of Res. 15/02; d. that para. 5 of Res. 15/02 be amended with the inclusion of "*and all other relevant gears*" in addition to purse seiners already mentioned in this paragraph; e. that para. 26 of Res. 19/02 be amended to also allow the use of buoy position data for scientific purposes, and to further clarify how to protect business confidentiality aspects as per para. 24 of Res. 19/02.	**Update**: Ongoing. Although two proposals were presented to the Commission to revise Resolutions 15/01 and 15/02, they were ultimately not adopted. No change was made to Res. 19/02.
	SC25.27 (para. 134) The SC **RECOMMENDED** the Commission to **STRENGTHEN** the requirements for the monitoring of artisanal and semi-industrial fisheries to improve the collection, reporting and the quality of Neritic tunas and Billfish fisheries statistics.	**Update**: Ongoing. No new Resolutions were adopted regarding data collection or reporting.
	Update on WGEMS02 SC25.28 (para. 148) The SC reviewed and **ENDORSED** a) the EM terms and definitions b) the EM Program standards, and c) the EM Data standards described in Appendices 6A, 6B and 6C (except Annex 1 and 2 to be adopted in March 15-16), respectively, and **RECOMMENDED** their adoption by the Commission.	**Update**: Completed. The Commission adopted **Resolution 23/08** *On Electronic Monitoring Standards for IOTC Fisheries.* This Resolution takes into account the recommendations from the SC.
SC25.29 Para. 151	***Invited Expert(s) at the WP meetings*** 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.	**Update**: Ongoing. The Commission has provided budget for invited experts for 2024.
SC25.30 Para. 153	***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	**Update**: No progress. The Rules of Procedure have not been modified to reflect this requested change.

	suitability of the application to receive funding using the IOTC MPF. The earlier submission dates would also assist with visa application procedures for candidates.	
SC25.31 Para. 154	***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 CPC scientific observers, both on board and at port, need to have hard copies.	**Update**: Ongoing. Budget has been made available through the IOTC main budget and the OFCF project to continue the printing of ID cards and this has continued in 2023 and will do again in 2024.
SC25.32 Para. 156 SC25.33 Para. 157	***General - Chairpersons and Vice-Chairpersons of the SC and its subsidiary bodies*** **ACKNOWEDGING** the need to have officers with sufficient experience and capability to serve as Chairs and Vice-chairs of the SC Working Parties and Working Groups, the SC **RECOMMENDED** that the Commission revise the current Rules of Procedure (if necessary) to allow Chairs to serve an additional year or years beyond two terms if no suitable candidates are available to replace them once their terms are completed. 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. The Commission endorsed the SCs Recommendations as their own. No change to the Rules of Procedure were made, but there was no disagreement with the recommendation to allow chairs to extend their terms if necessary to ensure sufficient capacity. **Update:** Completed.
SC25.34 Para. 172	***Implementation of the Regional Observer Scheme*** The SC **RECOMMENDED** that the Commission **ENDORSE** the mandatory reporting of geo-referenced effort data as number of sets/operations for longline and surface fisheries (according to the definitions in Res 15/02) to complement the current requirements of Res. 15/02, in order for the Secretariat to accurately and independently calculate the ROS coverage in agreement with the provisions of Res. 22/04**.**	**Update:** Ongoing. No new Resolutions were adopted regarding data collection or reporting.
SC25.35 Para. 186	***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 2023.
SC25.36 Para. 188	***Data preparatory meetings and Hybrid meetings*** **ACKNOWLEDGING** that holding data preparatory meetings prior to stock assessments is considered to be best practice and noting that since 2019 data preparatory meetings were successfully held for the WPTmT, WPTT and WPEB, the SC **AGREED** to continue the practice of having data preparatory meetings prior to stock assessment meetings for the major IOTC species. The SC **RECOMMENDED** that data preparatory meetings continue to be held virtually so as not to increase the travel and costs required for the already full IOTC timetable of meetings.	**Update:** Completed. All data preparatory meetings as well as working group meetings were held virtually in 2023.

SC25.37 Para. 189	The SC **NOTED** the utility of facilitating both in-person and virtual participation at future meetings to ensure increased participation and reduce the logistical costs for many CPCs. As such, the SC **RECOMMENDED** that future working party and Scientific Committee meetings are held in a hybrid format.	**Update:** Completed. All working party meetings as well as the Scientific Committee meeting were held in a hybrid format in 2023.

APPENDIX 35A
WORKING PARTY ON NERITIC TUNAS PROGRAM OF WORK (2024 – 2028)

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				
		2024	2025	2026	2027	2028
1. 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)). ➢ Reconstruction of historical catch by CPCs using recovered or captured information. ➢ Re-estimation of historic catches (with consultation and consent of concerned CPCs) 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)					
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, Spanish mackerel and kawakawa					
3. Biological information (parameters for stock assessment) including stock structure (connectivity)	Quantitative biological studies are necessary for all neritic tunas throughout their range to determine key biological parameters including age-at-maturity, and fecundity-at-age/length relationships, age-length keys, age and growth, longevity which will be fed into future stock assessments. Priorities for longtail tuna, kawakawa and Spanish mackerel. Genetic research to determine the connectivity of neritic tunas throughout their distributions (This should build on the stock structure work conducted in other previous studies)					

Other Future Research Requirements						
4. Social economic study	1. Undertake quantitative studies on socio-economic aspects of all neritic tunas throughout their range, to determine and explore other sources of data, such as but not limited to trade data from individual countries, nominal catch or other catch data on neritic tuna, information on important and significance of neritic for food security (animal protein), nutrition, contribution to national GDP. (priority countries, Indonesia, Iran, India, Malaysia, Thailand, Pakistan) 2. Identify and utilise other sources of information, by engaging with other bodies such as SEAFDEC, SEAFO, RECOFI, BOBLME, SWIOFC, IOC, among others. 3. Integrate or evaluate market support and recognition for neritic tuna (sub-regional markets) with a focus on data acquisition. 4. Explore alternate sources of data collection, including the rapid use of citizen science-based approaches which are reliable and verified by the SC. 5. Assess/scope/explore the significance and importance of neritic species for food security, nutrition and contribution to national GDP. 6. Strengthen the data collection of catches and species complexes and develop socio-economic indicators of neritic species, related to the national and regional livelihoods and economics of coastal CPCs. 7. Collate information and address data gaps and challenges by taking advantage of regional programmes or joint collaboration with NGOs/CPCs in order to support and facilitate data collection for neritic species.					

APPENDIX 35B
WORKING PARTY ON TEMPERATE TUNAS PROGRAM OF WORK (2023 – 2027)

Table 1. Priority topics for obtaining the information necessary to develop stock status indicators for albacore in the Indian Ocean (2023-2027). No WPTmT meeting was held in 2023 to update this plan.

Topic		Sub-topic and project	Priority	Timing				
				2023	2024	2025	2026	2027
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)					
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)					
		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.						
		2..1.2 Quantitative biological studies are necessary for albacore throughout its range to determine spatio-temporal patterns in 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.						

3	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 (3)					
		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.						
4	Size frequency data	4.1 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 (2)					
5	Management strategy evaluation	5.1 Continue to collaborate with the WPM on input to the Management Strategy Evaluation (MSE) process.	High (4)					

APPENDIX 35C
WORKING PARTY ON BILLFISH PROGRAM OF WORK (2024 – 2028)

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				
		2024	2025	2026	2027	2028
1. 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 inter-sessionally 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).					
2. Biological and ecological information	2.1 Age and growth research 2.1.1 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)					
	2.2 Spawning time and locations 2.2.1 Collect gonad samples from billfish or utilise any other scientific means to confirm the spawning time and location of the spawning areas 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.					
	2.3 Stock structure (connectivity and diversity) 2.3.1 Continue work on determining stock structure of Billfish species, using complimentary data sources, including genetic and microchemistry information as well as other relevant sources/studies.					
3. Billfish bycatch mitigation	WPB and CPCs scientists to firstly, review and summarise existing information on billfish bycatch mitigation, including also factors influencing at-haul and post-release mortality of billfish, and secondly to undertake further research to inform gaps in understanding on potential effective mitigation approaches, to provide options for the Commission to reduce fishing mortality for species where that is required (e.g. Black Marlin, Striped Marlin and					

	Sailfish) focusing on gillnet and longline fisheries but also including recreational and sport fishing activities .					
	Other Future Research Requirements (not in order of priority)					
1. Data mining and processing – (Development of subsequent CPUE indices)	Data on gillnet fisheries are available in Pakistan (and potentially other CPCs) and the recovery of this information and the development of gillnet CPUE indices would improve species assessments, particularly for: • Black marlin • Sailfish					
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.					
8. Close-Kin Mark-Recapture studies	Review of CKMR applicability for Billfish species and potential feasibility study					
9. 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.					

10. Billfish as bycatch	How to provide scientific advice to management on billfish caught as bycatch					

APPENDIX 35D
WORKING PARTY ON ECOSYSTEMS AND BYCATCH PROGRAM OF WORK (2024 – 2028)

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				
		2024	2025	2026	2027	2028
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.					
1. Fisheries data collection	1.1 Catch composition reconstruction (initial focus Sri Lanka, Pakistan and Indonesia)					
	1.1.2 Historical data mining for the key species and IOTC fleets (e.g., as artisanal gillnet and longline coastal fisheries) including workshops:					
	1.1.3 Historical data mining for the key species, including the collection of information about catch, effort and spatial distribution of those species and fleets catching them					
	1.1.4 CPUE standardisation and review of additional abundance indicators series for each key shark species and fishery in the Indian Ocean					
2. Shark research and management strategy	2.1 Implementation of work suggested by shark work plan consultancy					
	2.2 Prioritising shark research based on previous work and including analysing gaps in knowledge					

3. Ecoregions development	Support for the development and refinement of ecoregions in the Indian Ocean: • Development of a pilot study (focused on two ecoregions: one coastal, the Somali Current ecoregion and one oceanic, the Indian Ocean Gyre ecoregion)					

Other Future Research Requirements (not in order of priority)

Topic	Sub-topic and project	2024	2025	2026	2027	2028
1. Review and improve data collection for mobulid rays	1.1 Mobulid ID guide revision and translation. ID guides to be updated with help of CPC scientists					
2. Bycatch mitigation measures	2.1 Gears 2.1.1 Undertake a series of gear specific workshops focusing on multi-taxa bycatch issues					
	2.1.2 Develop studies on bycatch mitigation measures for the main gears using in the IOTC area (operational, technological aspects and best practices)					
	2.2 Sharks a) Harmonise and finalise guidelines and protocols for safe handling and release of sharks and rays caught in IOTC fisheries					
	2.3 Sea turtles 2.3.1 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					
	2.3.2 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.					

	2.3.3 Regional workshop to review the effectiveness of marine turtle mitigation measures					
	2.3.4 Harmonise and finalise guidelines and protocols for safe handling and release of sea turtles caught in IOTC fisheries					
	2.3 Seabirds 2.3.1 Bycatch assessment for seabirds taking into account the information from the various ongoing initiatives in the IO and adjacent oceans					
	2.3.2 Study on cryptic mortality of seabirds in tuna LL fisheries.					
	2.3.3 Study post release survival rates for seabirds and harmonise and finalise guidelines and protocols for safe handling and release of seabirds caught in IOTC fisheries					
	2.4 Cetaceans 2.4.1 Testing mitigation methods for cetacean bycatch in tuna drift gillnet fisheries					
	2.4.2 Harmonise and finalise guidelines and protocols for safe handling and release of cetaceans caught in IOTC fisheries					
	2.4.3. Intersessional meeting to discuss cetacean guidelines, ERA, Data gaps.					

3. CPUE standardisation / Stock Assessment / Other indicators	3.1 Develop standardised CPUE series for each key shark species and fishery in the Indian Ocean:					
	3.1.1 Development of CPUE guidelines for standardisation of CPC data.					
	3.1.2 Blue shark: Priority fleets: TWN,CHN LL, EU,Spain LL, Japan LL; Indonesia LL; EU,Portugal LL					
	3.1.3 Shortfin mako shark: Priority fleets: Longline and Gillnet fleets					
	3.1.4 Oceanic whitetip shark: Priority fleets: Longline fleets; purse seine fleets					
	3.1.5 Silky shark: Priority fleets: Purse seine fleets					
	3.2 Joint CPUE standardization across the main LL fleets for silky shark, using detailed operational data					
	3.3 Stock assessment and other indicators					
4. Ecosystems	4.1 Develop a plan for Ecosystem Approach to Fisheries (EAF) approaches in the IOTC, in conjunction with the Common Oceans Tuna Project.					
	4.1.2 Workshop for CPCs on continuing efforts to the development of an EAF including delineation of candidate eco regions within IOTC.					
	4.1.3 Practical Implementation of EBFM with the development and testing of ecosystem report cards.					
	4.1.4 Evaluation of EBFM plan in IOTC area of competence by the WPEB to review its elements components and make any corrective measures.					
	4.2 Assessing the impacts of climate change and socio- economic factors on IOTC fisheries					

4.3 Evaluate alternative approaches to ERAs to assess ecological risk					
4.4 Progress on Climate webpage on IOTC website and liaise with WPDCS for technical implementation					

APPENDIX 35E
WORKING PARTY ON TROPICAL TUNAS PROGRAM OF WORK (2024 – 2028)

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				
		2024	2025	2026	2027	2028
Stock assessment priorities	Address the issues identified as priorities by the yellowfin tuna peer review panel (February 2023)					
Abundance indices development	In view of the coming assessments of yellowfin, bigeye, and skipjack develop abundance time series for each tropical tuna stock for the Indian Ocean • Continue to develop CPUE indices from Longline, PS, Pole and line fisheries, and fishery independent indices of abundance such as those derived from echosounder buoys. • Explore and support the development of gillnet CPUE indices for fleets (e.g., Iran, Pakistan and Sri Lanka) • Evaluate effect of changes of spatial coverage on the longline CPUE through the Joint CPUE workshop and estimate spatial temporal abundance distribution through VAST modelling approach					
Analysis of tagging data	Analyze data from IOTC tagging programs outside stock assessment models and evaluate its utility and impact on stock assessments.					
Analyse recommendations from independent review	Carry out analyses recommended by the independent review of the yellowfin tuna stock assessment. Explore options, for example, for spatial structure, recruitment trends, movement dynamics, data weighting, selectivity before the 2024 WPTT Data Preparatory meeting.					
Analysis of environmental factors	Evaluate the impact of environmental factors on the dynamics of tropical tuna stocks					

Other Future Research Requirements (not in order of priority)						
1. Fisheries Independent Monitoring	1.1 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).					

	Plan for a staged approach for implementation of a YFT CKMR project					
2. Stock structure (connectivity and diversity)	2.1 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.					
	2.2 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).					
	Connectivity, movements and habitat use					
	2.3 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). 2.4 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.					
3. Biological and ecological information (incl. parameters for stock assessment)	3.1 Biological sampling					
	3.1.1 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.					
	3.1.2 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.					
4. Historical data review	4.1 Changes in fleet dynamics need to be documented by fleet					
	4.1.1 Provide an evaluation of fleet-specific fishery impacts on the stock of bigeye tuna, skipjack tuna and yellowfin tuna. Project potential impact of realizing fleet development plans on the status of tropical tunas based upon most recent stock assessments.					

5. CPUE standardisation	5.1 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). 5.11 Investigate the potential to use the Indian longline survey as a fishery-independent index of abundance for tropical tunas.					
6. Stock assessment stock indicators	6.1 Develop and compare multiple assessment approaches to determine stock status for tropical tunas 6.2 Scoping of ongoing age composition data collection for stock assessment 6.3 Develop a high-resolution age structured operating model that can be used to test the spatial assumptions including potential effects of limited tags mixing on stock assessment outcomes (see Terms of Reference, Appendix IXa IOTC-2017-WPTT19-R).					
7. Fishery monitoring	7.1 Develop fishery independent estimates of stock abundance to validate the abundance estimates of CPUE series. All of the tropical tuna stock assessments are highly dependent on relative abundance estimates derived from commercial fishery catch rates, and these could be substantially biased despite efforts to standardise for operational variability (e.g. spatio-temporal variability in operations, improved efficiency from new technology, changes in species targeting). Accordingly, the IOTC should continue to explore fisheries independent monitoring options which may be viable through new technologies. There are various options, among which some are already under test. Not all of these options are rated with the same priority, and those being currently under development need to be promoted, as proposed below: Acoustic FAD monitoring, with the objective of deriving abundance indices based on the biomass estimates provided by echo-sounder buoys attached to FADs 7.2 Longline-based surveys (expanding on the Indian model) or “sentinel surveys” in which a small number of commercial sets follow a standardised scientific protocol 7.3 Aerial surveys, potentially using remotely operated or autonomous drones 7.4 Studies (research) on flux of tuna around anchored FAD arrays to understand standing stock and independent estimates of the stock abundance. 7.5 Investigate the possibility of conducting ongoing ad hoc, low level tagging in the region					
8. Target and Limit reference points	8.1 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					
9. Fisheries Indicators	8.2 Examination of additional fisheries indicators and their discussion at WP meetings. Perhaps a section in report to accommodate these. See how this is being addressed in other RFMOs.					

APPENDIX 35F
WORKING PARTY ON DATA COLLECTION AND STATISTICS PROGRAM OF WORK (2024 – 2028)

Table 1. Priority topics for obtaining the information necessary to support the Scientific Committee and deliver the necessary advice to the Commission.

	Topic in order of priority		Sub-topic and project	Timing				
				2024	**2025**	**2026**	**2027**	**2028**
1	**Coastal fisheries data collection**	**1.2**	Assist the implementation of data collection and sampling activities for fisheries insufficiently sampled. Recommended actions include: (regional) training on species identification, designing sampling guidelines for IOTC fisheries. Priority to be given to the following countries / fisheries:					
			• Indonesia					
			• India					
			• Bangladesh					
			• Pakistan					
			• I.R. Iran					
			• Kenya					
			• Somalia					
			• Sri Lanka					
2	**Evaluation of catch and effort data uncertainties**	**2.1**	Review of historical nominal catches and catch-and-effort data for all stocks being assessed in the following years to determine the level of uncertainty to be used for stock assessment and management procedures[1]					
3	**Compliance with IOTC data reporting requirements**	**3.2**	Workshops to clarify data reporting requirements[2] and support preparation of annual submissions					
				2024	**2025**	**2026**	**2027**	**2028**

Other Future Research Requirements (not in order of priority)

Topic	Sub-topic and project	Timing				
		2024	2025	2026	2027	2028
1 Coastal fisheries data collection	**1.1** Implement a region-wide study focusing on the application of FAO methodology for the characterization of Indian Ocean fisheries (Secretariat, CPCs)					
3 Compliance with IOTC data reporting requirements	**3.1** Data support missions					
	3.1.1 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 CPCs / fisheries:					
	• Indonesia					
	• India					
	• Pakistan					
	• Oman					
	• Sri Lanka					
	• Somalia					
	• Tanzania					
	• Other (as required / determined)					
	3.3 Support the documentation of sampling protocols and processing[3]					
4 Data access	**4.1** Improve discoverability of IOTC scientific assets through standard metadata and DOI (e.g., remote workshops)					
	4.2 Scoping study to develop indicators for ocean-climate status and trends through an online atlas linked by the IOTC website (including provision of educational resources)					
5 Support for the implementation of the IOTC Regional Observer Scheme (ROS)	**5.1** ROS e-tools					
	5.1.1 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					

5.2	ROS Regional Database					
5.2.1	Incorporate all historical observer data currently available in other proprietary data formats (e.g., ObServe, ICCAT ST09 and other custom observer forms)					
5.3	ROS Electronic Monitoring Systems					
5.3.1	Implement pilot EMS system on gillnet / coastal longline vessels for fleets insufficiently covered by on-board observers, possibly by providing support through remote / in-person meetings[4]					
5.4	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 to develop protocols and guidelines for minimum data collection requirements in coastal fisheries, including through EMS systems.					
5.5	Revision of ROS data fields through intersessional activity / workshops coordinated by the WPDCS					
		2024	**2025**	**2026**	**2027**	**2028**

APPENDIX 35G
WORKING PARTY ON METHODS PROGRAM OF WORK (2024 – 2028)

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				
		2024	2025	2026	2027	2028
1. Management Strategy Evaluation	Continuation of Management Strategy Evaluation for Albacore, Skipjack, Yellowfin, Bigeye tunas as well as Swordfish					
	Peer review of BET MSE as per the ToRs endorsed by the SC					
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 simulation runs and presentation of results at the TCMP					
	1.1.3 Revision and evaluation of new set of Management Procedures after presentation of MP runs to TCMP and Commission (as needed)					
	1.1.5 External peer review					
	1.2 Skipjack tuna					
	1.2.1 Implementation of simulation runs and presentation of results at the TCMP					

1.2.2 Revision and evaluation of new set of Management Procedures after presentation of MP runs to TCMP and Commission (as needed)					
1.2.3 External peer review (2025-2026)					
1.3 Bigeye tuna					
1.3.1 Run MP using the catch and CPUE standardisation input data, consider exceptional circumstances, and provide the TAC advice					
1.3.2 External peer review					
1.3.3 Presentation of MP application and exceptional circumstances and resulting TAC to the TCMP and Commission meeting for adoption of the TAC					
1.3.4 Stock assessment to provide information on stock status					
1.4 Yellowfin tuna					
1.4.1 Update OM & present preliminary MP results to TCMP, WPTT/WPM review of new OM					
1.4.2 Present revised MP results to TCMP; iteratively update development if required)					
1.4.3 additional iterations if required					
1.5 Swordfish					
1.5.1 Implementation of simulation runs and presentation of results at the TCMP					
1.5.2 Revision and evaluation of new set of Management Procedures after presentation of MP runs to TCMP and Commission (as needed)					

1.5.3 External Peer-review						
Multiple stock status derived from different model structures	Develop specific guidance for the most appropriate models to be used or how to synthesize the results when multiple stock assessment models are presented: model selection and weighting. (*see IOTC-2016-WPTT18-R, para.91*)					
Stock status guidance and reference points.	Review IOTC stock status characterization against reference points and the framework for the provision of management advice (Resolution 15/10) to address the TORs of ad hoc reference point WG.					
CKMR pilot project	Implementation of a CKMR pilot project for Indian Ocean yellowfin tuna to evaluate the logistics and feasibility of sampling, and levels of cross contamination of DNA.					
Capacity Building	Ongoing development of tools, materials and courses to continue Capacity Building for increasing participation in the MSE process and develop improved MSE communication to fishery managers.					

APPENDIX 36
SCHEDULE OF STOCK ASSESSMENTS FOR IOTC SPECIES AND SPECIES OF INTEREST FROM 2024–2028, AND FOR OTHER WORKING PARTY PRIORITIES

Working Party on Neritic Tunas					
Species	**2024***	**2025****	**2026***	**2027***	**2028***
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	**Assessment**
Longtail tuna	Data preparation	Data preparation	**Assessment**	Data preparation	**Assessment**
Narrow-barred Spanish mackerel	Data preparation	Data preparation	**Assessment**	Data preparation	**Assessment**

* 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); one day may be reserved for capacity building activities.

Working Party on Billfish					
Species	**2024**	**2025**	**2026**	**2027**	**2028**
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 trend.

Working Party on Tropical Tunas					
Species	**2024**	**2025**	**2026**	**2027**	**2028**
Bigeye tuna	Indicators **MP to be run**	**Data preparatory meeting** **Full assessment**	Indicators	Indicators **MP to be run**	**Data preparatory meeting** **Full assessment**
Skipjack tuna	Indicators	Indicators	**Data preparatory meeting**	Indicators	Indicators

			Full assessment		
Yellowfin tuna	**Data preparatory meeting** **Full assessment**	Indicators	Indicators	**Data preparatory meeting** **Full assessment**	Indicators

Working Party on Ecosystems and Bycatch					
Species	**2024**	**2025**	**2026**	**2027**	**2028**
Blue shark	–	Data preparatory meeting Full	-	–	–
Oceanic whitetip shark	Data preparation	Indicator analysis	-	Data preparation	–
Scalloped hammerhead shark	–	–	Data preparatory meeting Full assessment	–	–
Shortfin mako shark	Data preparatory meeting Full assessment	–	-	Data preparatory meeting Full assessment	
Silky shark	-	–	Assessment*	-	Assessment*
Bigeye thresher shark	–	–	Assessment*	–	-
Pelagic thresher shark	–	–	Assessment*	–	-
Porbeagle shark	–	–	-	–	Assessment*
Mobulid Rays	Interactions/ Indicators	–	-	Interactions/ Indicators	-
Marine turtles	–	Indicators	-	–	Indicators
Seabirds	Development of draft workplan	–	Review of mitigation measures in Res. 23/06	–	–
Marine Mammals	• Review of mitigation measures • Review of handling guidelines		-	–	–

Data preparatory meeting	• Methods for using available data for assessments • Considering the shark research plan • Consider effectiveness of mitigation measures for a range of taxa				
Ecosystem Based Fisheries Management (EBFM) approaches	Ecoregions pilot study	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	**2024**	**2025**	**2026**	**2027**	**2028**
Albacore		Data preparatory Meeting (4 days) (April/May/June) Stock assessment meeting (5 days) (July/August)	–	–	**TBC**

APPENDIX 37
SCHEDULE OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE MEETINGS
(2024 and 2025)

	2024			2025		
Meeting	**No.**	**Date**	***Location**	**No.**	**Date**	***Location**
Management Strategy Evaluation Task Force of the Working Party on Methods (WPM)	15th	10 – 13 April (4d)	Virtual	16th	February/March	Virtual
Working Party on Ecosystems and Bycatch (Data Preparatory meeting) (WPEB)	20th	22-26 April (5d)	Virtual	21st	TBC	Virtual
Ad hoc Working Group on Electronic Monitoring Systems (WGEMS)	4th	5-7 June (3d)	Virtual	5th	TBC	Virtual
Ad hoc Working Group on FADs (WGFAD)	6th	10 -11 June (2d) (Maybe extend meeting hours – hour earlier)	Virtual	7th	May/June	Virtual
Working Party on Tropical Tunas (Data Preparatory meeting) (WPTT)	26th	12-14 June (3d) (Maybe extend meeting hours)	Virtual	27th	May/June	Virtual
Working Party on Neritic Tunas (WPNT)	14th	8-12 July (5d)	TBC	15th	July	TBC
Working Party on Billfish (WPB)	22nd	4-7 September (4d) (with WPEB)	TBC	23rd	September (with WPEB)	TBC
Working Party on Ecosystems and Bycatch (WPEB)	20th	9-13 September (5d) (with WPB)	TBC	21st	September (with WPB)	TBC
Ad hoc Working Group on FADs (WGFAD)	7th	1-4 October (4d)	Virtual	8th	Virtual	TBC
Working Party on Methods	15th	24-26 October (3d) (with WPTT)	TBC	16th	October (3d) (with WPTT)	TBC
Working Party on Tropical Tunas (Assessment meeting)	26th	28 October – 2 November (6d) (with WPM)	TBC	27th	October (6d) (with WPM)	TBC
Working Party on Data Collection and Statistics	20th	26 – 30 November (5d)	TBC	21st	November (5d)	TBC
Scientific Committee	27th	2 - 6 December (5d)	TBC	28th	December (5d)	TBC

* In accordance with the SC Recommendations, Data Preparatory and Working Group meetings will remain virtual. The Secretariat will endeavour to ensure all remaining meetings are held in a hybrid format.

APPENDIX 38
CONSOLIDATED SET OF RECOMMENDATIONS OF THE 26TH SESSION OF THE SCIENTIFIC COMMITTEE (4 – 8 DECEMBER 2023) TO THE COMMISSION

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

Tuna – Highly migratory species

SC26.01 (para. 159) 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 2022 (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

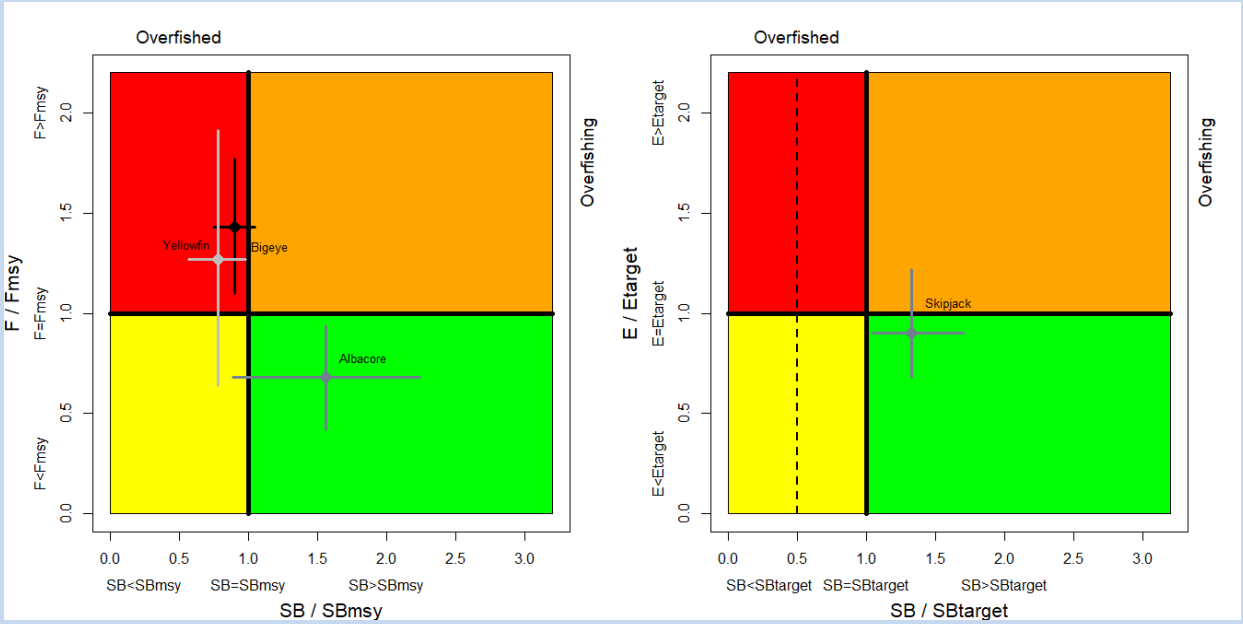

Fig. 1. (Left) Combined Kobe plot for bigeye tuna (black: status in 2021, based on the assessment conducted in 2022), and yellowfin tuna (light grey: 2020, with assessment conducted in 2021) and albacore (dark grey: 2020 with assessment conducted in 2022) showing the estimates of current spawning biomass (SB) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality. (Right) Kobe plot for skipjack tuna (2022 with assessment conducted in 2023) 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).

Tuna and seerfish – Neritic species

SC26.02 (para. 161) 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 2022 (Fig. 2):
Bullet tuna (*Auxis rochei*) – Appendix 12
Frigate tuna (*Auxis thazard*) – Appendix 13
Kawakawa (*Euthynnus affinis*) – Appendix 14
Longtail tuna (*Thunnus tonggol*) – Appendix 15
Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix 16
Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix 17

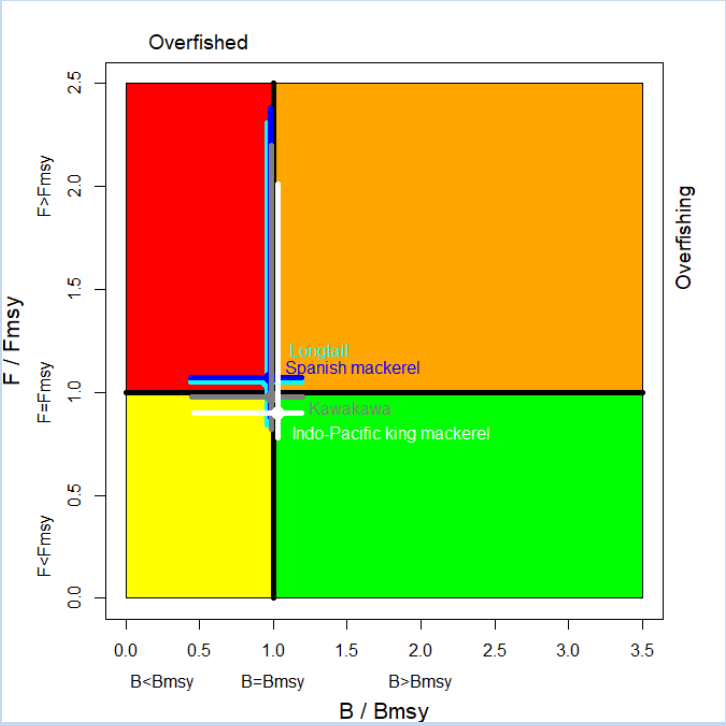

Fig. 2. Combined Kobe plot for longtail tuna (cyan), narrow-barred Spanish mackerel (blue), kawakawa (grey) (all for 2021 with assessment carried out in 2023) and Indo-Pacific king mackerel (2019 with assessment conducted in 2021 (white)), showing the estimates of stock size (B) and current fishing mortality (F) in relation to optimal biomass and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs. Given unresolved uncertainty in the assessment, status for bullet tuna, frigate tuna and Narrow-barred Spanish mackerel should be interpreted with caution.

Billfish

SC26.04 (para. 162) 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 2022 (Fig. 3):
Black marlin (*Istiompax indica*) – Appendix 18
Blue marlin (*Makaira nigricans*) – Appendix 19
Striped marlin (*Kajikia audax*) – Appendix 20
Indo-Pacific sailfish (*Istiophorus platypterus*) – Appendix 21
Swordfish (*Xiphias gladius*) – Appendix 22

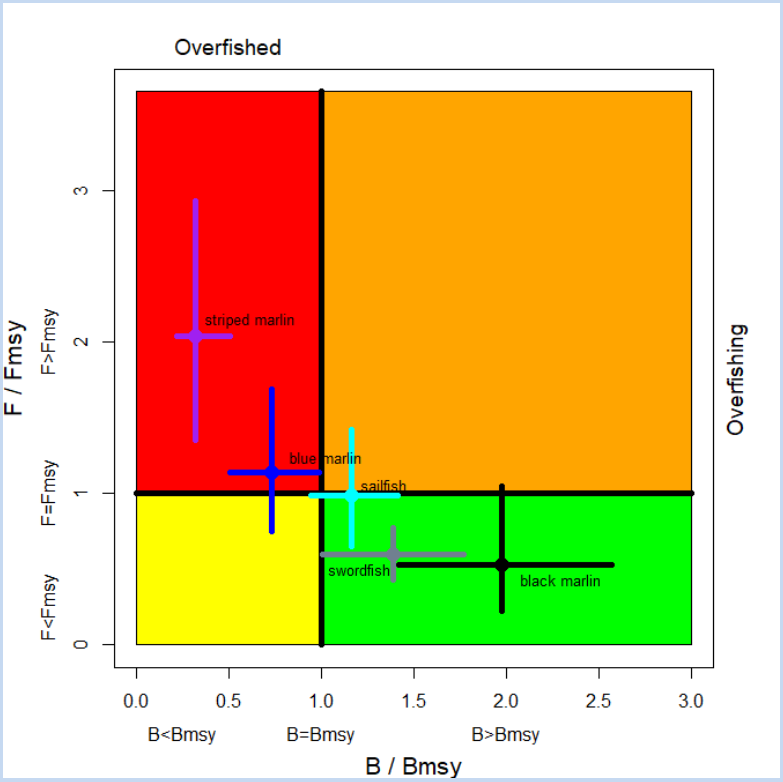

Fig. 3. Combined Kobe plot for swordfish (2021 with assessment conducted in 2023, grey), Indo-Pacific sailfish (2019 with assessment conducted in 2022, cyan), black marlin (2019 with assessment conducted in 2021, black), blue marlin (2020 with assessment conducted in 2022, blue) and striped marlin (2019 with assessment conducted in 2021, purple) showing the estimates of current stock size (SB or B, species assessment dependent) and current fishing mortality (F) in relation to optimal stock size and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs. Given unresolved uncertainty in the assessment, status for black marlin is uncertain.

Sharks

SC26.04 (para. 163) 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

SC26.05 (para. 164) 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

SC26.06 (para. 165) 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

SC26.07 (para. 166) 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

SC26.08 (para. 38) The SC **RECOMMENDED** that the Compliance Committee and Commission note the lack of compliance by 5 Contracting Parties (Members) that did not submit a National Report to the Scientific Committee in 2023, **NOTING** that the Commission agreed that the submission of the annual reports to the Scientific Committee is mandatory**.**

REPORT OF THE 21ST SESSION OF THE WORKING PARTY ON BILLFISH (WPB21)

SC26.09 (para. 49) The SC **NOTED** that the WPB had reviewed evidence that shortbill spearfish (*Tetrapturus angustirostris*) is being caught in IOTC fisheries and that the species population size may be declining. The SC **ACKNOWLEDGED** that the addition of shortbill spearfish in the official list of IOTC species may require a review of the IOTC Agreement, which would be a complex administrative process and unlikely to occur in the near future. The SC **AGREED** that a way to move forward may be for the Commission to adopt the same approach as for the main pelagic sharks caught in tuna and tuna-like fisheries (e.g., blue shark) and mandate the SC with collating information on this species and providing scientific advice for its management. As such the SC **RECOMMENDED** that the Commission endorse the SCs approach to address the captures of shortbill spearfish in IOTC fisheries.

Revision of catch levels of marlins under Resolution 18/05

SC26.10 (para. 57) Subsequently, the SC **RECOMMENDED** that Resolution 18/05 be urgently revised and updated so as to reflect MSY based catch limits for each species based on the most recent stock assessment and projections information available, and to contain provisions to ensure that catches do not exceed such limits. The SC REQUESTED that for Indo-Pacific sailfish, K2SM projections be provided based on the most recent assessment so as to inform revised limits for that stock, and that further work is undertaken to improve the black marlin assessment to generate status and catch limit information.

REPORT OF THE 19TH SESSION OF THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH (WPEB19)

SC26.11 (para. 64) The SC **NOTED** that several longline fleets targeting swordfish in the IOTC area of competence are using submerged artificial lights (chemical light sticks or electrically powered lights) attached to the terminal gear for the purpose of attracting the target species and further NOTED that Resolution 16/07 prohibits all vessels from using artificial lights to attract fish, without specifying the type of fleet or gear subjected to the Resolution. The SC therefore **RECOMMENDED** that the Commission provides clarity on whether Resolution 16/07 applies to longline fisheries as the current wording is somewhat ambiguous. The SC also **SUGGESTED** that Resolution 16/07 could be amended to clearly state which fleets and/or gears are bound by the Resolution to avoid future doubts.

SC26.12 (para. 66) The SC **RECOMMENDED** that the Commission consider extending measures to prevent finning of sharks such as fins naturally attached including partially attached and tethered for all fisheries or similar, alternative measures (for example, fins artificially attached), providing they had been assessed and endorsed by the SC and Compliance Committee as being equally or more likely to meet the conservation benefit (of a fins naturally attached measure) and are logistically feasible from a compliance monitoring perspective. The SC **NOTED** that while such other measures may be logistically more difficult to implement and monitor for governments, they may be more practical (and beneficial to crew safety) for the fishing industry when conducting their fishing operations and storing shark catches on board.

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

SC26.13 (para. 71) 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 6, 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 25TH SESSION OF THE WORKING PARTY ON TROPICAL TUNAS (WPTT25)

SC26.14 (para. 88) The SC **NOTED** that when looking into the effectiveness of measures within Resolutions which CPCs have objected to such as those contained within Resolution 23/02, the consequences of not having full implementation of measures should be considered in relation to future catch trends and **RECOMMENDED** that the Commission provide clarification on this situation.

Skipjack tuna stock assessment

SC26.15 (para. 96) The SC **RECALLED** that IOTC Resolution 21/03, which superseded Resolution 16/02 requires the skipjack tuna stock assessment estimates to be used as inputs for the Harvest Control Rule (HCR) to calculate the TAC. The SC therefore **ENDORSED** the stock assessment and that the median estimates from the model ensemble are used to calculate the TAC for skipjack tuna. The SC **RECOMMENDED** that the Commission endorse the calculated annual TAC of 628 606 t for 2024-2026.

Update on the WGFAD05

SC26.16 (para. 100) The SC **NOTED** the quantitative analyses presented during the meeting (IOTC-2023-WGFAD05-13 and IOTC-2023-WPTT25-INF08). The analyses which were all conducted with a 10 year time frame indicated that the most positive impact on the stocks for the three tuna species, in order of the largest to smallest benefits, would be (i) a three-month complete closure for all gears, (ii) a two-month complete closure for all gears, and (iii) a three-month oceanwide PS log school closure. In addition, several scenarios with closures applied to other gears also achieve the objective of recovering bigeye and yellowfin to the green quadrant of the Kobe plot in 10 years. However, the SC **NOTED** that these benefits were estimated under the assumption that there would not be an increase in catches from other gears during this time and further **NOTED** that the full benefits of these closures would only been seen if there is no reallocation of catches to other gears or time periods. The analyses further indicated that the period that would result in the best outcomes from the closure would be during Q1, Q3 and Q4 for BET and YFT and Q3 and Q4 for SKJ. In addition, the SC **RECALLED** that Resolution 23/03 (para. 3) states that "The IOTC Scientific Committee shall provide advice and recommendations no later than 31st December 2023 on appropriate fishing closures applicable to all fishing gears." As such the SC **RECOMMENDED** the Commission take these analyses into account, with results shown in Annex IX of the WPTT report (IOTC-2023-WPTT25-R) and Figures a-c (below), and **REQUESTED** the WPTT to consider conducting further analysis intersessionally to assess the impacts of all gears on stock status so that this issue can be comprehensively addressed. The SC **NOTED** that some artisanal fleets may struggle to implement closures due to socio-economic dependence on the resources and so REQUESTED that the WGFAD look into excluding artisanal fleets from future analyses.

SC26.17 (para. 101) The SC **NOTED** that the Jelly-FAD is an example of how the implementation of biodegradable DFADs can be achieved, further **NOTING** that other actions have been also carried out in the Indian Ocean for BIOFAD testing using alternative designs and materials and this work has been presented to the WGFAD and WPEB for many years. The SC further **NOTED** that the IATTC has recently adopted a step-wise approach to the full adoption of biodegradable DFADs (IATTC C-23-04). The SC therefore **RECOMMENDED** that the Commission initiate an ambitious step-wise approach for the implementation of biodegradable DFADs as soon as possible.

Bigeye Tuna MP

SC26.18 (para. 106) The SC agreed with the review findings that there was no evidence for exceptional circumstances and **RECOMMENDED** that the agreed TAC for 2024 and 2025 should remain unchanged.

Other Matters

SC26.19 (para. 114) Following the presentation of document IOTC-2023-SC26-11 the SC **RECOMMENDED** that pursuing the development of the Close-Kin Mark Recapture project for yellowfin tuna should be a high priority for the Commission.

REPORT OF THE 14TH SESSION OF THE WORKING PARTY ON METHODS (WPM14)

General MSE issues

SC26.20 (para. 129) The SC **NOTED** that there is a need to ensure that any code and input files used for developing MPs is housed internally on an accessible platform, so it is available to other users and not lost when developers move on to other tasks. The SC **NOTED** that ICES uses a Transparency and Assessment Framework (TAF) which is a useful frontend to direct users to the locations of relevant documents and code (e.g. Github repositories) that enable users to re-run assessments and other analyses, but that a much smaller system would be needed for the IOTC. The SC **NOTED** that most important information to be curated would be the input files, executables, and control files (not the large volume of output files), and **RECOMMENDED** that the Commission ensure that the IOTC Secretariat is provided with the necessary resources to manage the curation of this information.

REPORT OF THE 19TH SESSION OF THE WORKING PARTY ON DATA COLLECTION AND STATISTICS (WPDCS19)

SC26.21 (para. 138) The SC **ACKNOWLEDGED** the request to clarify the issues with data reporting requirements identified with Res. 12/02 and 19/07, as well as the request to change the status of reporting of fishing craft statistics from voluntary to mandatory in Res. 15/02 and **RECOMMENDED** that the Commission takes these requests in due consideration at the next revision of all concerned resolutions.

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

SC26.22 (para. 153) Given the importance of external independent review for working party meetings, the SC **RECOMMENDED** the Commission continue to allocate sufficient budget for invited scientific experts to be regularly invited to scientific working party meetings.

IOTC species identification guides: Tuna and tuna-like species

SC26.23 (para. 155) 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 CPC scientific observers, both on board and at port, need to have hard copies.

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

SC26.24 (para. 157) The SC **RECALLED** its recommendation in 2022 that the Commission revise the current Rules of Procedure (if necessary) to allow Chairs to serve an additional year or years beyond two terms if no suitable candidates are available to replace them once their terms are completed. The SC **NOTED** that the Commission endorsed the SC recommendations as its own and that therefore this recommendation was approved. In light of this recommendation the terms of several Working Party Chairs as well the SC Chair was extended beyond their two terms and the SC **RECOMMENDED** that this be noted and endorsed by the Commission.

SC26.25 (para. 158) 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.

IMPLEMENTATION OF THE REGIONAL OBSERVER SCHEME

SC26.26 (para. 175) The SC **ACKNOWLEDGED** that the estimated levels of coverage provided in Appendix B.1 of IOTC-2023-SC26-07_rev1 are based on the number of hooks (observed and total), as this effort unit is the only one generally available to the IOTC Secretariat. The SC further NOTED that the issue had been previously raised during SC25 and therefore **REITERATED** its **RECOMMENDATION** (SC25.34 (Para. 172)) that at the next revision of Res. 15/02 this is amended to include the mandatory reporting of sets/operations as a additional unit of effort for longline fisheries.

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

Consultants

SC26.27 (para. 187) 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.

Data preparatory meetings and Hybrid meetings

SC26.28 (para. 189) **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 since 2019 data preparatory meetings were successfully held for the WPTmT, WPTT and WPEB, 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 **RECOMMENDED** 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..

SC26.29 (para. 190) The SC **NOTED** that there had been a few teething problems holding meetings in a hybrid format in 2023, especially related to the costs associated with the audio-visual equipment required, as well as the issues associated with ensuring the equipment was suitable to ensure full participation of both those in person as well as those connecting virtually. However, the SC **AGREED** on the utility of facilitating both in-person and virtual participation at future meetings to ensure increased participation and reduce the logistical costs for many CPCs and observers. As such, the SC **RECOMMENDED** that future Scientific Committee meetings continue to be held in a hybrid format, as well as working parties if possible. The SC further **RECOMMENDED** that all presentations at these meetings be made in person to ensure the aforementioned issues did not adversely affect the quality of the advice being provided.

REVIEW OF THE DRAFT, AND ADOPTION OF THE REPORT OF THE 25TH SESSION OF THE SCIENTIFIC COMMITTEE

SC26.30 (para. 196) The SC **RECOMMENDED** that the Commission consider the consolidated set of recommendations arising from SC25, provided at Appendix 38.