Report of the 25th Session of the IOTC Scientific Committee

Seychelles, 5 – 9 December 2022

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BIBLIOGRAPHIC ENTRY
IOTC–SC25 2022. Report of the 25th Session of the IOTC Scientific Committee. Online, 5 – 9 December 2022. *IOTC–2022–SC25–R[E]: 267 pp.*

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ACRONYMS

ACAP	Agreement on the Conservation of Albatrosses and Petrels
aFAD	Anchored fish aggregation device
ASPIC	A Stock-Production Model Incorporating Covariates
B	Biomass (total)
B_{MSY}	Biomass which produces MSY
CBD	Convention on Biological Diversity
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CE	Catch and effort
CI	Confidence interval
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 fishing vessel
M	Natural mortality
MEY	Maximum economic yield
MOU	Memorandum of Understanding
MP	Management Procedure
MPA	Marine Protected Area
MSPEA	Maldives Seafood Processors and Exporters Association
MPF	Meeting Participation Fund
MSE	Management Strategy Evaluation
MSY	Maximum Sustainable Yield
n.a.	Not Applicable
NGO	Non-Governmental Organization
NPOA	National Plan of Action
OFCF	Overseas Fishery Cooperation Foundation of Japan
OM	Operating Model
OT	Overseas Territory
PS	Purse seine

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

STANDARDISATION OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE REPORT TERMINOLOGY

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

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

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

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

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

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EXECUTIVE SUMMARY

The 25th Session of the Indian Ocean Tuna Commission (IOTC) Scientific Committee (SC) was held in the Seychelles, from 5 – 9 December 2022. A total of 129 delegates and other participants attended the Session (130 in 2021), comprised of 104 delegates (107 in 2021) from 25 Contracting Parties with no delegates from Cooperating Non-Contracting Parties (0 in 2021), and 25 participants from 11 observer organisations (including the invited experts). The meeting was chaired by the Chairperson, Dr Toshihide Kitakado (Japan). The list of participants is provided at Appendix 1.

The following are the recommendations from the 25th Session of the Scientific Committee, which are provided in Appendix 38.

Tuna – Highly migratory species

SC25.01 (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

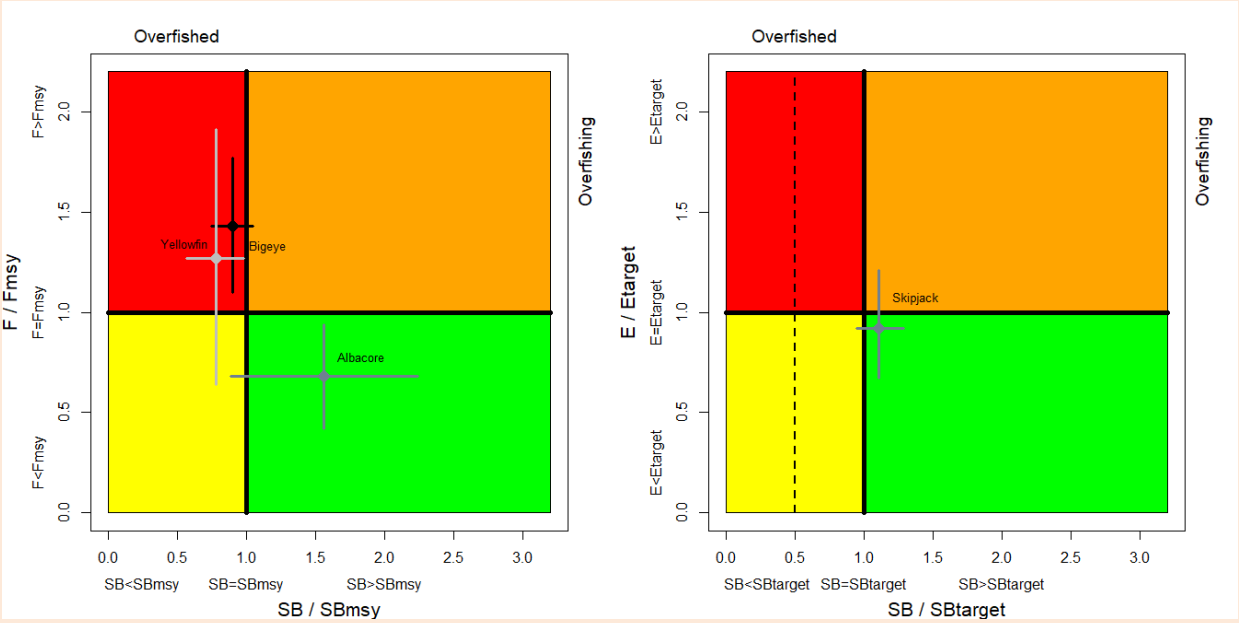


Fig. 1. (Left) Combined Kobe plot for bigeye tuna (black: status in 2021, based on the assessment conducted in 2022), and yellowfin tuna (light grey: 2020, with assessment conducted in 2021) and albacore (dark grey: 2020 with assessment conducted in 2022) showing the estimates of current spawning biomass (SB) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality. (Right) Kobe plot for skipjack tuna (2019 with assessment conducted in 2020) showing the estimates of the current stock status (The dashed line indicates the limit reference point at 20%SB0 while SBtarget=0.4 SB0). Cross bars illustrate the range of uncertainty from the model runs with an 80% CI (95% CI for albacore).

Billfish

SC25.02 (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):

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

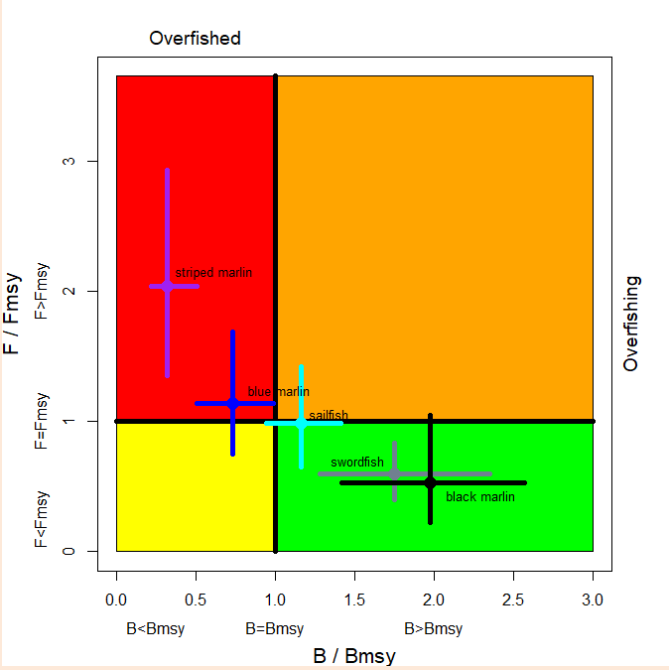


Fig. 3. Combined Kobe plot for swordfish (2018 with assessment conducted in 2020, grey), Indo-Pacific sailfish (2019 with assessment conducted in 2022, cyan), black marlin (2019 with assessment conducted in 2021, black), blue marlin (2020 with assessment conducted in 2022, blue) and striped marlin (2019 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.

Tuna and seerfish – Neritic species

SC25.03 (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 17
Frigate tuna (*Auxis thazard*) – Appendix 18
Kawakawa (*Euthynnus affinis*) – Appendix 19
Longtail tuna (*Thunnus tonggol*) – Appendix 20
Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix 21
Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix 22

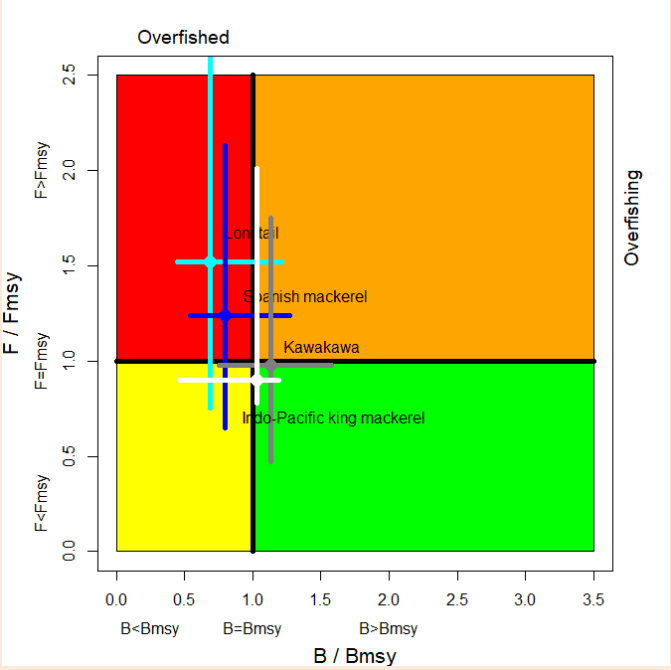


Fig. 2. Combined Kobe plot for longtail tuna (cyan), narrow-barred Spanish mackerel (blue), kawakawa (grey) (all for 2018 with assessment carried out in 2020, white) and Indo-Pacific king mackerel (2019 with assessment carried out in 2021 (white)), showing the estimates of stock size (B) and current 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.

Sharks

SC25.04 (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

SC25.05 (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

SC25.06 (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

SC25.07 (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

SC25.08 (para. 30) 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**.**

Report of the 12TH Session of the Working Party on Neritic Tunas (WPNT12)

SC25.09 (para. 41) 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**.**

Report of the 20TH Session of the Working Party on Billfish (WPB20)

Revision of catch levels of Marlins under Resolution 18/05

SC25.10 (para. 52) 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.

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.

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.

REPORT OF THE 18TH SESSION OF THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH (WPEB18)

SC25.13 (para. 62) 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 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).

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.

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.

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.

REPORT OF THE 24TH SESSION OF THE WORKING PARTY ON TROPICAL TUNAS (WPTT24)

Bigeye tuna MP

SC25.18 (para. 98) 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 **RECOMMENDED** that the Commission endorse the calculated TAC for 2024 and 2025.

SC25.19 (para. 99) 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.

REPORT OF THE 13TH SESSION OF THE WORKING PARTY ON METHODS (WPM13)

SC25.20 (para. 118) 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

SC25.21 (para. 122) 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.

SC25.22 (para. 123) 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

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**.**

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.

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.

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 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.

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

SC25.29 (para. 151) 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.

Meeting participation fund

SC25.30 (para. 153) The SC reiterated its **RECOMMENDATION** that the IOTC Rules of Procedure (2014), for the administration of the Meeting Participation Fund be modified so that applications are due not later than 60 days, and that the full Draft paper be submitted no later than 45 days before the start of the relevant meeting. The aim is to allow the Selection Panel to review the full paper rather than just the abstract, and provide guidance on areas for improvement, as well as the suitability of the application to receive funding using the IOTC MPF. The earlier submission dates would also assist with visa application procedures for candidates.

IOTC species identification guides: Tuna and tuna-like species

SC25.31 (para. 154) 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

SC25.32 (para. 156) **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

SC25.33 (para. 157) 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

SC25.34 (para. 172) 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.

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

Consultants

SC25.35 (para. 186) 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

SC25.36 (para. 188) **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.

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.

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

SC25.38 (para. 192) The SC **RECOMMENDED** that the Commission consider the consolidated set of recommendations arising from SC25, provided at Appendix 38.

Table 1. Status summary for species of tuna and tuna-like species under the IOTC mandate, as well as other species impacted by IOTC fisheries. (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		2018	2019	2020	2021	2022	Advice to the Commission
Albacore *Thunnus alalunga*	Catch (2021) (t) Mean annual catch (2017-2021) (t) MSY (x1,000 t) (95% CI) FMSY (80% CI) SBMSY (x1,000 t) (80% CI) F2020 / FMSY (80% CI) SB2020 / SBMSY (80% CI) SB2020 / SB0 (80% CI)	34,789 39,203 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%**	A new stock assessment was carried out for albacore in 2022 to update the assessment undertaken in 2019. 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 2021 (t) Average catch 2017-2021 (t) MSY (1,000 t) (80% CI) FMSY (80% CI) SBMSY (1,000 t) (80% CI) F2021 / FMSY (80% CI) SB2021 / SBMSY (80% CI) SB2021 / SB0 (80% CI)	94,803 87,488 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%**	In 2022 a new stock assessment was carried out for bigeye tuna in the IOTC area of competence to update the stock assessment undertaken in 2019. 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 *Katsuwonus pelamis*	Catch in 2021 (t) Average catch 2017-2021 (t) C40%SB0 (t) (80% CI) C2019 / C40%SB0 (80% CI) E40%SB0 (80% CI) E2019 / E40%SB0 (80% CI) SB0 (t) (80% CI) SB2019 (t) (80% CI) SB40%SB0 (t) (80% CI) SB20%SB0 (t) (80% CI) SB2019 / SB0 (80% CI) SB2019 / SB40%SB0 (80% CI) SB2019 / SBMSY (80% CI) MSY (t) (80% CI) E2019 / EMSY (80% CI)	650,331 580,408 535,964 (461,995–674,536) 1.02 (0.81–1.18) 0.59 (0.53–0.66) 0.92 (0.67-1.21) 1,992,089 (1,691,710–2,547,087) 870,461 (660,411–1,253,181) 794,310 (672,825–1,019,056) 397,155 (336,412–509,528) 0.45 (0.38-0.5) 1.11 (0.95-1.29) 1.99 (1.47-2.63) 601,088 (500,131–767,012) 0.48 (0.35-0.81)			**60%**			No new stock assessment was conducted in 2022 and so the advice is based on the 2020 assessment using Stock Synthesis with data up to 2019. On the weight-of-evidence available in 2020, the skipjack tuna stock is determined to be: (i) above the adopted biomass target reference point; (ii) **not overfished** (SB_{2019}>$SB_{40\%SB0}$); (iii) with fishing mortality below the adopted target fishing mortality, and; (iv) **not subject to overfishing** (E_{2019}<$E_{40\%SB0}$). The catch limit calculated applying the HCR specified in Resolution 16/02 is 513,572 t for the period 2021 -2023. The SC noted that this catch limit is higher than for the previous period notwithstanding regular overshooting of the previous established catch limit. This is attributed to the new stock assessment which estimates a higher productivity of the stock and a higher stock level relative to the target reference point, possibly due to skipjack life history characteristics and favourable environmental conditions. Thus, it is likely that the recent catches that have exceeded the limits established for the period 2018-2020 have been sustained by favourable environmental conditions. The catch in 2021 (650,331t) exceeded the 2020 level by 17% and exceeded the HCR recommended catch limit (for 2021-2023) by 27%, providing a need for the Commission to ensure that catches of skipjack tuna do not exceed the agreed limit and ensuring that the impact on associated tuna stocks (bigeye and yellowfin tuna) is reduced. Click here for full stock status summary: Appendix 10
Yellowfin tuna *Thunnus albacares*	Catch in 2021 (t) Average catch 2017-2021 (t) MSY (1,000 t) (80% CI) FMSY (80% CI) SBMSY (1,000 t) (80% CI) F2020 / FMSY (80% CI) SB2020 / SBMSY (80% CI) SB2020 / SB0 (80% CI)	416,235 435,225 349 (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)	**94%**			**68%**		No new stock assessment was carried out for yellowfin tuna in 2022 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. A number of additional uncertainties were identified that require further exploration, including those related to growth, natural mortality and longline catchability. Inconsistencies in the biomass trend by region also remain unresolved and this deserves further investigation. According to the K2SM,

								• if catches are reduced to 60% of 2020 levels[1] there is >50% probability of being above Bmsy levels by 2023. • if catches are reduced to < 80% of 2020 levels there is a >50% probability of being above BMSY in 2030. • if catches are reduced to less than 80% of 2020 levels there would be a >50% probability of ending overfishing (F<Fmsy) by 2023 and also by 2030. • The probability of breaching the biological limit reference point (0.4Bmsy) with 2020 catches is 7% by 2023 and 64% by 2030. The probability of breaching the F limit reference point (1.4 Fmsy) with 2020 catch is 52% by 2023 and 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 2020 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

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		2018	2019	2020	2021	2022	Advice to the Commission
Swordfish *Xiphias gladius*	Catch 2021 (t) Average catch 2017-2021 (t) MSY (1,000 t) (80% CI) FMSY (80% CI) SBMSY (1,000 t) (80% CI) F2018/FMSY (80% CI) SB2018/SBMSY (80% CI) SB2018/SB1950 (80% CI)	23,917 31,157 33 (27–40) 0.23 (0.15–0.31) 59 (41–77) 0.60 (0.40–0.83) 1.75 (1.28–2.35) 0.42 (0.36–0.47)			**98%**			An assessment was undertaken in 2020 using stock synthesis with fisheries data up to 2018. On the weight-of-evidence available in 2020, the stock is determined to be **not overfished** and **not subject to overfishing**. The 2019 catches (33,590 t at the time of the assessment) were close to the MSY level (33,000 t). Under those levels of catches, the spawning biomass was projected to remain relatively stable, with a high probability of maintaining at or above the SBMSY for the longer term. It is noted that 2021 catches (23,917 t) are significantly lower than MSY. Nevertheless, the Commission should consider limiting the catches so as not to exceed

[1] 2020 catch levels indicate the nominal catch available to the WPTT at its session in October 2021 (WPTT23).

								the 2018 catch level (31,018 t) to ensure that the probability of exceeding the SBMSY target reference points in the long term remains minimal (2%). Projections indicate that an increase of 40% or more from 2018 catch levels will likely result in the biomass dropping below the SBMSY level for the longer term (>75% probability). Taking into account the updated information regarding swordfish stock structure (IOTC-2020-WPB18-09), as well as the differential CPUE and biomass trends between regions, the WPB should continue to discuss the swordfish stock assessment model specifications and consider the feasibility of including a multi-stock assessment in 2023. Recognising that there is recurring evidence for localised depletion in the southern regions (particularly the South West) the WPB expresses concern and suggests this should be further monitored. Click here for full stock status summary: Appendix 12
Black marlin *Istiompax indica*	Catch 2021 (t) Average catch 2017–2021 (t) MSY (1,000 t) (95% CI) FMSY (95% CI) BMSY (1,000 t) (95% CI) F2019/FMSY (95% CI) B2019/BMSY (95% CI) B2019/B0 (95% CI)	14,115 16,864 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)						A stock assessment based on JABBA, a Bayesian state-space production model (age-aggregated), was conducted in 2021 for black marlin (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 two 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 13

Blue marlin *Makaira nigricans*	Catch 2021 (t) Average catch 2017-2021 (t) MSY (1,000 t) (80% CI) FMSY (80% CI) BMSY (1,000 t) (80% CI) F2020/FMSY (80% CI) B2020/BMSY (80% CI) B2020/B0 (80% CI)	5,772 7,964 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%**	In 2022 a stock assessment was conducted 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 7,964 t in the last 5 years, 2017-2021) are lower than MSY (8,740 t). In order to achieve the Commission objectives of being in the green zone of the Kobe Plot by 2027 (F2027 < FMSY and B2027 > BMSY) with at least a 60% chance, the catches of blue marlin would have to be reduced by 20% compared to 2020 catch (7,126 t), to a maximum value of approximately 5,700 t. Click here for full stock status summary: Appendix 14
Striped marlin *Kajikia audax*	Catch 2021 (t) Average catch 2017-2021 (t) MSY (1,000 t) (JABBA) MSY (1,000 t) (SS3) FMSY (JABBA) FMSY (SS3) F2019/FMSY (JABBA) F2019/FMSY (SS3) B2019/BMSY (JABBA) SB2019/SBMSY (SS3) B2019/B0(JABBA) SB2019/SB0 (SS3)	2,696 2,946 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)	**99%**			100%		In 2021 a stock assessment was conducted 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 current 2020 catches (2,587 t) are lower than MSY (4,601 t) but 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 15
Indo-Pacific Sailfish *Istiophorus platypterus*	Catch 2021 (t) Average catch 2017-2021 (t) MSY (1,000 t) (80% CI) FMSY (80% CI) BMSY (1,000 t) (80% CI) F2019/FMSY (80% CI) B2019/BMSY (80% CI) B2019/B0 (80% CI)	37,310 32,178 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%	In 2022 a new stock assessment was conducted based on JABBA, a Bayesian state-space production model (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 two 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 16

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

Stock	Indicators		2018	2019	2020	2021	2022	Advice to the Commission
Bullet tuna *Auxis rochei*	Catch 2021(t) Average catch 2017–2021 (t) MSY (1,000 t) F_{MSY} B_{MSY} (1,000 t) F_{2019}/F_{MSY} B_{2019}/B_{MSY} B_{2019}/B_0	14,072 22,562 unknown unknown unknown unknown unknown unknown						No new stock assessment was conducted in 2022 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. 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 BMSY and FMSY reference points remains **unknown** For assessed species of neritic tunas in Indian Ocean (longtail tuna, kawakawa and narrow barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both FMSY and BMSY were breached thereafter. Therefore, in the absence of a stock assessment of bullet tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between

								2009 and 2011 (8,870 t). The reference period (2009-2011) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available under the assumption that also for bullet tuna MSY was reached between 2009 and 2011. This catch advice should be maintained until an assessment of bullet tuna is available. Considering that MSY-based reference points for assessed species can change over time, the stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice Click here for a full stock status summary: Appendix 17
Frigate tuna *Auxis thazard*	Catch 2021 (t) Average catch 2017–2021 (t) MSY (1,000 t) F_{MSY} B_{MSY} (1,000 t) F_{2019}/F_{MSY} B_{2019}/B_{MSY} B_{2019}/B_0	107,065 104,697 unknown unknown unknown unknown unknown unknown						No new assessment was conducted in 2022 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. 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 BMSY and FMSY reference points remains **unknown.** For assessed species of neritic tunas in Indian Ocean (longtail tuna, kawakawa and narrow barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both FMSY and BMSY were breached thereafter. Therefore, in the absence of a stock assessment of frigate tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (94,921 t). The reference period (2009-2011) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available under the assumption that also for bullet tuna MSY was reached between 2009 and 2011. This catch advice should be maintained until an assessment of frigate tuna is available. Considering that MSY-based reference points for assessed species can change over time, the stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice. Click here for a full stock status summary: Appendix 18
Kawakawa *Euthynnus affinis*	Catch 2021 (t) Mean annual catch 2017-2021 (t)	147,228 153,645			**50%**			No new stock assessment was conducted for kawakawa in 2022 and so the results are based on the assessment carried out in 2020

	MSY (t) (80% CI) FMSY (80% CI) BMSY (t) (80% CI) F_{2018}/FMSY (80% CI) B_{2018}/BMSY (80% CI)	148,825 (124,114 – 222,505) 0.44 (0.21–0.82) 355,670 (192,080 – 764,530) 0.98 (0.85–1.11) 1.13 (0.75–1.58)						using data-limited assessment techniques (based on data up to 2018). Based on the weight-of-evidence available, the kawakawa stock for the Indian Ocean is classified as **not overfished** and **not subject to overfishing.** The assessment models rely on catch data, which are considered to be highly uncertain. The catch in 2021 was just below 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 19
Longtail tuna *Thunnus tonggol*	Catch 20212 (t) Mean annual catch (2017-2021) (t) MSY (80% CI) F_{MSY} (80% CI) B_{MSY} (80% CI) F_{2018}/F_{MSY} (80% CI) B_{2018}/B_{MSY} (80% CI)	135,962 133,499 128,750 (99,902 – 151,357) 0.32 (0.15 – 0.66) 395,460 (129,240 – 751,316) 1.52 (0.751 – 2.87) 0.69 (0.45 – 1.21)			**76%**			No new assessment was conducted for longtail tuna in 2022 and so the results are based on the assessment carried out in 2020 using the Optimised Catch-Only Method (OCOM) (based on data up to 2018). Stock structure for this species remains unclear with recent research indicating strong evidence of population structure, increasing uncertainty in the assessment, which assumes a single stock. Based on the weight-of-evidence currently available, the stock is considered to be both **overfished** and **subject to overfishing**. The catch in 2021 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 20
Indo-Pacific king mackerel	Catch 2021 (t) Average catch 2017-2021 (t)	33,491 43,764				**35%**		No new assessment was conducted in 2022 so results are based on the assessment conducted in 2021 using the data-limited techniques (CMSY and LB-SPR) (using data up to 2019). The catch-

Scomberomorus guttatus	MSY (1,000 t) F_{MSY} B_{MSY} (1,000 t) F_{2019}/F_{MSY} B_{2019}/B_{MSY} B_{2019}/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)						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 sufficiently improved quality for conducting an assessment albeit still with some uncertainty. 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 21
Narrow-barred Spanish mackerel *Scomberomorus commerson*	Catch 2021 (t) Average catch 2017-2021 (t) MSY (80% CI) F_{MSY} (80% CI) B_{MSY} (80% CI) F_{2018}/F_{MSY} (80% CI) B_{2018}/B_{MSY} (80% CI)	172,887 160,966 157,760 (132,140–187,190) 0.49 (0.25–0.87) 323,500 (196,260–592,530) 1.24 (0.65–2.13) 0.80 (0.54–1.27)			**73%**			No new assessment was conducted for narrow-barred Spanish mackerel in 2022 and so the results are based on the assessment carried out in 2020 using the Optimised Catch-Only Method (OCOM) (based on data up to 2018). Stock structure for this species remains unclear with recent research indicating strong evidence of population structure, increasing uncertainty in the assessment, which assumes a single stock. Based on the weight-of-evidence available, the stock appears to be **overfished** and **subject to overfishing.** The catch in 2021 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 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		2018	2019	2020	2021	2022	Advice to the Commission
Blue shark *Prionace glauca*	Reported catch 2021 (t) Estimated catch 2019 (t) Not elsewhere included (nei) sharks1 2021 (t) Average reported catch 2017-21 (t) Average estimated catch 2015-19 (t) Avg. not elsewhere included (nei) sharks 2017-21 (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)	24,418 43,240 29,845 26,694 48,781 32,523 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 2022 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 are 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>SBMSY) 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 2021 (t) Not elsewhere included (nei) sharks 2021 (t) Average reported catch 2017–2021 (t) Ave. (nei) sharks 2017–21 (t)	32 29,845 35 32,523						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 2021 (t) Not elsewhere included (nei) sharks 2021 (t) Average reported catch 2017–2021 (t) Ave. (nei) sharks 2017–21 (t)	232 28,770 97 31,281						

Shortfin mako *Isurus oxyrinchus*	Reported catch 2021 (t) Not elsewhere included (nei) sharks 2021 (t) Average reported catch 2017-21 (t) Av. (nei) sharks 2017-21 (t)	792 31,499 1,326 34,369						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 2021 (t) Not elsewhere included (nei) sharks 2021 (t) Average reported catch 2017–2021 (t) Ave. (nei) sharks 2017–21 (t)	1,423 21,879 1,702 25,732						
Bigeye thresher shark *Alopias superciliosus*	Reported catch 2021 (t) Not elsewhere included (nei) sharks 2021 (t) Average reported catch 2017–2021 (t) Ave. (nei) sharks 2017–21 (t)	< 1 26,965 < 1 30,323						
Pelagic thresher shark *Alopias pelagicus*	Reported catch 2021 (t) Not elsewhere included (nei) sharks 2021 (t) Average reported catch 2017–2021 (t) Ave. (nei) sharks 2017–21 (t)	76 26,965 270 30,323						

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

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

1. OPENING OF THE SESSION

1. The 25th Session of the Indian Ocean Tuna Commission (IOTC) Scientific Committee (SC) was held in the Seychelles and online, from 5 – 9 December 2022. A total of 129 delegates and other participants attended the Session (130 in 2021), comprised of 104 delegates (107 in 2021) from 25 Contracting Parties with no delegates from Cooperating Non-Contracting Parties (0 in 2021), and 25 participants from 11 observer organisations (including the invited experts). The meeting was chaired by the Chairperson, Dr Toshihide Kitakado (Japan). The list of participants is provided at Appendix 1.

2. ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE SESSION

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

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

3. ADMISSION OF OBSERVERS

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

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

- Agreement on the Conservation of Albatrosses and Petrels (ACAP)
- Birdlife International
- Blue Marine Foundation
- The Indian Ocean–South-East Asian (IOSEA) Marine Turtle memorandum of understanding (MoU)
- International Pole-and-line Foundation (IPNLF)
- International Seafood Sustainability Foundation (ISSF)
- PEW Charitable Trusts
- Sustainable Fisheries and Communities Trust (SFACT)
- Sustainable Indian Ocean Tuna Initiative (SIOTI)
- Southwest Indian Ocean Fisheries Commission (SWIOFC)
- 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 26th Session of the Commission

5. The SC **NOTED** paper IOTC–2022–SC25–03 which outlined the decisions and requests made by the Commission at its 26th Session, held in May 2022, that related to the IOTC science processes. The SC **NOTED** that 4 new CMMs were adopted in 2022 by the Commission.

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

7. Noting that the 26th session of the Commission also made a number of general comments and requests on the recommendations made by the Scientific Committee in 2021, 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–2022–SC25–04 which outlined a number of Commission decisions, in the form of previous Resolutions that require a response from the SC in 2022 and **AGREED** to develop advice to the Commission in response to each request during the current Session.

5. SCIENCE RELATED ACTIVITIES OF THE IOTC SECRETARIAT IN 2022

5.1 Report of the Secretariat – Activities in support of the IOTC science process in 2022

9. The SC **NOTED** paper IOTC–2022–SC25–05 which provided an overview of the work undertaken by the IOTC Secretariat in 2022 and congratulated the IOTC Secretariat for its contributions to the science processes in 2022. These contributions included support to the Working Parties and Scientific Committee meetings; in most years, 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; support for the development of the Regional Observer Scheme; recruitment and management of consultants; oversight of scientific projects and facilitation of the attendance of the invited scientific experts that support IOTC technical meetings.
10. The SC **CONGRATULATED** the Secretariat for the successful organization and completion of the different Working Party meetings in 2022 using Online meeting tools despite the technical challenges posed (internet connection, time zones and duration).
11. The SC **NOTED** that the number of working party and working group meetings that were held in 2022 increased substantially from previous years. The SC **NOTED** that while the number of participants for each of these meetings has increased, the number of papers submitted and the active participation by those attending meetings has decreased.
12. The SC **NOTED** although all meetings had been successfully held virtually in 2022, they were shortened to facilitate the virtual platform. The SC **AGREED** that in the future virtual meetings should still be conducted for certain meetings (such as Data preparatory meetings) to reduce the expenses travel imposes on CPCs as well as the IOTC MPF, but for those meetings requiring closer collaborations, in person, physical (or preferably hybrid) meetings will be continued as required.
13. The SC **NOTED** that in 2022, Secretariat staff continued to support collaborations and participated in several meetings with other organisations. The SC **ENCOURAGED** these ongoing collaborations.
14. The SC **NOTED** that data related activities at the Secretariat have been extensive and the capacity of the data team to complete this work needs to be increased, further **NOTING** that a new position within this team has recently been advertised and the Secretariat hopes to fill the position in 2023. The SC **NOTED** that the Secretariat would then determine if further capacity may be required.
15. The SC **ACKNOWLEDGED** that work on the Consolidated List of Authorised Vessels (CLAV) will resume in 2023 to overcome the technical issues that have affected the platform in 2022, and **THANKED** ISSF for having confirmed their intention of supporting the work of an external consultant to clean-up the consolidated list of vessels during 2023.
16. One participant noted that while the CLAV currently includes only vessels over 24m LOA or vessels below 24m operating outside their EEZ, it may be beneficial to extend this to also include vessels above 15m operating within the EEZ of their flag state. Another participant disagreed with this observation.
17. The SC **NOTED** the need to have a repository of information on data extrapolation procedures used by CPCs, further **NOTING** that while CPCs are required to submit this information in their national reports as per to paragraphs 4 and 5 of Res. 15/02, many CPCs have not provided this information.
18. The SC expressed support for the work of the Secretariat to investigate alternative data sources such as cannery data currently being funded by ISSF to help to validate catch estimates and **NOTED** that it would be better for this work to be funded directly by IOTC in the future.
19. **NOTING** the importance of CPCs providing good quality data to the IOTC for the work of the SC, the SC expressed support for the continuation of data support missions to be carried out to several CPCs who require assistance with their data collection and reporting mechanisms.
20. The SC expressed concern that some CPCs have declined offers for the Secretariat to carry out capacity building activities and **REQUESTED** the Secretariat to increase their efforts to facilitate these activities in the future.
21. The SC expressed **CONCERN** that the second and final terms of several Working Party Chairs and Vice-Chairs will be coming to an end in 2023 and **SUGGESTED** that it may be necessary for the Commission to consider allowing extensions to the WP chair terms if no suitable alternatives can be found. The SC particularly highlighted the need to find a Vice-Chair for the WPM as this position is currently vacant.

6. NATIONAL REPORTS FROM CPCS

6.1 National Reporting to the Scientific Committee: overview

22. The SC **NOTED** that 26 National Reports were submitted to the IOTC Secretariat in 2022 by CPCs (25 by CPs and 1 by a CNCP) (as well as a report by the invited experts, Taiwan,China). The abstracts of CPC reports are provided in Appendix 4b.

23. 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.

24. 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 2022, of the 26 National Reports submitted, 2 were submitted shortly after the deadline. The SC **NOTED** that the National Report does not replace the need for submission of data according to the IOTC Mandatory Data Requirements listed in the relevant IOTC Resolution (currently Resolution 15/02 *On mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs)*.

25. 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 2022, very few National Reports were submitted using older reporting templates and in these cases all mandatory information as stipulated in the CMMs was still provided. 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.

26. 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 2022/40 sent on the 7th of July 2022 as well as through the IOTC Science mailing list.

27. 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.

28. 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.

29. The SC **NOTED** that there was an increase in the Submission of National reports by CPCs in 2022 when compared with the 21 reports provided by CPCs in 2021 (25 in 2020, 23 in 2019, 26 in 2018, 23 in 2017 and 23 in 2016; see Table 2).

30. 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.

Table 2. CPC submission of National Reports to the SC from 2012 to 2022.

CPC	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Contracting Parties (Members)											
Australia											20 Nov
Bangladesh	n.a.	n.a.	n.a.								2 Nov
China											20 Nov
Comoros											16 Nov
Eritrea											
European Union											21 Nov
France (OT)											20 Nov
India											17 Nov
Indonesia											21 Oct
Iran, Islamic Rep. of											16 Nov
Japan											16 Nov
Kenya											20 Nov
Korea, Republic of											19 Nov
Madagascar											17 Nov
Malaysia											17 Nov
Maldives, Rep. of											21 Oct
Mauritius											20 Nov
Mozambique											16 Nov
Oman, Sultanate of											
Pakistan											
Philippines											20 Nov
Seychelles, Rep. of											20 Nov
Somalia	n.a.	n.a.									19 Nov
Sri Lanka											11 Nov
South Africa, Rep. of											18 Nov
Sudan											
Tanzania, United Republic of											20 Nov
Thailand											18 Nov
United Kingdom											20 Nov
Yemen											
Cooperating Non-Contracting Parties											
Liberia	n.a.	n.a.	n.a.								28 Nov

Green = submitted. Red = not submitted. Orange = Submitted using an outdated template n.a. = not applicable (not a CPC in that year). For 2022, the date of submission of the report is included in the table (**Note**: the deadline for submission was 20 November 2022).

6.2 Contracting Parties (Members)

31. The SC **NOTED** that in 2022 the Secretariat provided translations of all the submitted National report summaries in both English and French in response to the SC request in 2018.

32. **NOTING** the 26 National Reports submitted to the IOTC Secretariat in 2022 by Contracting Parties (Members), the SC expressed concern about the difference between the catches submitted in some National Reports and total catches, by fleet, in the IOTC database. The IOTC Secretariat uses the information from the National Report to update estimates of nominal catches, in the case of revisions to the data or when CPCs have not submitted any catch data; however, the time available between submission of the National Reports and the Scientific Committee makes it difficult to update the IOTC nominal database prior to the annual Session. The

Secretariat expressed their willingness to work with the CPCs concerned to resolve these differences and ensure all catches are consistent across the various data sources and that several CPCs had requested assistance in the past to conduct re-estimations of their historic catches.

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

6.3 Cooperating Non-Contracting Parties (CNCPs)

34. The SC **NOTED** that one National Report was submitted to the IOTC Secretariat in 2022 by the Cooperating Non-Contracting Party (CNCP).

35. The SC **NOTED** that in 2022 the Secretariat provided the translation of the submitted National report summary in both English and French in response to the SC request in 2018.

6.4 Invited Experts

36. The SC **NOTED** the report provided by the Invited Experts from Taiwan,China which outlined fishing activities in the IOTC Area of Competence. The report from the Invited Experts is document IOTC-2022-SC25-INF02 and is available upon request.

7. REPORTS OF THE 2022 IOTC WORKING PARTY MEETINGS

7.1 Report of the 12th Session of the Working Party on Neritic Tunas (WPNT12)

37. The SC **NOTED** the report of the 12th Session of the Working Party on Neritic Tunas (IOTC–2022–WPNT12–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 36 participants (cf. 33 in 2021). No MPF funding was provided as the meeting was held online.

38. The SC **NOTED** that for the neritic tuna species, an understanding of stock structure is of great importance as these species are coastal in nature and mixing between different regions across the Indian Ocean may be low. This is important when providing the scientific advice on stock status, as these species are assumed to have one stock for modelling purposes. The genetic stock structure project completed in 2020 indicated that there may be multiple stocks for some neritic tuna species (notably longtail tuna and Spanish mackerel) and this should be taken into account in future stock status estimations. The SC **NOTED** that the WPNT has prioritised stock structure studies in the future to build on the recently completed study.

39. The SC **NOTED** the lack of data available for this species and the effect this has on providing stock status advice. The SC **NOTED** that CKMR techniques may be a useful way of supplementing the current information and providing a clearer picture of current stock status for these species. Further discussions would be needed to determine the feasibility of this approach in this circumstance.

40. The SC **NOTED** that assessment models for these species have relied on data poor methods including catch only models. The SC **ACKNOWLEDGED** the limitations of these techniques and **NOTED** the intention of the WPNT to hold a CPUE workshop prior to the next WPNT meeting to develop CPUEs for stock assessment input to improve the assessment models.

41. 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.

42. One of the Participants suggested the removal of the neritic tunas from the management regime of the Commission, reasoning that many of these species, especially mackerels, reside exclusively in the EEZs of the coastal states. However, there was no consensus on this suggestion.

7.2 Report of the 20th Session of the Working Party on Billfish (WPB20)

43. The SC **NOTED** the report of the 20th Session of the Working Party on Billfish (IOTC–2022–WPB20–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 51 participants (cf. 55 in 2021). No MPF funding was provided as the meeting was held online.

44. The SC **REMINDED** that its previous recommendation on the inclusion of shortbill spearfish (*Tetrapturus angustirostris*) as an IOTC species has not yet been addressed by the Commission and **REQUESTED** the WPB to collate more data on the species to support this recommendation which would require a revision of the IOTC Agreement.

45. The SC **NOTED** that a study was carried out to look at the inclusion of marine subsurface variables on swordfish habit modeling in the Indian Ocean. The study makes use of the Species Distribution Model (SDM), which employs three-dimensional environmental data to estimate species distribution and derive sub-surface parameters.

46. The SC **NOTED** that the next WPB meeting will be preceded by a two-day workshop on billfish reproductive biology studies. If time permits, the SC suggested that the workshop's scope be broadened to incorporate additional biological components (such as the age and growth research as specified in the program of work). The SC also acknowledged the advantages of compiling available biological studies and requested that a summary table of the CPCs' recent and/or ongoing research on billfish biology be provided at the next WPB meeting.

7.2.1 Blue Marlin stock assessment

47. The SC **NOTED** that a new stock assessment was conducted in 2022 based on two different models: JABBA, a Bayesian state-space production model (age-aggregated); and SS3, an integrated model (age-structured). The SC further **NOTED** that uncertainty in the biological parameters was still apparent and as such the JABBA model (B_{2020}/B_{MSY} = 0.73, F_{2020}/F_{MSY} = 1.13) was selected as the base case as both models were consistent with regards to stock status.

7.2.2 Indo-Pacific Sailfish stock assessment

48. The SC **NOTED** that in 2022 a new stock assessment was conducted based on JABBA, a Bayesian state-space production model. Data poor methods applied to Indo-Pacific Sailfish 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 this species.

49. The SC **NOTED** that the new modelling approach has facilitated the use of additional information available for the species and provided additional insight into the Indo-Pacific sailfish stock status. As such, the SC **NOTED** that the stock status for Indo-Pacific sailfish has been revised from *Unknown*, to *not overfished and not subject to overfishing*.

50. The SC **NOTED** that the new assessment used the Just Another Red-List Assessment(JARA) model to link the LB-SPR and the JABBA model. It was **NOTED** that the JARA model was incorporated as an additional modelling step that acts as a smoother over the time series obtained from the LB-SPR and normalizes the time series with respect to the initial state, in order to calculate an estimate of depletion. However, the inclusion of the "JARA" model has a negligible influence on the outcomes of the JABBA assessment. The SC also **AGREED** that the methodology of converting the length data into an index of relative abundance, requires further review.

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

51. 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".

52. 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.

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 (K2SMs) 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.

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.

7.3 Report of the 18th Session of the Working Party on Ecosystems and Bycatch (WPEB18)

55. The SC **NOTED** the report of the 18th Session of the Working Party on Ecosystems and Bycatch (IOTC–2022–WPEB18–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 103 participants (cf. 93 in 2021). No MPF funding was provided as the meeting was held online.

56. The SC expressed support for the increasing scope of the work of the WPEB which in the past has focused mostly on sharks but is now increasing to include other taxa as well as climate and ecosystem issues.

57. The SC noted the concern expressed by one CPC who cautioned against discussions around the precautionary approach as this is moving from providing advice into the domain of the Commission but **NOTED** that the WPEB was trying to highlight the risk to species for which management actions should be taken.

58. The SC **NOTED** the ongoing ecoregion process, including their purpose and potential benefits in providing more integrated regional advice. The SC **NOTED** that the next step in the process of the development of these ecoregions is to conduct a series of pilot projects to evaluate their utility and effectiveness as a tool to support regional ecosystem planning and prioritisation, incentivised ecosystem research and the development of integrated advice products for informing fisheries management decisions. The SC **NOTED** that there are two pilot projects currently planned – one which will focus on coastal regions and other focused on more oceanic regions which will provide an opportunity to compare the artisanal and industrial fisheries that tend to operate in each of these regions.

59. The SC **NOTED** that in the future these ecoregions might be considered for their potential to provide structured management advice focused on issues of particular importance to each of the regions and stock assessment advice would be incorporated into the overall advice alongside other information.

60. The SC **ENDORSED** the proposed refined candidate ecoregions and the development of the proposed pilot projects to evaluate their utility and effectiveness.

61. The SC **NOTED** a recommendation from the WPEB to revise the list of sharks, rays and Endangered, Threatened and Protected (ETP) species included in Appendix II of Resolution 15/01 to ensure that all species under broad categories such as hammerhead sharks (*Sphyrna* spp.) are reported separately by species. The SC **NOTED** that this could help to provide an incentive to improve catches of these species which may have historically been reported aggregated.

62. 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 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.

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).

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.

65. With a view to identifying mitigation measures to avoid or limit unwanted by-catches, the SC **NOTED** the need to improve the provision of data and information to describe the fishing gears and methods used by these artisanal fisheries.

66. **RECALLING** the request by the Commission to develop research plans for sharks, the SC **ENDORSED** the creation of a working group to work intersessionally to develop a series of research plans/program for sharks with scalloped hammerhead as a priority species.

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

67. The SC **NOTED** paper IOTC–2022–SC25–06 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.

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.

69. 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.

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

71. The SC **NOTED** that there have been small revisions to the previous update on NPOAs in 2022 including the drafting of revisions of NPOAs by some CPCs and updates on the progress on the development of NPOAs by other CPCs.

7.3.2 Other Matters

72. The SC **NOTED** paper IOTC-2022-SC25-INF01 on a draft Cooperation agreement between the IOTC and the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA).

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.

74. The SC **NOTED** that a better technical understanding of fishing gears and methods, used in fisheries harvesting highly migratory stocks in the IOTC area, is needed to inform the WPEB recommendations. This knowledge will also assist the SC and Commission in their understanding of fishery interactions with bycatch species and to better facilitate consideration of management options to mitigate interactions for bycatch species for which that is needed. The SC suggested that particular consideration of this could be built into the work of the WPEB, through CPC contributions (fishing gears/methods descriptions for all areas and vessel types/sizes) and data summaries developed by the IOTC Secretariat.

7.4 Report of the 24th Session of the Working Party on Tropical Tunas (WPTT24)

75. The SC **NOTED** the report of the 24th Session of the Working Party on Tropical Tunas (IOTC–2022–WPTT24–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 113 participants (cf. 108 in 2021). No MPF funding was provided as the meeting was held online.

7.4.1 Bigeye tuna stock assessment

76. The SC **NOTED** that the 2022 bigeye tuna assessment (using Stock Synthesis III, SS3) concluded that the stock is overfished and is subject to overfishing. The SC further **NOTED** that two models were applied to the bigeye stock (Statistical Catch at Size (SCAS) and SS3), with the SS3 stock assessment selected to provide scientific advice.

77. The SC **NOTED** that the new bigeye tuna stock assessment captured structural uncertainty through a grid of 24 models covering stock recruitment, growth, natural mortality and selectivity assumptions, and statistical uncertainty of individual models was also incorporated into the estimates of stock status. The SC further **NOTED** that all models in the grid are equally weighted.

78. The SC **NOTED** that although the assessment looked at using diagnostics for model selection and weighting, no agreement on how different diagnostic information can be converted to model weights was reached. Model weighing is an active topic on the WPM meeting agenda and is an ongoing study in the field of stock assessment, particularly at the Center for the Advancement of Population Assessment Methodology (CAPAM) stock assessment good practice workshops, which have covered model weighting and diagnostics in detail.

79. The SC **DISCUSSED** whether models with lower steepness should be removed from the model grid noting that several diagnostic tests on such models had failed. The SC **NOTED** that an early ISSF workshop recommended steepness levels between 0.7 and 0.9 for tropical tuna species. The workshop suggested that higher values may be less suited for bigeye tuna but are more likely to be better for yellowfin and skipjack. The SC further **NOTED** that the cut-off ranges for certain diagnostic criteria for model selection may be arbitrary.

80. The SC **NOTED** that the new CPUE index in region 3 (South) shows a greater decline than the previous index, which may be due to changes in data access arrangement which resulted in the CPUE standardization being based on catch effort data at a coarser geographical resolution (i.e., 1x1 degree) than the prior standardization. This may have resulted in a more negative stock trajectory but regardless, did not fundamentally change the conclusion of the assessment. The SC also **NOTED** that the new CPUE in other regions are more consistent with the earlier estimates.

81. The SC **NOTED** the substantial increase of catch for Seychelles in 2021 is due to changes in data processing rather than increase of harvest.

82. The SC **RECALLED** that WPTT21 used a spatial-temporal re-estimation approach to revise the bigeye tuna catch reported by EU, Spain in 2018 (limited to their log-associated school component). The official reported catches were, however, kept in the IOTC database, and the revised catch was incorporated in the assessment as scientific estimates. The WPDCS15 further improved the re-estimation technique, and the WPTT24(DP) has agreed to utilize it in the current assessment.

83. The SC **NOTED** that preliminary fishery impact analysis (to help understand the contribution of different gears/fisheries to stock depletion), which the commission had requested, had been initiated; however, the methodology needs to be reviewed by the WPM before the analysis is finished and presented to the commission.

7.4.2 Update on the WGFAD03

84. The SC **NOTED** the report of the 3rd ad hoc working group meeting on FADs (IOTC-2022-WGFAD03-R). The meeting was attended by 111 participants (cf. 93 in 2021).

85. The SC **THANKED** the WGFAD for their work and the chair for the presentation which included a summary of the progress made on the terminology and definitions related to FAD-fishing as proposed by a Small Working Group on FAD definitions who worked intersessionally between the WGFAD and the WPDCS.

86. The SC **NOTED** the presentation of the three updated forms for reporting FAD-related data to the Secretariat, **NOTING** that the resolution of the data is higher than in the previous form 3FA (i.e., at vessel and operational levels) to better reflect the data requirements set in Resolutions 15/02 and 19/02.

87. The SC **NOTED** that the new 3FA forms would become available for download on the IOTC website in the forthcoming weeks and that they could be used for the 2023 data cycle, i.e., for reporting data for the statistical year 2022.

88. The SC **NOTED** that several FAD-related definitions were agreed on by the Small Working Group that was held after the WGFAD, but that no consensus was reached on the general definition of a FAD, **NOTING** further that two alternate definitions were proposed by the Small Working Group.

89. The SC **AGREED** that both definitions have some merit and that each one could be used if all FAD-related data are included as part of the submissions to the Secretariat, **NOTING** however that the definition derived from the EU-funded CECOFAD project (i.e., a FAD is a floating object constructed and deployed by fishers with the purpose to aggregate fish) makes a clear distinction between man-made rafts and natural floating objects, which is essential for some scientific analyses, e.g., to assess the contribution of FAD-fishing to marine pollution.

90. The SC **REQUESTED** the WGFAD to discuss further the FAD definition and report to the WPEB and WPDCS in 2023.

91. The SC **NOTED** that the implementation of time-area closures for FAD fishing has been discussed for several years at the IOTC while found to be an effective management tool in other oceans, e.g., to reduce fishing mortality on juveniles of tuna. The SC **ACKNOWLEDGED** the need to provide clear guidance to the Commission on this matter and **REQUESTED** the WGFAD to prioritise this undertaking.

92. The SC **NOTED** that no agreement was reached by the WGFAD regarding the potential efficacy of time-area closure for FAD fishing in absence of scientific assessment on their location and duration, further **NOTING** that FAD purse seine fishing grounds are widely spread in the Indian Ocean as compared to other oceans (e.g., Atlantic Ocean).

93. The WGFAD **NOTED** that some research is currently conducted by some CPCs to assess the feasibility and effects of seasonal closing of FAD fishing.

94. **NOTING** that the WGFAD endorsed the need to move towards biodegradable FADs and **RECALLING** that the transitioning to biodegradable FADs is explicitly included in Resolution 19/02, the SC **NOTED** that more guidance might be required by the Commission so support the concrete implementation of biodegradable FADs.

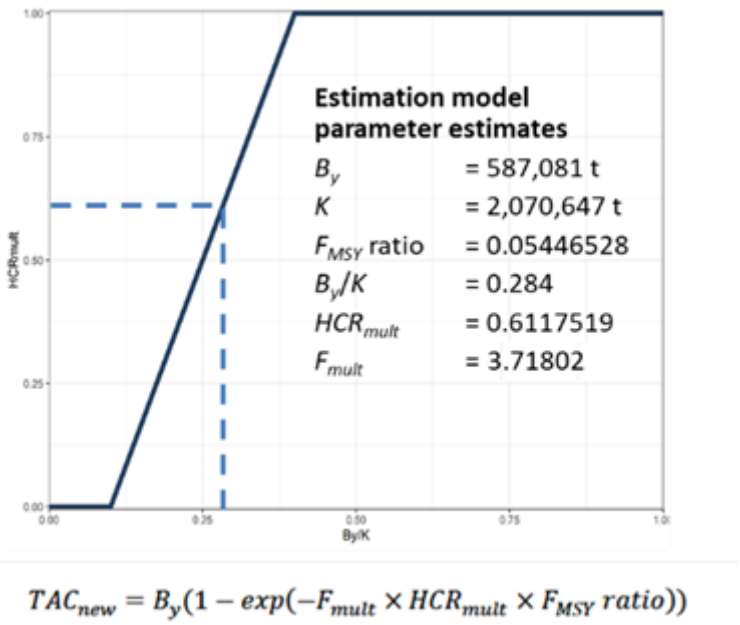
7.4.3 Bigeye Tuna MP

95. The SC **RECALLED** that Resolution 22/03 adopted the bigeye management procedure and that due to the adoption of the MP for bigeye tuna, the role of the BET stock assessment has now changed to only providing information on stock status rather than also being a tool for providing management advice.

96. The SC **NOTED** the MP schedule requires the MP to be run by the IOTC Scientific Committee in 2022, through the Working Party on Methods and Working Party on Tropical Tunas, including a review of exceptional circumstances, to recommend a TAC for 2024 and 2025 for IOTC Commission consideration. The SC **NOTED**

that the key data inputs to the MP and the calculation of the TAC has been presented to both the WPM13 and WPTT24.

97. The SC **NOTED** that to run the BET MP, a Pella-Tomlinson biomass dynamic model was firstly fitted to the catch and the longline CPUE index to estimate (within the MP model) stock depletion, and then the harvest control rule ($TAC_{new} = B_y(1 - exp(-F_{mult} \times HCR_{mult} \times F_{MSY}ratio))$) was used to calculate the TAC (Figure a), and finally the 15% maximum TAC change is applied. The SC **NOTED** that the data input to the MP is consistent with the stock assessment (the longline CPUE index was combined across the four regional indices used in the assessment), and the internal estimation model of the MP fits well to these data.



$$TAC_{new} = B_y(1 - exp(-F_{mult} \times HCR_{mult} \times F_{MSY}\, ratio))$$

Figure a: the BET tuna Harvest Control Rule and control parameters estimated from the Pella-Tomlison model used to calculate the TAC

98. 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 **RECOMMENDED** that the Commission endorse the calculated TAC for 2024 and 2025.

99. 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.

100. The SC **NOTED** the consideration of exceptional circumstances for the Bigeye Tuna MP in 2022 were discussed extensively at WPM8 and WPTT24 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. The SC **AGREED** that the review of evidence for exceptional circumstances did not identify any reasons to change the advice on the TAC.

101. The SC **NOTED** that there is a one-year gap between the TAC's calculation and intended implementation. The SC also **NOTED** that the TCMP had discussed and agreed this timeline for running the MP. It is noted that the MP is robust to the implementation lag, which has been thoroughly tested in the MSE.

7.4.4 Other Matters

102. The SC thanked the Australian scientists for taking the lead of running the bigeye MP for the first year. The SC **AGREED** that the secretariat would from now take responsibility for managing it going forward, with assistance from the CPC's scientists.

7.5 Report of the 8th Session of the Working Party on Temperate Tunas (WPTmT08)

103. The SC **NOTED** the report of the 8th Session of the Working Party on Temperate Tunas (IOTC–2022–WPTmT08(AS)–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 42 participants (cf. 23 in 2019). No MPF funding was provided as the meeting was held online.

7.5.1 Albacore tuna stock assessment

104. The SC **NOTED** that a new stock assessment was carried out for albacore in 2022 to update the assessment undertaken in 2019. The stock assessment was carried out using Stock Synthesis III (SS3). 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.

105. The SC **NOTED** that the final assessment is based on two models, one of which incorporates the southwest CPUE and the other incorporates the northwest CPUE. The two models are integrated to provide the estimations of the stock status. The SC **NOTED** that the revised model indicated that the status of the stock has been revised from not overfished but subject to overfishing to not overfished and not subject to overfishing.

106. The SC **NOTED** the following potential causes for the change in stock status: some differences between the new joint CPUE series and the previous indices, including a decline in longline catches over the past four years, a significant downweighting of size data, and changes to the fleet structure in the model where each regional LL fishery are divided into four quarterly fisheries.

107. The SC **NOTED** that the main factor influencing estimations of the stock state is the LL CPUE indices. Due to the restricted access to operational data, there have been some changes to the standardization method. Therefore, uncertainty exists on whether these modifications lead to more representative indices. It was noted that the CPUE index in the North-western fishery (LL 1) has much higher variability than the CPUE index in the South-western fishery (LL 3), which has a somewhat flatter trend than the previous index.

7.6 Report of the 13th Session of the Working Party on Methods (WPM13)

108. The SC **NOTED** the report of the 13th Session of the Working Party on Methods (IOTC–2022–WPM13–R), including the consolidated list of recommendations provided as an appendix to the report. The meeting was attended by 60 participants (cf. 54 in 2021). No MPF funding was provided as the meeting was held online.

109. 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.

7.6.1 Management Strategy Evaluation Progress

110. The SC **NOTED** the good progress made in Management Strategy Evaluations exercises for IOTC species in 2021, 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 2022.

7.6.2 Albacore MSE

111. The SC **NOTED** that the ALB operating model (OM) has been updated from the 2021 assessment models, which are now based on 2 model runs, each with a different CPUE index. The OM consists of a total of 432 models runs which are configured along similar sources of uncertainty levels as the previous one.

112. The SC **NOTED** that alternate methods for conditioning OMs, such as Approximate Bayesian Computation (ABC), might provide a wide range of options to the many issues that can arise during conditioning. The SC agreed that it should first be tested, and albacore could serve as a useful case study for

the use of ABC for OM conditioning. The SC further **NOTED** that if such a strategy is to be used in the future, prior distributions for parameters need to be established.

7.6.3 Skipjack tuna MSE

113. The SC **NOTED** the recent SKJ MSE focused on addressing the TCMP05's request to incorporate implementation errors in the MSE framework and has evaluated MPs that are resilient to implementation errors. The MSE tested implementation errors ranging from 10% to 40% (the actual catches in 2018 and 2019 were 29% and 16% greater than the current TAC). As such, the magnitude of implementation errors adequately compensates for the discrepancy between the TAC and the actual catch.

7.6.4 Yellowfin tuna MSE

114. The SC **NOTED** there has been no further progress on the OM development of yellowfin tuna, pending the results of the external review of the yellowfin stock assessment model which is scheduled to take place February in 2023.

7.6.5 CKMR design study

115. The SC, However, **NOTED** that there has been further advancement of the CKMR design study for yellowfin tuna. The SC **NOTED** that the design study indicates that collection of 30,000 samples each year would provide useful population metrics (Total Reproductive Output (TRO, similar to spawning stock biomass), depletion in TRO, adult mortality and mean recruitment) with reasonable precision. Specifically, the depletion in total reproductive output (TRO), could be estimated with a coefficient of variation (CV) of 15% with 30,000 samples collected each year for 5 years. The logistics of sampling appear feasible given the size samples available throughout the IOTC fisheries, however, it is vital to account the variability in access and sampling quality between fisheries, therefore a phased approach is needed.

116. The SC **NOTED** that the result of the design study is thought to be robust, which means that if targeted samples can be gathered and enough kinship pairs can be located, the intended precision of the population estimates can be achieved, to significantly improve the precision of assessment and robustness of management advice. Further collaborative work is needed to resolve logistical challenges of sampling, feasibility, costs and benefits.

7.6.6 Bigeye tuna MSE

117. The SC **NOTED** that the running the BET MP and the calculation of the TAC has been presented to both the WPM13 and WPTT24 (see Section 7.4.3).

118. 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.

7.6.7 Swordfish MSE

119. The SC **NOTED** that the newly proposed simplified OM grid provides a comparable perspective on uncertainty to the existing OM. It was noted that there is a wide spread of uncertainty related to stock status in the swordfish OM.

120. The SC **NOTED** that the value of 0.2 for sigmaR that came from the assessment is quite low and may not be appropriate for an oceanic species like swordfish. The SC agreed that higher values are explored as a robustness test of the OM

7.6.8 Update on TCMP05

121. The SC **NOTED** document IOTC-2022-TCMP05-R on the Report of the 5th session of the TCMP held in May 2022. The SC **NOTED** that the WPM had taken into consideration the recommendations and discussions held at that meeting.

122. 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.

123. 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.

7.7 Report of the 18th Session of the Working Party on Data Collection and Statistics (WPDCS18)

124. The SC **NOTED** the consolidated list of recommendations from the 18th Session of the Working Party on Data Collection and Statistics provided as an appendix to the report. The meeting was attended by 111 participants (cf. 94 in 2021) 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. No MPF funding was provided as the meeting was held online.

7.7.1 Updates to the workflow for the management and submission of statistical data to the IOTC

125. The SC **ACKNOWLEDGED** the extensive work done to improve the characterization of fisheries of relevance to the IOTC and **NOTED** how the proposed approach guarantees a better understanding of the different segments of all fisheries concerned.

126. The SC **NOTED** the Secretariats intention to continue working with CPCs and national experts to retroactively apply the new fisheries characterization to all historical data, in order to guarantee full continuity in the time series of all relevant datasets. This issue will then be discussed again by the WPDCS in 2023.

127. The SC **NOTED** the proposed updates to the *recommended* forms for the submission of fishery statistics to the IOTC and **ACKNOWLEDGED** that their adoption will further streamline and simplify the data submission process for both the CPCs and the Secretariat, and therefore significantly improve the timeliness and accuracy of the information available to IOTC scientists.

128. Furthermore, the SC **RECALLED** that the IOTC data submission forms are *recommended* and that CPCs can also submit fishery data using different templates as long as the reference codes and all the mandatory data elements prescribed by the IOTC Resolutions are all included.

129. In order to transition to a future adoption of the IOTC forms and workflow, the SC **AGREED** that the IOTC Secretariat organize workshops, webinars and any other form of training and interactive tools to support CPCs in this regard.

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.

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.

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.

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.

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.

135. The SC **NOTED** the Secretariat's proposal for a continuation of the study on the application of the matrix approach for the characterization of Indian Ocean fisheries and **REQUESTED** interested CPCs to liaise with the Secretariat to express their interest in further contributing to this study.

136. The SC **ENDORSED** the request that Indonesia continue reassessing their official catch data in collaboration with the IOTC Secretariat, and that this process continues until fluctuations in the official catch levels reported for several species are reduced sensibly, and the discontinuities with years before and after those subject to this re-estimation exercise are minimized.

7.7.2 ROS

137. The SC **ENDORSED** the revised versions of the ROS data reporting forms for longline and purse seine fisheries presented at the WPDCS for use by those fleets / CPCs that do not adopt the ROS electronic tools for the collection and management of scientific observer data.

7.7.3 Yellowfin tuna catch limits for 2022 and 2023 (Res. 19/01 and 21/01)

138. The SC **NOTED** the comment from Seychelles regarding the need of a more precise interpretation of para. 14.a of Res. 21/01 which determines how overcatch from Res. 19/01 should be accounted for in 2022 and 2023 and **ACKNOWLEDGED** that Seychelles will bring this matter to the attention of the Commission for further clarification.

139. The SC **NOTED** that Indonesia's official catches used for the calculation of catch limits according to Res. 19/01 are taken from the National Reports, as requested, and that the categorisation adopted therein for the apportioning of catches by the artisanal / industrial nature of the fisheries is currently under revision by Indonesia, with a view to better comply with the official categorisation used by the IOTC.

140. Therefore, the SC **ACKNOWLEDGED** Indonesia's request to consider the YFT catch limits presented in Appendix 33, Table 2 as *preliminary* and subject to updates that will be communicated in due course to the IOTC.

141. The SC also **NOTED** a remark from I.R. Iran regarding their historical yellowfin tuna catches used to calculate the annual limits according to Res. 19/01, and how these might include catches of vessels of less than 24 m in length overall and exclusively fishing in Iran's EEZ, which should be excluded from the limit of applicability of Res. 19/01.

142. For this reason, the SC **ACKNOWLEDGED** that I.R. Iran will provide revised historical catch series of yellowfin tuna from their industrial gillnet fishery that will eventually be used by the Secretariat to re-estimate their base annual limit in Appendix 33, Table 2 and the potential over-catches for 2020-2022 in agreement with the criteria expressed by Res. 19/01, and that therefore the values presented in this table for I.R. Iran fisheries shall be considered *preliminary*.

143. The SC **ENCOURAGED** Indonesia. I.R. Iran and all CPCs bound by resolution 19/01 to re-submit their historical catches of yellowfin tuna (2014-2021) through form 1-RC-YFT, which accounts for the breakdown of said catches by vessel size category and area of operation, to improve the calculation of base catch limits and potential overcatches.

144. The SC also **NOTED** that the base annual limit calculated for the EU in agreement with Res. 21/01 is based on the revised historical time series that exclude any catch originally attributed to EU,GBR.

145. The SC **RECALLED** that this approach was jointly agreed by the EU and GBR, and that for this reason the current base annual limit presented in Appendix 33, Table 1 for the EU differs from what originally included in IOTC circular 2021-78, which *estimated* the catch limit for 2022 on the basis of the information current at the time of its drafting.

146. Considering this, the SC **ENDORSED** with *caveats* the annual catch limits for 2022 (calculated) and 2023 (estimated) as deriving from Res. 19/01 and 21/01 and presented in Appendix 33 as Table 1 and Table 2, respectively, **RECALLING** that these will be updated as soon as Indonesia and I.R. Iran will provide their revised historical catch series of yellowfin tuna from 2014 onwards.

7.7.4 Update on WGEMS02

147. The SC **NOTED** the report of the 2nd ad hoc working group meeting on Electronic Monitoring Standards (IOTC-2022-WGEMS02-R). The meeting was attended by 104 participants (cf. 79 in 2021).

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.

149. Moreover, the SC **NOTED** that Annex 1 and 2 of the EM Data Standards (Appendix 6C) are general guides that should be tailored to each fishery and could vary from fleet to fleet, those annexes (VMS and EM capabilities to collect ROS minimum requirements) will be finalised during next IOTC WGEMS (15-16 March, 2023) before IOTC Commission Consideration.

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

7.8.1 Data collection and capacity building

150. 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.

7.8.2 Invited Expert(s) at the WP meetings

151. 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.

7.8.3 Meeting participation fund

152. The SC **NOTED** that in 2022, no MPF funding was provided for working party participation as all meetings were held online. However, the MPF was utilised to support participation at the SC meeting.

153. The SC reiterated its **RECOMMENDATION** that the IOTC Rules of Procedure (2014), for the administration of the Meeting Participation Fund be modified so that applications are due not later than 60 days, and that the full draft paper be submitted no later than 45 days before the start of the relevant meeting. The aim is to allow the Selection Panel to review the full paper rather than just the abstract, and provide guidance on areas for improvement, as well as the suitability of the application to receive funding using the IOTC MPF. The earlier submission dates would also assist with visa application procedures for candidates.

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

154. 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.

155. The SC **NOTED** that short term funding for the shipment of ID Guides had also been provided by the OFCF Japan. The SC expressed its gratitude to the OFCF for providing this important funding.

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

156. **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.

157. 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

158. The SC **STRESSED** that yellowfin and bigeye tuna are overfished and subject to overfishing.

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

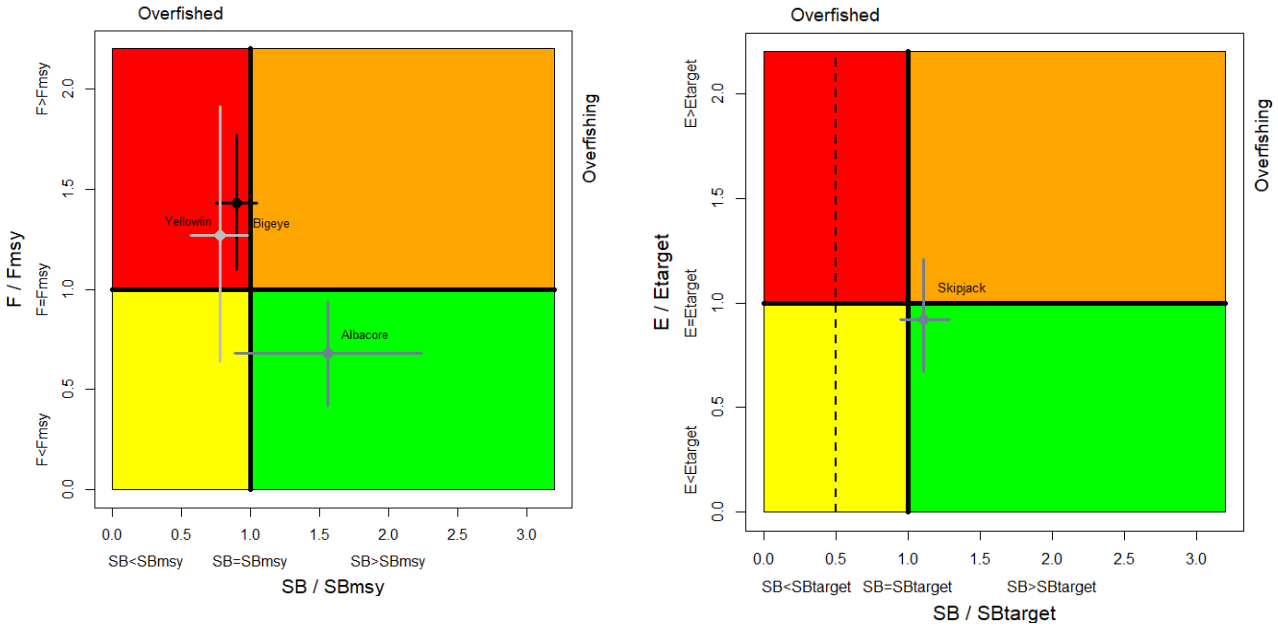


Fig. 1. (Left) Combined Kobe plot for bigeye tuna (black: status in 2021, based on the assessment conducted in 2022), and yellowfin tuna (light grey: 2020, with assessment conducted in 2021) and albacore (dark grey: 2020 with assessment conducted in 2022) showing the estimates of current spawning biomass (SB) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality. (Right) Kobe plot for skipjack tuna (2019 with assessment conducted in 2020) showing the estimates of the current stock status (The dashed line indicates the limit reference point at 20%SB0 while SBtarget=0.4 SB0). Cross bars illustrate the range of uncertainty from the model runs with an 80% CI (95% CI for albacore).

160. The SC **NOTED** paper IOTC–2022–SC25–ES05 which provided an overview of the biology, stock status and management of southern bluefin tuna (*Thunnus maccoyii*), and thanked CCSBT for its provision.

8.2 Tuna and mackerel – neritic species

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 17

Frigate tuna (*Auxis thazard*) – Appendix 18

Kawakawa (*Euthynnus affinis*) – Appendix 19

Longtail tuna (*Thunnus tonggol*) – Appendix 20

Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix 21

Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix 22

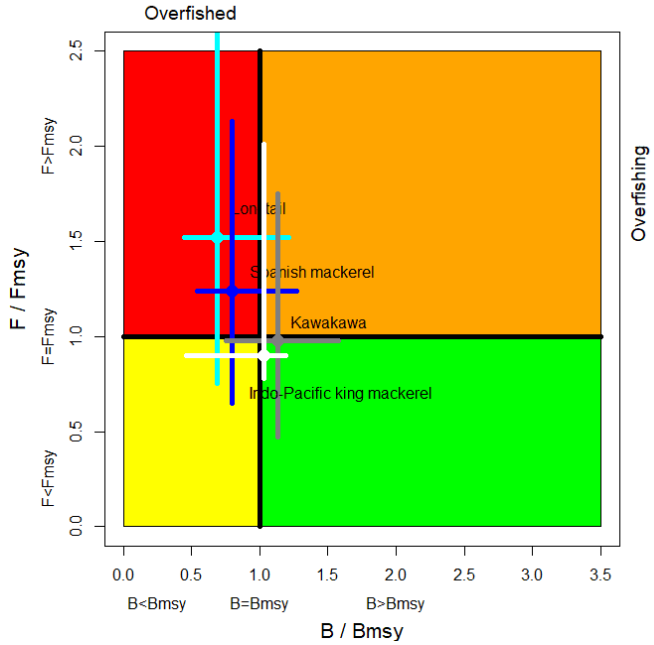


Fig. 2. Combined Kobe plot for longtail tuna (cyan), narrow-barred Spanish mackerel (blue), kawakawa (grey) (all for 2018 with assessment carried out in 2020, white) and Indo-Pacific king mackerel (2019 with assessment carried out in 2021 (white)), showing the estimates of stock size (B) and current 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 2022 (Fig. 3):

Swordfish (*Xiphias gladius*) – Appendix 12

Black marlin (*Istiompax indica*) – Appendix 13

Blue marlin (*Makaira nigricans*) – Appendix 14

Striped marlin (*Kajikia audax*) – Appendix 15

Indo-Pacific sailfish (*Istiophorus platypterus*) – Appendix 16

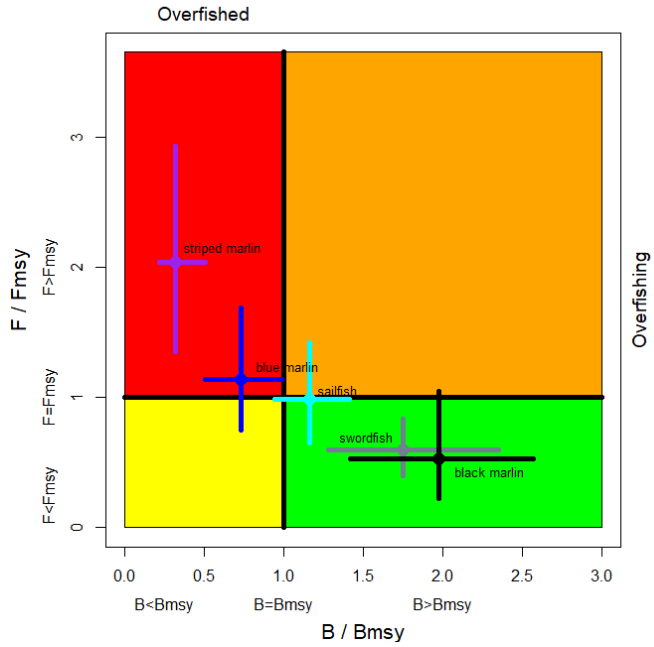


Fig. 3. Combined Kobe plot for swordfish (2018 with assessment conducted in 2020, grey), Indo-Pacific sailfish (2020 with assessment conducted in 2022, cyan), black marlin (2019 with assessment conducted in 2021, black), blue marlin (2020 with assessment conducted in 2022, blue) and striped marlin (2019 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–2022–SC25–07 which provided an update on the status of implementation and reporting to the IOTC Secretariat set out by Resolution 11/04 On a Regional Observer Scheme (ROS) including the coverage estimated for both the longline and purse seine large scale fisheries from concerned CPCs, and how these compare to the expected minimum coverage level.

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-2021-SC24-07, 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-2022-SC25-07 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. 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 for the SC, the SC **NOTED** that raising this minimum level of coverage would be beneficial.

172. 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.

173. 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

174. The SC **NOTED** that the ROS pilot project had been paused throughout 2020 and most of 2021 due to the inability of the Contractors to travel to the participating countries and provide the necessary training. However, the project resumed towards the end of 2021.

175. 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 was now coming to a close.

176. The SC **NOTED** that the Secretariat plans to continue working with CPCs to further develop their observer schemes and to finalise the eCollection systems 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

177. The SC **NOTED** paper IOTC–2022–SC25–10 which provided the SC with an update on the progress made on its 2020 recommendations (also available in Appendix 34).

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

11.2 Program of Work (2023–2027) and assessment schedule

11.2.1 Program of Work

179. The SC **NOTED** IOTC–2022–SC25–08 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.

180. 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.

181. 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.

182. 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.

183. The SC **NOTED** a request from a member to provide MSY and catch information by zone (and in particular by EEZ). The SC were informed by the Secretariat that the data provided by CPCs is not stratified by EEZ and therefore proportioning catch in this way is problematic. In addition, the SC **NOTED** that for highly migratory pelagic tuna species, providing MSY by region is not possible due to the high mobility of the species. As such any MSY estimate would not reflect the true abundance of the species in a region throughout the year or between years and that MSY only makes sense if provided across the entire range of a stock.

184. 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)	**CPUE standardisation** • Develop standardised CPUE series for each tropical tuna fleet/fishery for the Indian Ocean • Review period where stock was assessed as being overfished without experiencing overfishing. • Regional scaling parameters • Effect of piracy on CPUE after piracy period	**Fisheries impact analysis** Impact of individual fisheries on stock parameters.
WPEB	**Fisheries data collection**: 1.1 Historical data mining for the key species and IOTC fleets (e.g., as artisanal gillnet and longline coastal fisheries) including workshops: 1.1.2 Historical data mining for the key species, including the collection of information about catch, effort and spatial distribution of those species and fleets catching them 1.1.3 Catch composition reconstruction (initial focus Pakistan and Indonesia) 1.2 Implementation of the Pilot Project (Resolution 16/04) for the Regional Observer Scheme 1.2.1 Development of a Regional Observer database and population with historic observer data 1.2.2 Development, piloting and implementation of an electronic reporting tool to facilitate data reporting	**Shark research plans** Consultancy to develop shark research plans Priority species: scalloped hammerhead sharks	**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)

	1.2.3 Development and trial of Electronic Monitoring Systems for gillnet fleets 1.2.4 Port sampling protocols for artisanal fisheries.		
WPNT	**Stock structure (connectivity)** 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)	**Stock assessment / Stock indicators** Explore alternative assessment approaches and develop improvements where necessary based on the data available to determine stock status for longtail tuna, kawakawa and Spanish mackerel • The Weight-of-Evidence approach should be used to determine stock status, by building layers of partial evidence, such as CPUE indices combined with catch data, life-history parameters and yield-per recruit metrics, as well as the use of data poor assessment approaches (eg. CMSY, OCOM, LB-SPR, Risk based methods). • Exploration of priors and how these can be quantifiably and transparently developed • Take into consideration the outputs of genetic studies to investigate stock structure and regional differences in populations Improve the presentation of management advice from different assessment approaches to better represent the uncertainty and improve communication between scientists and managers in the IOTC.	**Data mining and collation** Collate and characterize operational level data for the main neritic tuna fisheries in the Indian Ocean to investigate their suitability to be used for developing standardised CPUE indices. The following data should be collated and made available for collaborative analysis: 1. catch and effort by species and gear by landing site; 2. operational data: stratify this by vessel, month, and year for the development as an indicator of CPUE over time; and 3. operational data: collate other information on fishing techniques (i.e. area fished, gear specifics, depth, environmental condition (near shore, open ocean, etc.) and vessel size (length/horsepower)). 4. Re-estimation of historic catches for assessment purposes (taking into account updated identification of uncertainties and knowledge of the history of the fisheries) • (Data support missions to priority countries: India, Oman, Pakistan)
WPTmT	**Stock structure (connectivity and diversity)** 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)	**CPUE standardization** 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.

		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.	3.1.1 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.
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	**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	**Stock structure (connectivity and diversity)** Continue work on determining stock structure of Swordfish, using complimentary data sources, including genetic and microchemistry information as well as other relevant sources/studies.

	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).	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.	
WPDCS	**Artisanal fisheries data collection** a) Assist the implementation of data collection and sampling activities for fisheries insufficiently sampled (2023-2024). Priority to be given to the following fisheries: ● Indonesia ● India ● Bangladesh ● Pakistan ● I.R. Iran ● Kenya ● Somalia ● Sri Lanka ● Other CPCs as required	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 (2023-2024)	
WPM	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

11.2.2 Assessment schedule

185. The SC **ADOPTED** a revised assessment schedule, ecological risk assessment and other core projects for 2023–27, 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

186. 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 2023 and 2024

187. The SC **NOTED** paper IOTC–2022–SC25–09 which outlined the proposed schedule for IOTC Working Parties and SC meetings for 2023 and 2024.

11.3.1 Data preparatory meetings and Hybrid meetings

188. **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.

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.

11.3.2 Final Meeting schedule

190. The SC **REQUESTED** that the schedule of Working Party and Scientific Committee meetings for 2023 and 2024 provided at Appendix 37 be communicated by the IOTC SC Chairperson to the Commission for its endorsement.

12. OTHER BUSINESS

191. The SC **NOTED** that on several occasions, Working Parties referred to the application of the Precautionary Approach (PA). The SC **RECALLED** that the WPs should continue to provide all information regarding uncertainty in the scientific advice, but that the application of the PA is implicit in the Commissions deliberations at is not the responsibility of the SC to advise on this approach.

13. ADOPTION OF THE REPORT OF THE 25TH SESSION OF THE SCIENTIFIC COMMITTEE

192. The SC **RECOMMENDED** that the Commission consider the consolidated set of recommendations arising from SC25, provided at Appendix 38.

193. The report of the 25th Session of the Scientific Committee (IOTC–2022–SC25–R) was **ADOPTED** by correspondence.

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APPENDIX 2
AGENDA FOR THE 25TH SESSION OF THE SCIENTIFIC COMMITTEE

Date: 5 - 9 December 2022
Location: Eden Bleu, Seychelles/Hybrid
Time: 09:00 – 17:00 daily
Chair: Dr Toshihide Kitakado (Japan)
Vice-Chair: Dr Denham Parker (South Africa)

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

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

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

4. **DECISIONS OF THE COMMISSION RELATED TO THE WORK OF THE SCIENTIFIC COMMITTEE** (IOTC Secretariat)
   - 4.1 Outcomes of the 26th Session of the Commission.
   - 4.2 Previous decisions of the Commission

5. **SCIENCE RELATED ACTIVITES OF THE IOTC SECRETARIAT IN 2022** (IOTC Secretariat)
   - 5.1 Report of the Secretariat – Activities in support of the IOTC science process in 2022

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

7. **REPORTS OF THE 2022 IOTC WORKING PARTY MEETINGS**
   - 1.1 IOTC–2022–WPNT12–R Report of the 12th Session of the Working Party on Neritic Tunas
   - 1.2 IOTC–2022–WPB20–R Report of the 20th Session of the Working Party on Billfish
     - 1.2.1 Blue Marlin stock assessment
     - 1.2.2 Indo-Pacific Sailfish stock assessment
     - 1.2.3 Revision of catch levels of Marlins under Resolution 18/05
   - 1.3 IOTC–2022–WPEB18–R Report of the 18th Session of the Working Party on Ecosystems and Bycatch
     - 1.3.1 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
     - 1.3.2 Other Matters
   - 1.4 IOTC–2022–WPTT24–R Report of the 24th Session of the Working Party on Tropical Tunas
     - 1.4.1 Bigeye tuna stock assessment
     - 1.4.2 Update on the WGFAD03
     - 1.4.3 Bigeye Tuna MP
     - 1.4.4 Other Matters
   - 1.5 IOTC-2022-WPTmT08-R Report of the 8th Session of the Working Party on Temperate Tunas
     - 1.5.1 Albacore Tuna stock assessment
   - 1.6 IOTC–2022–WPM13–R Report of the 13th Session of the Working Party on Methods
     - 1.6.1 Management Strategy Evaluation Progress
     - 1.6.2 Update on TCMP05

1.7 IOTC–2022–WPDCS18–R Report of the 18th Session of the Working Party on Data Collection and Statistics
  1.7.1 Update on WGEMS02
1.8 Summary discussion of matters common to Working Parties (capacity building activities; connecting science and management, etc.)
  1.8.1 Data collection and capacity building
  1.8.2 Invited Expert(s) at the WP meetings
  1.8.3 Meeting participation fund
  1.8.4 IOTC species identification guides: Tuna and tuna-like species
  1.8.5 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 (2023–2027) and assessment schedule
  11.2.1 Program of Work
  11.2.2 Assessment schedule
  11.2.3 Consultants
11.3 Schedule of meetings for 2023 and 2024
  11.3.1 Data preparatory meetings
  11.3.2 Final Meeting schedule

12 OTHER BUSINESS (Chairperson)

13 REVIEW OF THE DRAFT, AND ADOPTION OF THE REPORT OF THE 25th SESSION OF THE SCIENTIFIC COMMITTEE (Chairperson)

APPENDIX 3
LIST OF DOCUMENTS

Document	Title
IOTC–2022–SC25–01a	Draft: Agenda of the 25th Session of the Scientific Committee
IOTC–2022–SC25–01b	Draft: Annotated agenda of the 25th Session of the Scientific Committee
IOTC–2022–SC25–02	Draft: List of documents of the 25th Session of the Scientific Committee
IOTC–2022–SC25–03	Outcomes of the 26th Session of the Commission (IOTC Secretariat)
IOTC–2022–SC25–04	Previous decisions of the Commission (IOTC Secretariat)
IOTC–2022–SC25–05	Report of the Secretariat – Activities in support of the IOTC science process in 2022 (IOTC Secretariat)
IOTC–2022–SC25–06	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–2022–SC25–07	Update on the implementation of the regional observer scheme (IOTC Secretariat)
IOTC–2022–SC25–08	Revision of the program of work (2023–2027) for the IOTC science process (IOTC Secretariat)
IOTC–2022–SC25–09	Proposed schedule of Working Party and Scientific Committee meetings for 2023 and 2024 (IOTC Secretariat)
IOTC–2022–SC25–10	Progress on SC24 recommendations (IOTC Secretariat)
Executive Summaries	
IOTC–2022–SC25–ES01	Status of the Indian Ocean Albacore (ALB: *Thunnus alalunga*) resource
IOTC–2022–SC25–ES02	Status of the Indian Ocean bigeye tuna (BET: *Thunnus obesus*) resource
IOTC–2022–SC25–ES03	Status of the Indian Ocean skipjack tuna (SKJ: *Katsuwonus pelamis*) resource
IOTC–2022–SC25–ES04	Status of the Indian Ocean yellowfin tuna (YFT: *Thunnus albacares*) resource
IOTC–2022–SC25–ES05	Report on biology, stock status and management of southern bluefin tuna: 2019 (from CCSBT)
IOTC–2022–SC25–ES06	Status of the Indian Ocean bullet tuna (BLT: *Auxis rochei*) resource
IOTC–2022–SC25–ES07	Status of the Indian Ocean frigate tuna (FRI: *Auxis thazard*) resource
IOTC–2022–SC25–ES08	Status of the Indian Ocean kawakawa (KAW: *Euthynnus affinis*) resource
IOTC–2022–SC25–ES09	Status of the Indian Ocean longtail tuna (LOT: *Thunnus tonggol*) resource
IOTC–2022–SC25–ES10	Status of the Indian Ocean Indo-Pacific king mackerel (GUT: *Scomberomorus guttatus*) resource
IOTC–2022–SC25–ES11	Status of the Indian Ocean narrow-barred Spanish mackerel (COM: *Scomberomorus commerson*) resource
IOTC–2022–SC25–ES12	Status of the Indian Ocean black marlin (BLM: *Makaira indica*) resource
IOTC–2022–SC25–ES13	Status of the Indian Ocean blue marlin (BUM: *Makaira nigricans*) resource

Document	Title
IOTC–2022–SC25–ES14	Status of the Indian Ocean striped marlin (MLS: *Tetrapturus audax*) resource
IOTC–2022–SC25–ES15	Status of the Indian Ocean Indo-Pacific sailfish (SFA: *Istiophorus platypterus*) resource
IOTC–2022–SC25–ES16	Status of the Indian Ocean swordfish (SWO: *Xiphias gladius*) resource
IOTC–2022–SC25–ES17	Status of the Indian Ocean blue shark (BSH: *Prionace glauca*)
IOTC–2022–SC25–ES18	Status of the Indian Ocean oceanic whitetip shark (OCS: *Carcharhinus longimanus*)
IOTC–2022–SC25–ES19	Status of the Indian Ocean scalloped hammerhead shark (SPL: *Sphyrna lewini*)
IOTC–2022–SC25–ES20	Status of the Indian Ocean shortfin mako shark (SMA: *Isurus oxyrinchus*)
IOTC–2022–SC25–ES21	Status of the Indian Ocean silky shark (FAL: *Carcharhinus falciformis*)
IOTC–2022–SC25–ES22	Status of the Indian Ocean bigeye thresher shark (BTH: *Alopias superciliosus*)
IOTC–2022–SC25–ES23	Status of the Indian Ocean pelagic thresher shark (PTH: *Alopias pelagicus*)
IOTC–2022–SC25–ES24	Status of marine turtles in the Indian Ocean
IOTC–2022–SC25–ES25	Status of seabirds in the Indian Ocean
IOTC–2022–SC25–ES26	Status of cetaceans in the Indian Ocean
Other meeting reports	
IOTC–2022–WPNT12–R	Report of the 12th Session of the Working Party on Neritic Tunas
IOTC–2022–WPB20–R	Report of the 20th Session of the Working Party on Billfish
IOTC–2022–WPEB18–R	Report of the 18th Session of the Working Party on Ecosystems and Bycatch
IOTC–2022–WPM13–R	Report of the 13th Session of the Working Party on Methods
IOTC–2022–WPDCS18–R	Report of the 18th Session of the Working Party on Data collection and Statistics
IOTC–2022–WPTT24–R	Report of the 24th Session of the Working Party on Tropical Tunas
IOTC-2022-TCMP05-R	Report of the 5th Session of the Technical Committee on Management Procedures
IOTC-2022-WGFAD03-R	Report of the 3rd meeting of the Working Group on FADs
IOTC-2022-WGEMS02-R	Report of the 2nd meeting of the Working Group on Electronic Monitoring Standards
National Reports	
IOTC–2022–SC25–NR01	Australia
IOTC–2022–SC25–NR02	Bangladesh, People's Republic of
IOTC–2022–SC25–NR03	China
IOTC–2022–SC25–NR03	Comoros
IOTC–2022–SC25–NR06	European Union
IOTC–2022–SC25–NR07	France (OT)
IOTC–2022–SC25–NR08	India
IOTC–2022–SC25–NR09	Indonesia
IOTC–2022–SC25–NR10	Iran, Islamic Republic of

Document	Title
IOTC–2022–SC25–NR11	Japan
IOTC–2022–SC25–NR12	Kenya
IOTC–2022–SC25–NR13	Korea, Republic of
IOTC–2022–SC25–NR14	Madagascar
IOTC–2022–SC25–NR15	Malaysia
IOTC–2022–SC25–NR16	Maldives, Republic of
IOTC–2022–SC25–NR17	Mauritius
IOTC–2022–SC25–NR18	Mozambique
IOTC–2022–SC25–NR21	Philippines
IOTC–2022–SC25–NR22	Seychelles
IOTC–2022–SC25–NR23	Somalia
IOTC–2022–SC25–NR24	South Africa
IOTC–2022–SC25–NR25	Sri Lanka
IOTC–2022–SC25–NR27	Tanzania
IOTC–2022–SC25–NR28	Thailand
IOTC–2022–SC25–NR29	United Kingdom of Great Britain and Northern Ireland
Information Papers	
IOTC–2021–SC24-INF01	Draft cooperation agreement between IOTC and IOSEA
IOTC–2021–SC24-INF02	Taiwan,China Report 2021

APPENDIX 4A
NATIONAL STATEMENTS

The SC noted the following statements made by Mauritius

25th Session of IOTC Scientific Committee
5-9 December 2022, Eden Bleu, Seychelles

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.

25th Session of IOTC Scientific Committee
5-9 December 2022, Eden Bleu, Seychelles

Agenda Item 6: National Reports from CPCs

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

25th Session of IOTC Scientific Committee
5-9 December 2022, Eden Bleu, Seychelles

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 have decided to begin negotiations on the exercise of sovereignty over the Chagos Archipelago.

However, the Republic of Mauritius wishes to point out that its position 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.

The SC noted the following statement made by the United Kingdom:

25th Session of IOTC Scientific Committee 5-9 December 2022

Statement by the UNITED KINGDOM

The United Kingdom notes the statement by Mauritius under agenda Item 6. As referenced by Mauritius, the United Kingdom and Mauritius have decided to begin negotiations on the exercise of sovereignty over the British Indian Ocean Territory (BIOT)/Chagos Archipelago.

The SC noted the following Statemenbt by France-OT

25th Session of IOTC Scientific Committee
5-9 December 2022
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 4B
NATIONAL REPORT EXECUTIVE SUMMARIES (2022)

Australia (IOTC-2022-SC25-NR01)

Pelagic longline and purse seine are the two main fishing methods used by Australian vessels to target tuna and billfish in the Indian Ocean Tuna Commission (IOTC) Area of Competence. The number of active longliners and levels of fishing effort are relatively low due to reduced profitability, primarily as a result of lower fish prices and higher operating costs. In 2021, two Australian longliners from the Western Tuna and Billfish Fishery and two longliners from the Eastern Tuna and Billfish Fishery operated in the IOTC Area of Competence. They caught 17.8 t of albacore (Thunnus alalunga), 50.7 t of bigeye tuna (*Thunnus obesus*), 19.9 t of yellowfin tuna (*Thunnus albacares*), 131 t of swordfish (*Xiphius gladius*) and 0.7 t of striped marlin (*Kajikia audax*). In 2021, three shortfin makos were landed by the Australian longline fleet operating in the IOTC Area of Competence and 3,565 other sharks were discarded/released. In addition, 10.5% of hooks deployed in the WTBF were observed with electronic monitoring in the 2021 calendar year. The actual catch of southern bluefin tuna (*Thunnus maccoyii*) in the purse seine fishery was 4,395 t in 2021. There was no skipjack tuna (*Katsuwonus pelamis*) caught by purse seine fishing.

Bangladesh (IOTC-2022-SC25-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 of high seas. 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 tunas and tuna-like fishes (mackerels) comprise about 6.63% (7893 MT) in industrial sector and 2.53% (14237 MT) in artisanal mechanized sector in the year 2020-21. 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-2022-SC25-NR04)

Deep-frozen longline targeting for tropical tuna and frozen longline targeting albacore are the only two fishing gears used by Chinese fleets to catch tuna and tuna-like species in the IOTC waters. The total number of Chinese longline vessels operating in the IOTC waters in 2021 was 78. The number of active deep-frozen longline vessels decreased from 72 in 2020 to 70 in 2021. The tropical tuna catch (bigeye and yellowfin tuna) of Chinese longline fleet in 2021 was estimated at 7,344MT, which was 51 MT higher than that in 2020 (7,293MT). The number of frozen longlines remained 8 in 2021, which

had no change compared with 2020. The albacore longline catch for 2021 was estimated at 2,360MT, less than in 2020 (3,763MT). Both the logbook and observer programs are being implemented for the Chinese longline fleets. In 2021, four scientific observers were deployed on board longline vessels to collect data for both target and bycatch species as required.

Comoros (IOTC-2022-SC25-NR03)

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 3 m à 9 m. Elle exploite essentiellement les espèces pélagiques (*Thunnus albacares*, *Katsuwonus pelamis*, *Thunnus alalunga*, *Istiophorus platypterus*, *Thunnus obesus*, *Euthynnus affinis*) et aussi des espèces benthiques. Elle contribue, 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 2021 est estimé à 18 585 tonnes de thonidés sur un ensemble de 4 803 embarcations.

Eritrea (No National Report Submitted)

European Union (IOTC-2021-SC24-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:
  - Data 2021:
    - 27 active vessels
    - 34.810 m^3.j transport capacity
    - 2.277 searching days and 5.608 days at sea
    - 154.702 t of catch
      - YFT 28,7 %
      - SKJ 60,9 %
      - BET 10,5 %
- Longliners targeting swordfish with significant associated catches of some pelagic shark species
  - Data 2021
    - 10 active vessels
    - 2,733* 10^6 hooks
    - 5.533 t of catch
      - SWO 35 %
      - BSH 52 %
      - SMA 9 %
- Longliners targeting swordfish with significant associated catches of tunas (La Réunion)
  - Data 2021

        - 19 active vessels (≥12m)
        - 3,42 * 10^6 hooks
        - 1.664 t of catch
            - SWO 48 %
            - YFT & BET 30 %
            - ALB 13 %

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

- Longliners
    - Data 2021
        - 21 vessels at Reunion Island (<12m)
            - 0,454 *10^6 hooks
            - 443 t of catch
                - SWO 27 %
                - YFT & BET 30 %
                - ALB 20 %
        - 2 vessels at Mayotte Island
            - 17,3 t of catch
                - YFT 52 %
                - SWO 37 %
- Trolling line and hand-lines
    - Data 2021
        - Reunion: 130 vessels
            - 515,6 t of catch
        - Mayotte: 87 vessels
            - 331, 6 t of catch

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

France-territories (IOTC-2022-SC25-NR07)
Depuis le passage de Mayotte comme territoire sous régime européen 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 parc naturel marin 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 2021, 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 2021 sur les thoniers senneurs ou navires auxiliaires sous pavillon étranger opérant dans la zone. Parmi les senneurs, les données collectées sur un des navires se sont révélées inexploitables, ainsi le présent rapport porte sur 317 journées observées réalisées en 10 marées.
La distribution géographique des activités montre que les jours de mer observés pour les 8 senneurs ont été distribués majoritairement et en proportion presque équivalente dans les eaux internationales (40,5%) et dans les ZEE seychelloise et malgache (42,3%). Seuls 8 jours de mer (2,5% de la totalité des jours observés) ont été localisés dans la ZEE des Iles Éparses. Au cours des 317 jours, 414 coups de pêche ont été observés (dont 368 coups positifs et 46 nuls), soit une moyenne de 1,3 coup/jour. Le total estimé des captures est de 12 997,3 tonnes avec presque une moitié dans les eaux internationales et l'autre moitié dans les ZEE visitées. Pour les 414 coups de pêche, 344 (83,1%) et 67 (16,2%) ont eu lieu sur des objets flottants et sur bancs libres, respectivement. Trois coups de pêche (0,7%) ont été réalisés avec une association avec un requin baleine malgré l'interdiction de ce type de calées (résolution 13/05).
La proportion de calées sur objets flottants varie entre 52,8% et 100% selon les senneurs. L'activité des senneurs autour des objets flottants (1303 opérations) a pu être intégralement documentée entre mise à l'eau, visite sur DCP, retrait, abandon, coulé, renforcement et remplacement. 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 2021, 54 opérations de pêche ont été observées lors de 2 marées entre le 7 octobre et le 10 décembre sur 2 navires réunionnais dans les ZEE des Iles Éparses, dont 30 par un observateur embarqué et 24 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 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 capturée 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 2020. 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 17 contributions scientifiques en 2021.

India (IOTC-2022-SC25-08)
The total landings of tuna and tuna-like species along Indian coasts had been showing a decreasing trend in the recent past. However, there was a marginal increase of 4.69% during the year 2021 with reference to 2020. The total landings of tuna and tuna-like species for 2021is estimated at1,59,744.03 tonnes, against 1,52,593.16tonnes during 2020. Gillnets remained the major gear contributing to the tuna and tuna like fish catch during 2021 also. Trawl and ring seine (19.28% and 12.66% respectively), followed by small longline (10.18%) were the principal gears contributing the catch. Pole and line fishing, practiced exclusively in the waters of the Lakshadweep Group of Islands, contributed 6.25% to the total landings. Other gears like Drift longline, Small purse seines, Handline, and Troll lines also contributed to the tuna landings in small quantities during the year. Considerable spatial variation was observed in the tuna landings during 2020. The western coast of India (FAO area 51) contributed the larger share to the landings (56.71%) and the balance 43.29% landings came from the east coast (FAO area 57).Tuna landings in 2021comprisedseven species, four representing the neritic (44.62%) and

three from the oceanic group (55.38%). Kawakawa (*Euthynnus affinis*, 31.01%) and Skipjack (*Katsuwonus pelamis*; 28.01%) contributed the maximum tuna catch, followed by Yellowfin tuna (*Thunnus albacares*) (26.55%). 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-2022-SC25-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, marlins, 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 2021 was estimated at around 210,613 tons1 which are composed of yellowfin tuna (57,106 tons), bigeye tuna (14,183 tons), skipjack tuna (129,754 tons), and albacore (9,570 tons). Landing ports, both artisanal and industrial, are still consistently monitored through various projects and scientific observer programs conducted altogether by the Research Institute for Tuna Fisheries (RITF) and Directorate General of Capture Fisheries (DGCF).

Iran (Islamic Republic of) (IOTC-2022-SC25-NR10)

Iran fishing grounds in southern waters of country are of the oldest and most important resources of large pelagic species. There are 4 coastal provinces in those areas and more than 11 thousand vessels consist of fishing boat, dhows and vessels which are engaged in fishing in the coastal and offshore waters. There are four fishing methods

targeting tuna and tuna-like species in the IOTC area which include gillnet, purse seine, long line by traditional boats and also some of small boats use trolling in coastal fisheries. Gillnet is the dominant fishing gear in the IOTC area competency, Majority of the production comes from the gillnet vessels operating within EEZ of Iran as well as offshore fishery. Iran has taken various actions to implement the Scientific Committee recommendations and IOTC Resolutions. One of them is national actions to improve data collection system for Tuna fishery. We have implemented modification of logbook template for Iran industrial purse seiners and artisanal gillnets to meet mandatory minimum statistic requirement, particularly concerning data recording of vessel position in IOTC area for target species, by-catch including 8 species of sharks and 5 species of billfish, non-targeted, associated and dependent species and discard.

The total production of large pelagic species during 2021 was 308,231 Mt which 274,235Mt belongs to tuna and tuna-like fishes in the Indian Ocean areas. Those amount of catch contains 211269 Mt of Tunas, 36969 Mt of Seerfish 26,530 Mt of Billfish, 4,140 Mt different species of shark and 29,323 Mt other species.

Japan (IOTC-2022-SC25-NR11)

This Japanese national report describes following eight relevant topics stipulated in the 2021 national report guideline mainly in recent five years (2017-2021) (2021 is provisional) , i.e. (1) Fishery information (longline and purse seine fishery), (2) fleet information, (3) catch and effort by species and gear, (4) ecosystem and bycatch (sharks, seabirds, marine turtles), (5) national data collection and processing systems including “logbook data collection and verification”, “vessel monitoring system”,

"observer scheme", "port sampling programs" and "unloading and transshipment", "Monitoring billfish catch", and sampling plans for mobulid rays", (6) national research programs, (7) Implementation of Scientific Committee recommendations and resolutions of the IOTC relevant to the Scientific Committee", and (8) "literature cited". Highlights from the eight topics are described as follows: Japan is currently operating longline and purse seine fisheries in the Indian Ocean. Catch and effort data are collected mainly through logbooks. Bigeye, yellowfin, albacore, southern bluefin tuna are main components of the catch by longliners, while three species (skipjack, yellowfin and bigeye tuna) are exploited by purse seiners. In recent years, catch and effort by longliners are in a low level mainly because of piracy activities off Somalia. Japan has been dispatching scientific observers in accordance with the Resolution 11/04, whose coverage for longline fishery has been more than the 5% compliance level in recent years except for 2020 and 2021 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-2022-SC25-NR12)

The Kenya national scientific report has described the topics provided in the 2022 national report guideline with information provided from 2017 to 2021 and in some cases making reference to the available information. The longline data is provisional until verified from the longline data.

In 2021, the industrial fleet consisted of 4 industrial longline vessels and 6 purse seine vessels. The purse seine vessels did not report any catch. In 2021 four (4) Kenya pelagic longline vessels operated in the IOTC area of competence. The IOTC species landed during the year included swordfish (298 tons), yellowfin tuna (12 tons) Bigeye tuna (17 tons), sharks (97 tons) in the industrial longline.

The artisanal vessels were 455 that caught tuna and tuna like species with a total catch amounted to 1613 tonnes, a decrease from the 2020 records. The main gears used are artisanal long line hooks, gillnets, monofilament nets and artisanal trolling lines.

Monitoring of the artisanal and semi-industrial vessels was also done while the industrial vessels were monitored through logbooks. The Observer Programme resumed in mid-2021 and the coverage was low to abide to the COVID 19 measures and ministry of health protocol for boarding vessels.

Republic of Korea (IOTC-2022-SC25-NR13)

The number of active vessels in 2021 was 5 for longline fishery and 2 for purse seine fishery. With this fishing capacity, Korean tuna longline fishery caught 1,016 ton in 2021, which was 66% lower than that of 2020. The fishing efforts in 2020 were 4,981 thousand hooks. The fishing efforts averaged for 5 recent years (2016-2020) were 5,851 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-2022-SC25-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. L'année 2021, le nombre des palangriers nationaux s'est maintenu au nombre de cinq (05) comme ceux des quatre dernières années. 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. 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.
En ce qui concerne le suivi de débarquement des poissons pélagiques issus de la petite pêche et de la pêche artisanale dans le Nord, Est et Ouest de Madagascar, 34 sites de débarquement de capture sont actuellement couverts pour l'année 2021. Les engins de pêche utilisés sont principalement le filet maillant, la ligne et la palangre.

Malaysia (IOTC-2022-SC25-NR15)
Total catch of marine fish from Malaysian waters in 2021 were 1.328 million mt, a slight decreased 3.99% compared to 1.383 million in 2020. The total landing in 2021 were attributed to the catch from 48,493 registered vessels with trawlers, purse seines, drift nets contributed large percentage of the catches. In 2021, marine fish production from the west coast of Peninsular Malaysia (Malacca Straits) contributed 747,063 mt (56.25%) out of the total catch.
Neritic tuna contributes 51,014 mt (3.84%) of Malaysia's marine fish landings in 2021. Purse seiners are the main fishing gears in neritic tuna fisheries, especially the 40-69.9 GRT (Zon C) and >70 GRT (Zon C2) vessel size, with longtail tuna dominated the landings followed by kawakawa and frigate tuna. In 2021, neritic tuna landings in west coast Peninsular Malaysia amounted to 9,974 mt; decreasing by 21.09% compared to 12,633 mt in 2020. Meanwhile landings of neritic tuna in Malaysia ranged from 51,000 mt to 80,000 mt (2016-2021). The highest catch was recorded in 2019 with 87,400 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 19.7% from 2446.73 mt in 2020 to 1,965.9 mt in 2021. Albacore landings declined from 1,821.4 mt in 2020 to 1271.2 mt in 2021. Albacore tuna formed nearly 75% of the total catches in the form of whole frozen tuna meanwhile, Yellowfin contributed 15.3% and Bigeye 10.25% 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-2022-SC25-NR16)
Maldives is a tuna fishing nation with a history dating back hundreds of years. Tuna fishery was the mainstay of the Maldivian economy, providing employment and income, until the establishment of the tourism industry.
The Maldives enacted a new fisheries act in 2019 which superseded the Fisheries Act of 1987. The new Act strengthened fisheries management and governance within the Maldivian waters and Maldives flagged vessels as well as personnel on board these vessels. The Act requires all commercial fisheries, including tuna and non-tuna fisheries, to be managed through respective management plans which have been gazetted.
The tuna fishing fleet has undergone several changes following mechanization that began in 1974. The current fleet is a mixed of wooden and fibre reinforced plastic (FRP) vessels. Majority of the tuna fishing vessels range from 12.5 - 32.5 m in length. Trip lengths for pole and line trip may last between a single day and a week while handline trips are generally 10-15 days long and may depend on the catch and bait availability. The longline fleet that operated in the outer waters of the Maldives EEZ,

beyond 100 miles and the high seas, that was suspended in June of 2019 remained as such and therefore did not operate in 2021.

Maldives tuna catches peaked in 2006, reaching about 167,000 t, after which the catches declined by 53% by 2010. Tuna catches have been recovering since with 2021 recording about 143,531 t. In terms of species, skipjack and yellowfin are the two main species in the Maldives tuna fisheries with 82% and 17% contribution respectively

Skipjack tuna catch from all gears increased by 33% in the last five years (from 88,825t to 118,683t). In contrast, yellowfin tuna catch continues to decline and observed a 50% drop within the last five years (49,359 t to 24,547 t). With the absence of the longline fishery, bigeye tuna catch has been reduced substantially. Over the past 5 years, the decline was at 79%. However, reported catch of bigeye tuna increased in 2021 to 224 t from 87 t in 2020. Neritic tunas, frigate and kawakawa remain minor components, contributing about 1% of all tunas.

Pole and line gear landed nearly all of skipjack tuna in 2021 (118,571 t), representing 99% of skipjack tuna landed. Yellowfin tuna contribution from the pole and line gear was at 41% (10,161 t) with the remaining 58% (14,369 t) from the handline fishery. The trolling fleet catch was a negligible amount of 19 t of tuna in 2021. The longline fishery did not operate in 2021 reporting zero catch.

The two primary gears of the Maldivian tuna fisheries, pole-and-line and handline are highly selective with virtually no bycatch and discards. Observation of over 161 pole-and-line trips by Miller et al, (2017) reported an amount of 0.65% of total tuna catch by weight. Being surface gears, the pole and line and handline gears do not interact or record bycatch of blue sharks, thresher sharks and marine turtles.

Almost all of the important bycatch and other species that interact with commercial tuna fisheries are protected in the Maldives. These include sharks, whalesharks, marine turtles, marine mammals and seabirds inter alia.

Logbooks for the pole and line and handline tuna fisheries were introduced in 2010 and revised in 2012. To improve logbook reporting, modifications to the regulatory framework as well as the fishery licensing conditions were brought about in 2019, which required the submission of the log sheet for the trip prior to unloading the catch. As a results, the logbook coverage has increased substantially.

The web-enabled fishery information system, “Keyolhu” serve as the central system to house and report the fishery catch and effort data. The system also facilitates issuing of fishing and fish processing licenses, entry of fish purchase data by the exporters. A mobile-phone based catch reporting application has also been developed for the tuna fisheries which would allow electronic reporting. Full roll-out of the electronic reporting was hampered due to the COVID crisis.

The vessel monitoring system continues to be improved by replacing the old units with newer models with additional features. Installation of VMS systems onboard the required 373 vessels is almost complete with less than 40 vessels remaining. The revised tuna fishery regulation now makes it mandatory for the vessels that fit the criterion to install VMS systems.

A program to implement electronic monitoring of fishing activities is ongoing with the system being installed on 14 vessels. The activities of the program has been delayed due to delays in training staff and customization of the software.

National fishery monitoring programs and research activities for the species of importance in the tuna fisheries are implemented. However, as most species, e.g. mobulids, thresher sharks, blue shark, whale sharks and marine turtles, have zero interactions and bycatch, systemic sampling and monitoring programs for such species do not exist. Further, various national legislations protect these species within the Maldivian waters.

Maldives strived to implement the various requirements from IOTC Conservation and Management Measures. Utmost importance of these are the mandatory statistical data recording and reporting. Several measures have been taken to improve the quality and quantity of catch and effort data from the tuna fisheries. Most of the measures relating to sharks, marine turtles, marine mammals and seabirds are not applicable to the Maldives due to the absence in the tuna fisheries and virtually non-existent interactions (noting the longline fishery did not operate in 2021).

Mauritius (IOTC-2022-SC25-NR17)
In 2021, the Mauritian tuna fleet comprised 3 purse seiners, 1 supply vessel and 1 semi-industrial longliner operating. The three purse seiners are large freezer vessels having an overall length of 89.4 M each. The longliner is a semi-industrial boat of less than 24 Meters in length.
The semi-industrial longliner operated exclusively inside the Mauritius EEZ. The boat undertook 8 fishing trips for a total of 84 fishing days and a deployment of 84000 hooks. The majority of the catch consisted of yellowfin (54.0%) and albacore (36.5%). The total catch amounted to 21.8 tonnes with a CPUE of 0.26kg/ hook.
The Mauritian purse seiners operated between latitude 15 oN to 9 oS and longitude 46 o to 78 oE. The total catch amounted to 25803.2t comprising 37.4% yellowfin, 54.8% skipjack and 7.4% bigeye tuna for 804 positive sets out of a total of 827 sets. The Observer Programme could not be covered in 2021 due to the precautionary measures put into place in the context of the COVID-19.
Sampling exercises were carried out on the catch unloaded from the semi-industrial, artisanal and purse seine fishery. A total of 4231 fishes were sampled for length frequency; 551 from the semi-industrial longliner, 331 from the artisanal fishery and 3349 from the Mauritian purse seiners when they unloaded at Port Louis.

Mozambique (IOTC-2022-SC25-NR18)
The total catch of IOTC species in the Mozambique EEZ in 2021 was estimated at 7782 tons. No foreign vessels have
been licensed. The national longline fleet, expanded from two to eight operational longliners from 2019 to 2021. As
result, the fleet landed 390.3 tons in 2021, an increase of 34.4% compared to 2020 and an increase of 170% compared to 2019. IOTC primary species represented 95% of the total catch, with yellowfin tuna (41%) and swordfish (34%) being the most important species followed by bigeye (13%). The only shark species retained by this fleet was the shortfin mako shark with 6 tons landed in 2021.
The artisanal fishing sector landed 7,325 tonnes of IOTC primary species in 2021, a decrease of -30% compared to
2019, probably associated with the impact of Covid-19. Catch composition continued being dominated by narrowbarred Spanish mackerel (49%) and frigate and bullet tuna with 39%. The catch of sharks as estimated at around 2200 tonnes composed mainly of scallop hammerhead shark.
The recreational and sport fishing sector presented a significant reduction in the number of licenses and suffered
serious operational restrictions directly associated with Covid-19 mitigation measures in the last two years. In 2021
the Recreational and Sport Fishing Regulation was revised and approved, bringing some conservation and management measures that will impact positively on IOTC species. To improve knowledge about the dynamics of tuna fishing and strengthen the management and conservation of IOTC and associated Endangered species in Mozambique, some tools and programs have been implemented, including 100% implementation of logbooks, implementation of scientific programs on-board large vessels and observer sampling at the landing site for artisanal fisheries, development of NPOA-Sharks and NDFs and other research initiatives. In 2020, a new Maritime Fishing Regulation was approved, incorporating a wide range of IOTC conservation and management measures, including the protection of all sharks prohibited by the IOTC; banning shark finning and establishing minimum sizes for billfish and sharks.

Oman (No National Report Submitted)

Pakistan (No National Report Submitted)

Philippines (IOTC-2022-SC25-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 yellow, fin, 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-2022-SC25-NR22)

The Seychelles National Report summarizes activities of the Seychelles' fishing fleet targeting tuna and tuna-like species in the WIO for the year 2021 in comparison with previous years. It also summarizes research, and data collection related activities as well as actions undertaken in 2021 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 2021. In 2021 the nominal effort decreased slightly by 195 days (6%) when compared to the previous year to reach a total of 3,027 days fished corresponding to a 9% increase in catches from 112,621 MT in 2020 to 122,885 MT in 2021. This resulted in a higher catch rate of 40.60 MT/ fishing day in the year 2021 compared to 34.84 MT/ fishing day during the previous year. Catches of yellowfin tuna decreased by 4% whilst catches of bigeye tuna and skipjack tuna increased by 91% and 8% respectively when compared to the previous year.

The Seychelles Industrial longline fleet comprised of 64 vessels in 2021 compared to 62 vessels in 2020. The total catch reported by the industrial longline fleet for the year 2021 was estimated at 14,526 MT of which 3,064 MT consisted of yellowfin tuna. The estimated catch rate estimated at 0.36 Mt/1000 hooks for the year 2021 was lower than the previous year (0.55 Mt/1000 hooks).

In 2021, the total catches by the Semi industrial vessels increased by 18% to reached 1,759 MT compared to 1,485 Mt the previous year. This corresponds to an increase of 36% in fishing effort thus giving a mean catch rate of 0.64 MT/ 1000 hooks for the year 2021 compared to 0.73 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 2021 to clear the backlog in longline fishery for years 2019 and 2020 resulted from technical and administrative related issues in late 2019 and the Covid19 pandemic in early 2020.

Somalia (IOTC-2022-SC25-NR23)

Thanks to a strong seasonal upwelling just off its Indian Ocean coast, Somali waters are seasonally productive and home to various fish and shellfish species, including valuable pelagic tuna resources. The Somali EEZ is one of the most productive ecosystems in the global oceans. Because of a major upwelling created by the Southwest monsoon that supports much fish. As a result of the nutrient-rich water upwelling from the depths of the Indian Ocean, the coast of Somalia has made one of the most productive fish grounds in the world, Rashid. & Mahamudu (2014) and Glaser, et al. (2015).

Somalia's marine fisheries could make important contributions to the national economy, local livelihoods, food supply and export earnings but has been hindered by a lack of up-to-date scientific information on catch and fishing effort statistics, and other data relevant for the management and conservation of fish stock and marine mammals in Somali waters. There was no reliable and timely statistics, vital for effective policy formulation, for measuring progress, and for accurate reporting on domestic fisheries. Somalia has made important progress in the past years towards data collection that will improve our contributions to IOTC reporting, we transitioned the collection of catch and effort data from a randomly selected fish landing sites, We have also made important progress in improving technical capacity for data collection. A series of workshops have improved the statistical capacity of our ministries, and the training of 24 data enumerators in important landing sites has created a standardized approach to data collection throughout the country. Finally, amendment of Fisheries Law will further Somalia's commitment to IOTC CMMs and to supporting a strong national fleet.

South Africa (IOTC-2022-SC25-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 2021, 16 longline vessels were active in the IOTC Area of Competence, which is one more than in 2020. Effort increased substantially in 2021 (901 104) compared to 2020 (572 461) but was still less than that of 2019 (1 355 677). As such, 2020 is considered a low effort year. Joint-venture vessels did not operate in South African waters in 2020 or 2021, however more fishing effort was undertaken by South African flagged vessels in 2021. Consequently, catches increased substantially in 2021 for all tuna species. Notably, landings of sharks decreased substantially. There was no Tuna Pole-line effort in the Indian Ocean area of competence in 2021. A total of 312 368 hooks were observed in the IOTC area of competence during 2021 which equates to 35% observer coverage.

Sri Lanka (IOTC-2022-SC25-NR25)

The total production of tuna and tuna like species of Sri Lanka in year 2021 was 87546t. 81 % of the catch was from the EEZ. 36% of the total catch was Yellow fin tuna, 39% Skipjack tuna and 7% was bigeye tuna. 12% of the catch was bill fish while Sword fish dominate in the catch. The total shark catch was 1227t. 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 multi day boats engaged in large pelagic fishing in both high seas and within EEZ. 1194 vessels were authorized to fish in high seas and the same number of 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. 34% , 23% and 22% of vessels were exclusively operated for longline, gill net and ring net respectively. 21% of the vessels used multi-gear of more or less combinations of the above gears in seasonal or incidental manner.

Multi-gear vessels are being promoted to long line by introducing mechanized line haulers and the upgrading of vessel conditions to accommodate better cooling systems to improve the fish quality and reduce the post economic loss. High fuel cost has restricted the year round vessel operations and most vessels are being kept anchored. The pilot project on electronic log book is successful but was not able to fully implement due to lack of electronic devices. The paper log books are being used. 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-2022-SC25-NR27)

Tanzania has a coastline of about 1,242 km, a territorial sea of about 64,000 km² and Exclusive Economic Zone with an area of 223,000 km². The marine waters are potential fishing grounds for tuna and tuna-like species for both national fleets and Distant Water Fishing nations fleets. The most caught tuna and tuna-like species are Bigeye, Skipjack, Yellowfin, Albacore, Swordfish, Marlin, Sailfish, Frigate tuna, Kawakawa, Dogfish tuna and bycatch which mainly consists of Sharks, Dorado, Barracuda and Escolar.

Fishing activities in the Tanzanian EEZ are developed, managed and regulated by the Deep Sea Fishing Authority of Tanzania (DSFA) under the Deep Sea Fisheries Management and Development Act, Cap 388 of 2020 and its Regulations of 2021. In the inner and territorial waters tuna and tuna like fisheries is mainly conducted by artisanal fishers using non- and motorized fishing vessels with overall length between 4 m to 12 m. These are day out fishers except for those with landlines, longline or trolling using motorized boat with insulated ice boxes who can spend 3 to 7 days at sea.

Tanzania has improved her fisheries data collection using smart phones which send the data to databases at DSFA, Fisheries Departments in Mainland and Zanzibar, the system also captures catch information of sharks and rays. Furthermore, awareness creation to artisanal fishers on endangered, threatened and protected species (ETPs) has increased and almost all ETPs that interact with artisanal fishery are protected by Laws.

The two widely used fishing gears in the EEZ are large-scale longlines and purse seines. According to artisanal fishery statistics from catch assessment surveys of 2021, the total catch of Kanadi king fish was 2,319.81 mt, Bigeye 795.99 mt, Swordfish 3,212.03 mt, Kawakawa 2,241.42 mt, Dogtooth tuna 711.16 mt, Frigate tuna 2602.36 mt and Yellowfin tuna 4,294.24 mt. Artisanal fishers of URT do not provide logbooks and therefore data are collected at landing sites by Beach Management Units trained enumerators in Mainland and Beach Recorders in Zanzibar. Two semi industrial flagged longline vessels operated within the EEZ and Territorial waters of Tanzania, during the fishing period of the year 2021, and reported a total of 15 mt, which were landed at Zanzibar Port. With regards to Distant Water Fishing Nations (DWFNs), 23 longline vessels operated in the EEZ of Tanzania, with reported annual landings (January to December 2021) of commercial tuna of 1,616.6 mt, of which Bigeye tuna contributed 866.6 mt and Yellowfin tuna 606.6 mt.

Thailand (IOTC-2022-SC25-NR28)

Thailand has advance 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. Thailand has implemented PSM and assigned 26 PSM ports for port entry of foreign vessel. Moreover, for Thai oversea vessels installation of vessel monitoring system (VMS), and especially installation of electronic reporting system (ERS) electronic monitoring system (EM) for oversea fishing fleet, as well as the development of traceability system for catches from Thai-flagged vessel. Thailand has implemented NPOA-Sharks, Thailand: Plan 1, 2020-2024.

In 2021, Thailand had no fishing vessel operated in high sea of IOTC competent. Thailand had only domestic purse seiner fishery in the Andaman Sea, the number of fishing vessel was registered 227 vessels. In 2021, kawakawa (29.06%) and bullet tuna (28.15%) are the main composition, followed by Longtail tuna 20.79%, skipjack tuna 19.63%, narrow-barred spanish mackerel 2.02%, frigate tuna 0.27%, Indo-Pacific sailfish 0.08% and yellowfin tuna 0.0049%. Catch and effort decrease from the

2020 due to the decreasing of fishing vessel and fisher stopped operation due to the increasing of fuel price.
At Present, DOF is launch authorizing Thai-flagged overseas fishing vessels. Currently, there has been applications from begin with Thai-flagged overseas fishing fleet. These vessels operate in SIOFA area and target demersal fish species. No application has been submitted for vessels operating in the IOTC area.

United Kingdom of Great Britain and Northern Ireland (IOTC-2022-SC25-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 2021.
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 2021 and provides details of research activities undertaken to date within the MPA.
The recreational fishery landed 9.1 tonnes of tuna and tuna like species on Diego Garcia in 2021. Principle target tuna species of the industrial fisheries (yellowfin and skipjack tunas) contributed to 33% of the total catch of tuna and tuna like species of the recreational fishery. Recognising that yellowfin tuna are currently overfished and subject to overfishing in the Indian Ocean and that Resolution 19/01 seeks to address this, UK("BIOT") have been taking action to reduce the number of yellowfin tuna caught in the "BIOT" recreational fishery and encouraging their live release. Length frequency data were recorded for a sample of 359 yellowfin tuna from this fishery. The mean length was 73.3cm. 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 2021 the "BIOT" Environment Officer continued to take forward the current conservation priorities. In 2021/22 Recommendations of the Scientific Committee and those translated into Resolutions of the Commission have been implemented as appropriate by the "BIOT" Authorities and are reported.

Yemen (No National Report Submitted)

Liberia (IOTC-2022-SC25-NR31)
NA.

APPENDIX 5
STATUS OF DEVELOPMENT AND IMPLEMENTATION OF NATIONAL PLANS OF ACTION (NPOA) FOR SEABIRDS AND SHARKS AND IMPLEMENTATION OF THE FAO GUIDELINES TO REDUCE MARINE TURTLE MORTALITY IN FISHING OPERATIONS (2022)

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			n.a.				**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 rules on requirements for hunting wild animals. It includes provisions for the protection of sharks and rays including the species for which there are active IOTC CMMs (hammerhead, blue, mako, silky, oceanic whitetip, thresher and whale sharks, and mobulid rays). **Seabirds:** Bangladesh currently do not have a NPOA for seabirds. The Wildlife Conservation and Security Act introduced in 2012 lays out rules on permits required to hunt wild animals and includes provisions for the protection of seabirds. Bangladesh does not have any flagged purse seine 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 rules on requirements for hunting wild animals and includes provisions for the protection of marine turtles.
China		–		–			**Sharks:** China is currently considering developing an NPOA for sharks. Regulations relating to the conservation of sharks managed by RFMOs has been updated. Targeted distant water fisheries for sharks are prohibited and vessels must avoid or reduce catching of sharks. Sharks (species not under a retention ban) caught shall be fully utilised and finning is prohibited. Longliners are prohibited from using shark lines. **Seabirds:** China is currently considering developing an NPOA for seabirds. Regulations relating to the conservation of seabirds managed by RFMOs has been updated. Vessels operating in the area south of 25ºS shall use two mitigation measures from: tori lines, night setting and weighted branch lines. **Marine turtles:** Regulations relating to the conservation of turtles managed by RFMOs has been updated. All longlines shall use circle hooks whenever possible. Longline vessels are encouraged to use finfish as bait, not squid.

–Taiwan,China		1st: May 2006 2nd: May 2012		1st: May 2006 2nd: Jul 2014			**Sharks:** No revision currently planned. **Seabirds:** No revision currently planned. **Marine turtles:** Wildlife Protection Act introduced in 2013, Protected Wildlife shall not be disturbed, abused, hunted, killed, traded, exhibited, displayed, owned, imported, exported, raised or bred, unless under special circumstances recognized in this or related legislation. *Cheloniidae spp*., *Caretta Caretta*, *Chelonia mydas*, *Eretmochelys 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 period2015-2020. 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 has established an NPOA for Marine Turtles but this does not fully conform with FAO guidelines. 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 is being developed and shall put in place a framework to ensure the conservation and management of sharks and their long-term sustainable use in Kenya. A draft has been developed and preliminary meetings have been held to finalise this. **Seabirds:** Kenya does not have any flagged longline vessels on its registry. There is no evidence of any gear seabird interaction with the current fishing fleet. Kenya plans to develop a NPOA for seabirds after the NPOA Sharks has been finalised. **Marine turtles:** The Kenyan fisheries law prohibits retention and landing of turtles caught incidentally in fishing operations. Public awareness efforts are conducted for artisanal gillnet and artisanal longline fishing fleets on the mitigations measures that enhance marine turtle conservation. Kenya plans to develop a NPOA for turtles after the NPOA Sharks has been finalised.
Korea, Republic of		08-Aug-11		2019		–	**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. The ongoing process is expected to be completed by the end of 2018. **Seabirds**: Mozambique is regularly briefing the Masters of their fishing vessels on the mandatory requirement to report any seabird interaction with longliner fleet. **Marine turtles**: see above.
Oman, Sultanate of							**Sharks:** 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 (c) of Pakistan Fish Inspection & Quality Control Act, 1997, "Aquatic turtles, tortoises, snakes, mammals including dugongs, dolphins, porpoises and whales etc" are totally forbidden for export and domestic consumption. 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 and is currently being implemented. 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:** Currently the draft NPOA – Seabirds for Thailand is being reviewed. 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. Regulations on Fishing Vessels operating outside Thai waters in the IOTC area of competence contains clauses relating to the conservation of marine turtles including: Clause 14 prohibiting purse seines from setting around cetaceans, marine turtles or whale sharks; Clause 18 requiring the release and recording of incidental bycatch of sensitive species including marine turtles; Clause 19 requiring that any bycaught marine turtles that are not healthy should be cared for until it is ready to be released.
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 ("BIOT").

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 6A
ELECTRONIC MONITORING RELATED TERMS AND DEFINITIONS

Electronic Technologies (ET): any electronic tool that is used to support fisheries-dependent data collection, both on shore and at sea, including electronic reporting (ER) and electronic monitoring (EM).

Electronic Reporting (ER): the use electronic systems (application, software, form or file) to record, store, receive and transmit fisheries data.

Monitoring: the requirement for the continuous collection of fishery-related data (adapted from FAO, 1994).

Electronic Monitoring (EM): the use of electronic devices to record fishing vessel's activities using video technology linked to a Global Position Systems (GPS), which may include sensors.

Electronic Monitoring System (EMS): the system comprising the vessel and shore-based components for collecting, transmitting and reviewing EM records, reporting of EM data and implementing an EM Program.

EM Program: a process administered by a national or regional administration that regulates the use of EMS on vessels to collect and verify fisheries data and information responsible through an implementation of an EMS in a defined area and/or fishery.

EM Program standards: the agreed standards, specifications and procedures (SSP) governing the establishment and operation of an EM Program, applicable to all components of the EMS.

EM data standards: the agreed subset of data requirements by the IOTC Regional Observer Scheme (ROS) that could be collected by the EMS.

EM records: Imagery, and possibly sensor, raw data linked to positional data collected by an EM equipment that can be reviewed to produce EM data.

EM data: processed/analysed data produced through review of EM records that conforms with the EM data standards.

EM equipment: a network of electronic cameras, sensors and data storage devices installed on a vessel and used to record the vessel's activities.

Vessel Monitoring Plan (VMP): The vessel's EM equipment characteristics and how the vessel's EM equipment is installed and configured to monitor fishing activites and meet the EM Program and EM Data Standards as required by the IOTC Regional Electronic Monitoring Program.

EM review: the review of EM records by EM observers/reviewers to produce EM data.

EM observer/reviewer: a person qualified to review EM records, store and produce EM data in accordance with the EM Data standards and analysis procedure.

EM review system: application software used by the EM observer to review the EM records and produce the processed EM data as per the EM data standards.

EM review center: local, national, or regional office facility where EM records are received and reviewed to produce and store EM data.

EM review provider: a third-party provider of EM review services to review EM records to produce EM data. The same third-party organization can provide both the EM equipment and EM review services but they can also be supplied by different providers.

EM installation coverage: the proportion of vessels by fleet that has EM equipment installed that is operational.

EM record coverage: the proportion of fishing effort for which EM records are collected by installed EM equipment.

EM observer/review coverage: the proportion of fishing effort for which EM records are reviewed to produce EM data and submitted to the IOTC.

EM service provider: a third-party provider of EM equipment (and/or system), technical and logistical services to maintain the EM equipment and monitor its proper functioning.

APPENDIX 6B
IOTC ELECTRONIC MONITORING PROGRAM STANDARDS

General

- National/Regional data collection Programs using Electronic Monitoring Systems (EMS) that are certified as meeting the minimum standards of the Electronic Monitoring Program (EMP) as adopted by IOTC may be included within IOTC Regional Electronic Monitoring Program (REMP).
- IOTC REMP shall be coordinated by the IOTC Secretariat.

Objectives

- The objective of the IOTC REMP is to collect, via EMS, verified catch data and other scientific data related to the fisheries for tuna and tuna-like species in the IOTC area of competence and achieve the EM observer/review coverage to meet the requirements of IOTC Observer Resolution on Regional Observer Scheme.

Purpose:

- The purpose of IOTC REMP is to allow CPCs to utilise EMS to collect data to assist CPCs in meeting the requirements of IOTC Observer Resolution on Regional Observer Scheme, including in situations where onboard observer coverage is low or non-existent.
- The REMP aims to improve the quantity and quality of fishery data and the monitoring of IOTC fisheries and address gaps in the collection and verification of fishery data. The REMP may also in the future help CPCs meet the requirements of other IOTC Resolutions.

Scope:

- The IOTC's REMP and associated minimum EM Program and EMS Data Standards (including this standard) **apply only to IOTC CPCs who are developing or who have implemented EMS as a data collection tool** to meet the requirements of the IOTC Observer Resolution on Regional Observer Scheme.
- IOTC's REMP provides a framework for the development of EMS in the following IOTC fisheries:
    - Purse-seine vessels over 24 meters length overall and under 24 meters LOA when fishing outside their EEZs,
    - Longline vessels over 24 meters length overall and under 24 meters LOA when fishing outside their EEZs,
    - Gillnet vessels over 24 meters length overall and under 24 meters LOA when fishing outside their EEZs,
    - Pole and line vessels over 24 meters length overall and under 24 meters LOA when fishing outside their EEZs,
    - Other gear types under 24 meters length overall (when fishing in the high seas).
- IOTC's REMP or any National EMP, under IOTC's REMP, shall ensure that the data collected through EMS are documented and that all ROS minimum data standard requirements (e.g., "Mandatory Reporting"), if necessary complemented with any

additional monitoring program (e.g., port sampling, biological sampling, etc.), are collected by EMS.

Definitions:

- ***Electronic Technologies (ET)***: any electronic tool that is used to support fisheries-dependent data collection, both on shore and at sea, including electronic reporting (ER) and electronic monitoring (EM).
- ***Electronic Reporting (ER):*** the use electronic systems (application, software, form or file) to record, store, receive and transmit fisheries data.
- ***Monitoring:*** the requirement for the continuous collection of fishery-related data.
- ***Electronic Monitoring (EM):*** the use of electronic devices to record fishing vessel's activities using video technology linked to a Global Position Systems (GPS), which may include sensors.
- ***Electronic Monitoring System (EMS):*** the system comprising the vessel and shore-based components for collecting, transmitting and reviewing EM records, reporting of EM data and implementing an EM Program.
- ***EM Program:*** a process administered by a national or regional administration that regulates the use of EMS on vessels to collect and verify fisheries data and information responsible through an implementation of an EMS in a defined area and/or fishery.
- ***EM Program standards:*** the agreed standards, specifications and procedures (SSP) governing the establishment and operation of an EM Program, applicable to all components of the EMS.
- ***EM data standards:*** the agreed subset of data requirements by the IOTC Regional Observer Scheme (ROS) that could be collected by the EMS.
- ***EM records:*** Imagery, and possibly sensor, raw data linked to positional data collected by an EM equipment that can be reviewed to produce EM data.
- ***EM data***: processed/analysed data produced through review of EM records that conforms with the EM data standards.
- ***EM equipment:*** a network of electronic cameras, sensors and data storage devices installed on a vessel and used to record the vessel's activities.
- ***Vessel Monitoring Plan (VMP):*** The vessel's EM equipment characteristics and how the vessel's EM equipment is installed and configured to monitor fishing activites and meet the EM Program and EM Data Standards as required by the IOTC Regional Electronic Monitoring Program.
- ***EM review:*** the review of EM records by EM observers/reviewers to produce EM data.
- ***EM observer/reviewer:*** a person qualified to review EM records, store and produce EM data in accordance with the EM Data standards and analysis procedure.
- ***EM review system:*** application software used by the EM observer to review the EM records and produce the processed EM data as per the EM data standards.
- ***EM review center:*** local, national, or regional office facility where EM records are received and reviewed to produce and store EM data.
- ***EM review provider:*** a third-party provider of EM review services to review EM records to produce EM data. The same third-party organization can provide both the EM equipment and EM review services but they can also be supplied by different providers.

- ***EM installation coverage:*** the proportion of vessels by fleet that has EM equipment installed that is operational.
- ***EM record coverage:*** the proportion of fishing effort for which EM records are collected by installed EM equipment.
- ***EM observer/review coverage:*** the proportion of fishing effort for which EM records are reviewed to produce EM data and submitted to the IOTC.
- ***EM service provider:*** a third-party provider of EM equipment (and/or system), technical and logistical services to maintain the EM equipment and monitor its proper functioning.

EM Systems

- EMS should be approved and accredited by an appropriate IOTC body (e.g., IOTC WGEMS/WPDCS) or CPCs to ensure that the minimum standards of the REMP (and ROS) are met, including EM equipment installation (through an EM Vessel Monitoring Plan), collection of data consistent with ROS minimum data standards, EM records reviewed by accredited companies/organizations and independence of EMS are maintained. In case that CPCs approved the EMS the CPC shall present such plan to the IOTC relevant bodies (e.g., WGEMS, WPDCS) in accordance with IOTC and national relevant confidentiality resolutions.

Data:

- EM data submitted by Regional or National EMPs are subject to Resolution 12/02 *on data confidentiality policy and procedures* concerning the requirements for sharing data in the public domain (e.g., the level of stratification to apply in order to prevent activity from a single vessel to be clearly identified from the published data) and the procedures for the safeguard of records.
- EM data collected via EM should be provided in compliance with the requirements established by the Commission in Resolution 15/01 on the recording of catch and effort data by fishing vessels in the IOTC area of competence, Resolution 15/02 on mandatory statistical reporting requirements for IOTC Contracting Parties and Cooperating Non-Contracting Parties (CPCs) and IOTC Observer Resolution on Regional Observer Scheme.
- National EM Programs EM data should be submitted to IOTC in accordance with the electronic data format specifications provided by the IOTC Secretariat and adopted by the IOTC Commission, in order for data to be incorporated in the IOTC Regional Observer Scheme database. The EM data should be properly marked in the database to be distinguished from data collected through onboard human observers.

Roles

- *IOTC Commission:*
    - To monitor and provide oversight of the implementation of the REMP, including those implemented through National EM Programs.
    - To adopt and revise, when necessary, minimum standards for the EM Program, technical specifications, and associated data collection.
    - To agree on overall EM observer/review coverage through IOTC Observer Resolution on Regional Observer Scheme.

  - To develop and adopt a REMP implementation plan.
  - When necessary, the Commission may contract Regional EM review centers to review EM records obtained in the frame of the REMP.
  - To ensure sufficient financial resources to effectively administrate IOTC's REMP.
  - To review IOTC's REMP after an initial period (e.g., 3 years) of IOTC's REMP implementation.
- *IOTC CPCs:*
  - In case they choose EMP to meet IOTC Observer Resolution on Regional Observer Scheme, to ensure that EM equipment installed on fishing vessels under its flag and the EMS implementation complies with the requirements established by the Commission for the purpose of IOTC's REMP.
  - To require that a Vessel Monitoring Plan (see below) is developed for each vessel equipped with EM equipment and delivered to the CPC competent authorities.
  - To ensure that EM equipment are installed in their vessels following a Vessel Monitoring Plan to collect the required data and to comply with the coverage objectives agreed by the Commission.
  - To ensure that EMS implementation is consistent with IOTC's REMP and its minimum standards.
  - To collaborate to ensure National EM Programs are compatible and harmonized where necessary.
  - To document the roles and responsibilities of fisheries government authorities and vessel owner/crew with respect to inter alia installing and maintaining equipment, routine cleaning of cameras, sending storage devices, access to EM records and EM data, responses to mechanical or technical failure of EMS.
  - The CPC shall provide the IOTC Secretariat with the contact details of their EM Program Coordinator(s).
- *IOTC Secretariat:*
  - To approve National EM Programs.
  - To collaborate with the Commission and CPCs to ensure that National EM Programs are consistent and compatible with the REMP and meet IOTC's REMP monitoring minimum standards.
  - To summarize and provide annual reports about the progress of the REMP, including National EM Programs, to the Commission and its Subsidiary Bodies.
  - To recommend improvements and adjustments to the REMP to ensure that data and monitoring requirements of IOTC Commission are met.
  - To coordinate activities regarding EM with other tuna RFMOs as required by the Commission.

EM Vessel Monitoring Plan

- The vessel's EM equipment characteristics and how the vessel's EM equipment is optimized to meet the EM System and Data Standards must be recorded on a Vessel

Monitor Plan (VMP) for each vessel.

- The VMP shall be developed in collaboration with the EM service provider, vessel owner and fishing authorities.
- The Vessel Monitoring Plan will describe the numbers of cameras, position and settings, and key areas to be monitored for fishing activities, catch handling, species identification, fate and storage of the individuals.
- The VMP should include information on:
    - Contact information: contact information for the vessel owner, vessel operator and EM service provider as long as the contract lasts.
    - General vessel information: basic information about the vessel and its fishing activities and operations (e.g., vessel name, registration number, target fishery, areas, fishing gear, LOA…).
    - Vessel layout: equipment of the vessel with detailed information, plan of the vessel disposition and different areas (decks, processing area, storage, etc.).
    - EM equipment setup: description of the settings of the EM equipment, such as time running, number of cameras and areas covered, time recording for each of the cameras, number and position of sensors (if any), software used, control box disposition, procedures for checking the proper functioning of the EM equipment installed onboard, etc.
    - A snapshot of each camera should be inserted in the VMP.
- The VMP should be signed off by the vessel owner and finally approved by the flag state competent authority.
- Any physical changes on a vessel that will affect EMS should be reported to the flag state competent authorities. The VMP should be updated and approved again by the competent authority as soon as possible.
- Any change on the EM equipment (e.g., installation of a new generation of cameras) should be reported to the flag state competent authorities. The VMP should be updated and approved again by the competent authority as soon as possible.

Operationalising IOTC's REMP – Accreditation and Auditing of National EMPs

- CPCs should apply to the IOTC Secretariat to have its own National EM Program recognized as part of IOTC's REMP so as to comply with ROS data minimum standards.
- IOTC shall audit the National EM Programs against the EM minimum standards.
- National EM Programs shall be reviewed and subject to regular and periodic audits as agreed by IOTC Commission.
- IOTC could authorize National EM Programs approved by other tRFMOs.

APPENDIX 6C
IOTC ELECTRONIC MONITORING SYSTEM AND DATA STANDARDS

EM TECHNICAL MINIMUM STANDARDS

The Technical Minimum Standards shall describe the requirements of the EM. CPCs shall ensure all EM equipment installed in their national or subregional programs are consistent with these technical specifications.

Customized to vessel level: there is no standard configuration that will cover all vessels from fleets operating in the Indian Ocean region, therefore each EM equipment installation must be customized at the vessel level. An EM equipment to be installed on board of a fishing vessel should consist of a control system connecting a number of cameras, and optionally to a number of different sensors, to collect and record images to address the objectives of the EM Program. The number of cameras and sensors should be tailored to each vessel through a Vessel Monitoring Plan to meet overall objectives of the program rather than being too prescriptive and should include a sufficient number of cameras. Although it will depend on the configuration of each particular vessel, as a general setup, cameras shall capture the areas and activities provided in **Table 1 and 2 and Figure 1 to 3 of Annex 1**[2]. Each vessel should develop a "Vessel Monitoring Plan" specifying how many and where the cameras are located, and their settings, to collect the required ROS minimum "mandatory" data fields[3] (**Annex 2**[4]). Within a given EM program, a certain level of harmonisation among vessels may also be necessary (camera placement and settings).

Include sensor/automatic devices: since EM records require large storage capacities, most EMS are not recording vessel activities on a full-time basis. The recording of some cameras may be triggered by the detection of gear usage or fishing activity. EMS may therefore include sensors, and other procedures (Computer Vision, Artificial Intelligence), to detect when fishing or other activities of interest occur on board. This will ensure proper EM record acquisition (e.g. trigger video recording when fishing operation starts) and facilitate EM record reviewing.

Include Global Positioning System (GPS): to monitor vessel position, route, speed and provide information on date/time and location of fishing activities. Fishing vessel position and date/time stamps should be incorporated directly on images or in the metadata of images.

Compatibility: the EMS could ideally be capable of integrating with other Monitoring, Control and Surveillance (MCS) tools (e.g. Vessel Monitoring System).

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[2] Annex 1 should be taken as a general guide since they are examples of existing EMS installations. The EM configuration (number of cameras, position, and monitoring objectives for each) should then be tailored to each fishery/vessel through a Vessel Monitoring Plan.

3 The collection of some of the required ROS minimum data standards may be complemented by port sampling and/or other data collection methods.

4

EM capabilities to collect ROS minimum data requirement fields provided as examples in Annex 2 may vary from fleet to fleet if the catch handling and setting/hauling maneuvers differ among fleets. Therefore, these values should be taken as a general guide and subject to constant review.

Robust System: the EM equipment components installed outdoors (such as cameras/camera housing and sensors) should be capable to resist rough conditions at-sea and harsh environment on board the vessels.

Secure System: the EM equipment components and data need to be tamper-resistant and tamper-evident, ideally using encrypted data, such that attempts at unauthorized modifications are not possible.

Cameras: digital, high-resolution when possible, cameras covering all areas of interest on the vessel according to the vessel and fishing operations are recommended. Camera placement, settings and recording must assure the detection of vessel activities, catch and bycatch species, and enable accurate species identification (at least for all species under the IOTC mandate). The system should be able to record activities in low and very bright natural light conditions (low and high contrasts). The cameras must be water resistant and in a self-contained, weather resistant box.

EM records: EM records shall contain the following information: EM record file name including, at a minimum, the vessel name and vessel ID, camera ID, trip ID, geolocation data (date, time (UTC), latitude and longitude), camera recording status, EM health status(when available), images, and sensor data when used.

Independence: the system needs to be self-governing with the exception of minimal maintenance by the crew (e.g., cleaning sensors and cameras). The system may include remote verification of its functionality in real time to collect all information. A designated person should ensure that the system is working properly before leaving port and at sea, and a protocol (checklist) should exist for that purpose.

No interference: EM equipment should not generate or cause radio frequency interference with other on-board vessel communication, navigation, safety, geolocation devices (e.g. VMS) or fishing equipment.

Autonomy: the EM equipment should have its own uninterruptible power supply or be connected to that of the vessel to ensure that it can work even in the event of a vessel power outage. The EM equipment should include separate, duplicate backup devices to ensure that data are not lost if a storage device fails.

EM Data storage autonomy: the EM equipment should have enough storage capacity to store all EM records for a certain period of time, which should be at minimum a complete trip. The duration will depend on the vessel's operational characteristics that could range from 4 months (in the case of purse seiners) to 12 months or more (in the case of longliners).

Interoperability: EMS ideally should generate EM records that are interoperable between different EM service and review providers and, where possible, integrate with other data collection and monitoring tools.

Maintenance: a designated person on board (and/or on land) should be designated to maintain the equipment (e.g., clean of lenses, etc.) and report to the EM equipment provider and the competent authority (e.g., IOTC or flag state) when the system is malfunctioning at port or at sea so the system is fixed as soon as possible, and should record any failure of the EM equipment in a dedicated form.

EM LOGISTICAL MINIMUM STANDARDS

EM records retrieval: the EM records should be transmitted via mobile networks, Wi-Fi, or satellite, or storage device (i.e., SSD or HDD) exchange. For the latter, a protocol to recover and send the storage devices to the designated EM review center should also be implemented.

EM record storage: EM records should be stored by the vessel/company/EM service provider/EM review provider/EM program administrator for at least 1 year or for the period established in the national/regional EM programs.

EM records backup: if EM records are automatically transmitted electronically, operational procedures for their receipt and backup should be implemented taking into account any necessary chain of custody arrangements.

Storage device chain of custody: the EMS must ensure traceability of every storage device and EM records. The chain of custody of the EMS storage devices should be assured.

Frequency: EM programs should include requirements on the method and frequency (e.g. after each trip) of EM records transmission to EM review centers, that should be consistent with the minimum standards established by the CPC or IOTC.

EM DATA REVIEW MINIMUM STANDARDS

EM review software: EMS should include software to facilitate the review of EM records and to produce EM data that will allow compiling and reporting in an IOTC common output format for exchange/submission to IOTC. Ideally, EM review software can be used to review EM records collected from different EM equipment providers.

EM review and EM data reporting: EM records reviewing and EM data reporting should be done by institutions, organizations and independent companies with proven expertise and experience (e.g., work experience with onboard observers). These tasks can be centralized in a "regional EM review center" when implementing a regional program and/or can be carried out by national or independent organizations.

EM records and EM data quality check: the reviewing process of EM records should include quality controls through EM records quality check, EM data entry checks, possible automatic error identification in EM data (e.g. incorrect fishing set positions on land, etc), debriefing of EM observers. The produced EM data should be checked prior to reporting to the IOTC Secretariat.

EM data: EMS should allow collecting and reporting, at a minimum, the ROS Minimum Standard Data Fields. EM data will be submitted to the IOTC Secretariat using IOTC standard forms according to the time frame specified in Resolution 22/04, or any superseding Resolution. Data confidentiality requirements outlined in Resolution 12/02, Data Confidentiality Policy and Procedures, or any superseding Resolution, shall apply to all EM data submitted to the IOTC Secretariat.

EM observers' training: EM observers must have specific qualifications related to EM record review which should be integrated into the regional or national EM program standards. The EM observer should participate in specialised training courses that should be updated upon modification of the EM review protocol to ensure EM data high-quality standards.

EM observer's qualifications: EM observers must have the ability to review EM records and produce EM data according to IOTC requirements. EM observers should be familiar with fishing activities and

be capable of identifying (i) IOTC species and species of special interest, (ii) IOTC fishing methods, and (iii) IOTC mitigation methods.

Compatibility with ongoing standardized data flow and databases: EM data should have compatible output format (including usage of standardized, well-established code lists) to exchange collected information with current IOTC data reporting format and standards, and should be consistent with IOTC data rules. EM data will be submitted in an approved electronic data reporting format to the IOTC Secretariat, using IOTC standard codes and units.

Data storage and retention: legal provisions on data protection, storage, and retention by IOTC should be developed and agreed upon whether it is a REMP or EM National Programs.

EM records ownership: EM records ownership is of the vessel owner/flag state but should provide IOTC with the EM data outputs to incorporate in the IOTC database for use, analysis, and disposal as required by the IOTC observers Resolution on Regional Observer Scheme.

Hardware/software ownership: irrespective of the scope of the EM program, it is recommended that hardware and software license ownership (and maintenance) is of the vessel owner/flag state.

Annex 1 – Vessel Monitoring Plans

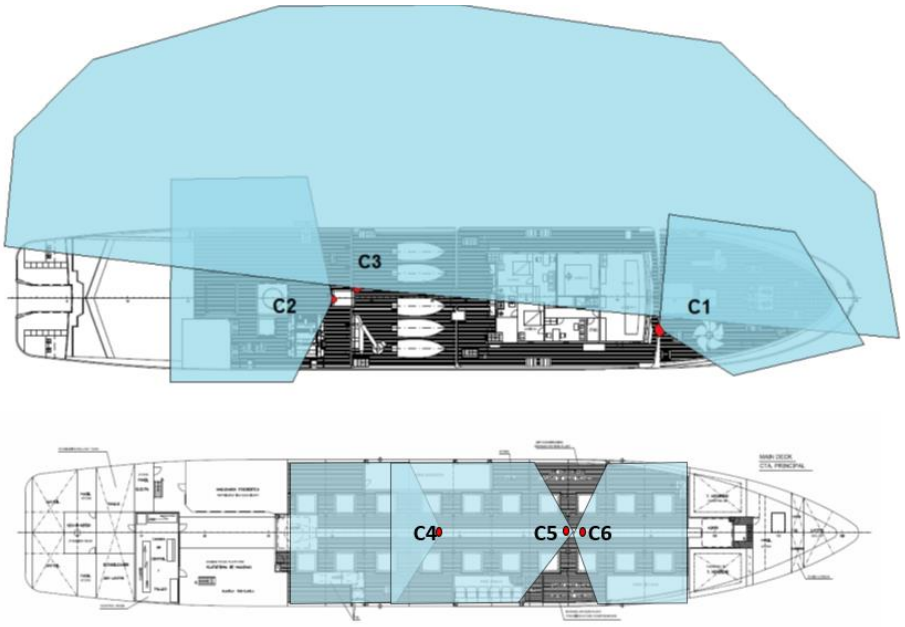
Each vessel should develop a "Vessel Monitoring Plan" so as to define how many and where cameras are located to collect the required ROS minimum data fields. Vessel Monitoring Plans should be reviewed by the CPCs fishery management agency and presented to the WGEMS/WPDCS to ensure it meets IOTC REMP Program and EM System and Data Standards.

On purse seine vessels, the minimum areas that cameras are recommended to cover:

- the working deck (both port and starboard sides),
- the net sack and the brailer,
- the foredeck or amidships (e.g., FAD activity),
- and the well deck and conveyor belt (Murua et al., 2022; Restrepo et al., 2018): for the conveyor belt, in more than one place (e.g. at the beginning and at the end of the conveyour belt as a minimum). If a discard conveyor belt exists, it should also be covered.
- Cameras must cover the following actions: fishing set, brailing, net hauling, FAD activities, total catch, catch well sorting (process of putting the catch in the hold or wells), bycatch handling and release, and tuna discards (**Figure 1 and Table 1**).
- In large purse seines, at least 6 cameras are needed to cover fishing and fish-handling operations; however, less fewer cameras (e.g. 4 cameras) could cover the activity to collect the data required of smaller purse seines (e.g. 300-400 tonnes capacity).

The preferred EM equipment configuration would be the one that allows a greater number of images (frames) of higher quality/resolution. Digital video is generally preferred, but still images can also be a viable option to capture information during the various phases of the vessel activity. However, considering that storage capacity is limited, an optimal configuration may have video on certain areas/cameras/moments, while still photos on others. In the case of photographs, the minimum requirement should be that a picture is taken by the camera with viewing angle fully covering the fish management areas at least every 2 seconds when fishing action occurs (Restrepo et al., 2018). Image quality should also be adequate enough to allow accurate collection of all required data field, such as species ID, FAD materials and design, or bait used and, hence, achieve the monitoring objectives.

A



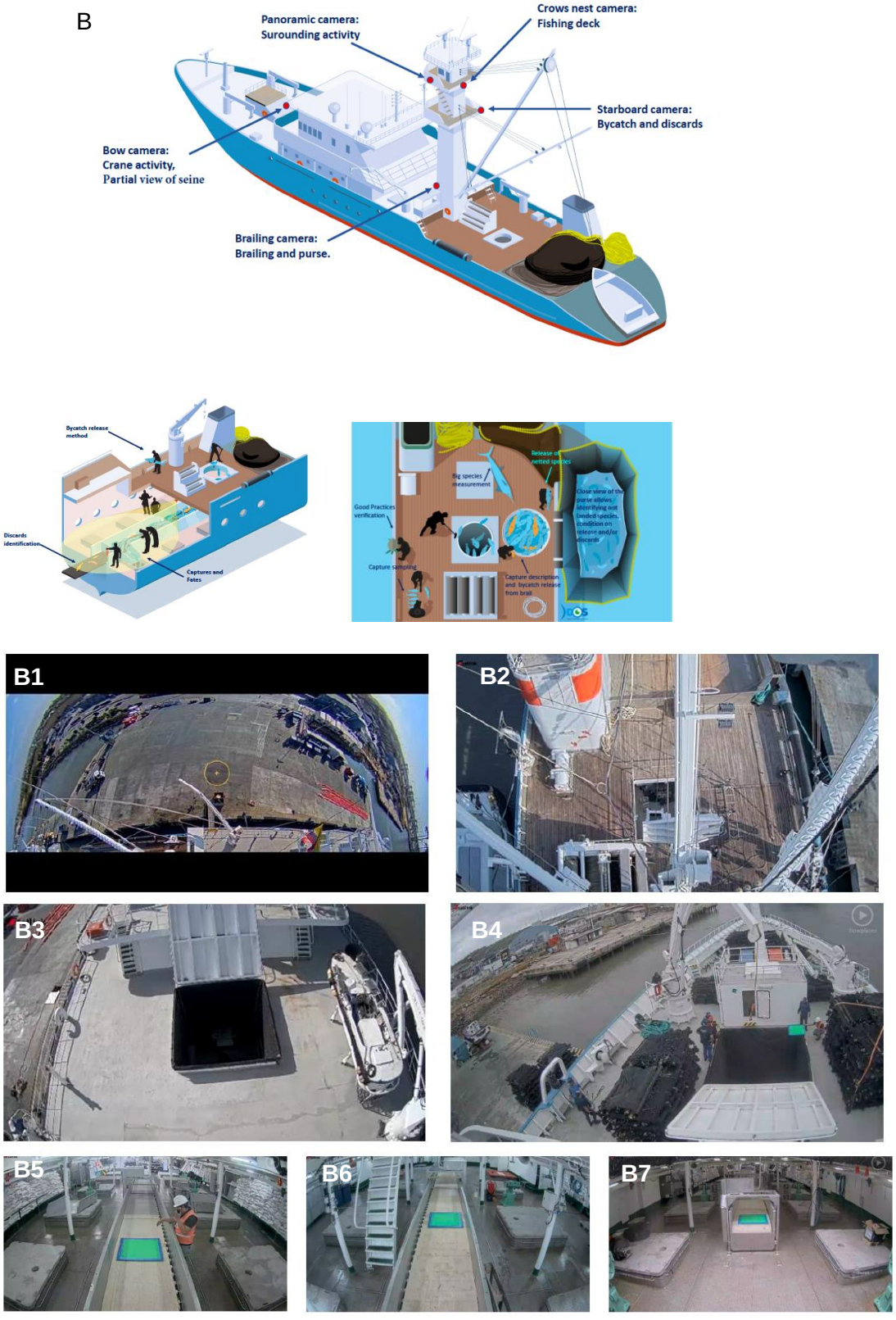


Figure 1. (A) 6-cameras EM system installed in a purse seine covering main areas of fishing and fish handling operations (from Murua et al., 2020b) and (B) 7-cameras EM system (4 in the upper deck and 3 in the well deck) installed in a purse seine covering main areas of fishing and fishing handling operations including 1 more camera in the conveyor belt: (B1) 360˚ Panoramic view camera (e.g port side view), (B2) Crows nest stern view camera, (B3) Working deck crane camera view , (B4) Foredeck view camera, (B5) Conveyor belt stern camera view, (B6) Conveyor belt middle camera, and (B7) Conveyor belt bow camera (source: Digital Observer Services).

Table 1. Minimum areas and actions that should be monitored (adapted from Murua et al., 2022; Ruiz et al., 2017).

Area covered	Action covered	Purpose	Minimum data requirements to be monitored

Work deck (port side)	Brailing	Total catch by set Species composition	Number of brails & fullness by brail. Weight, size and species of retained tuna
	Tuna discards	Total tuna discards by set	Weight, size and species of discarded tuna
	Bycatch handling	Bycatch estimation	number of individuals handling mode Species ID
Work deck (starboard side)	Bycatch handling	Bycatch estimation	Handling mode
	Bycatch release	Total bycatch by	Number of individuals and species ID
In-water purse seine area	Brailing	Total catch by set	Number of brails & fullness by brail
	Bycatch handling and safe-release of individual animals (whale sharks, manta rays…)	Total bycatch by set . Application of handling and safe-release best practices	Handling mode
	Bycatch release of big species (whale sharks, manta rays…)	Total bycatch by set Application of handling and safe-release best practices.	Number of individuals and species ID
Foredeck or amidships	FAD activity (deploying, replacement, reparation…)	Total number of FAD deployments, FAD design and FAD activities by trip	Number, material (natural or artificial), and FAD characteristics (entangling or no entangling)
Well deck and conveyor belt	Catch well sorting	Species composition	Weight, size and species of retained tuna.
	Bycatch handling	Best practices	Handling mode
	Estimation of bycatch discards, releases or retention	Total bycatch by set Species composition Application of handling and safe-release best practices.	Number, size or weight of individuals, species ID and fate

On longline vessels, the minimum areas and activities that cameras are recommended to cover (**Table, 2, Figure 2**):

- The area of setting the longline (usually vessel stern site camera),
- the area of hauling the longline,
- the working deck where catch is handled,
- and the surrounding water area for those discarded species not brought onboard
- Cameras must cover the following actions: setting of the longline, bait type information, whether mitigation techniques are being used (e.g. tori lines for seabirds), hauling of the longline, all hooked species (both retained and discarded), the fate of the catch, and the size of the specimens.
- On most tuna longlines, at least 3 cameras are needed to cover fishing activities and fish

handling operations: one capturing images when setting the longline, one to record the hauling and boarding of the catch, and other mounted over the processing deck to record species, size of specimens and fate (Murua et al., 2020a). And additional camera to cover the surrounding water area for those discarded species not brought onboard is also recommended.

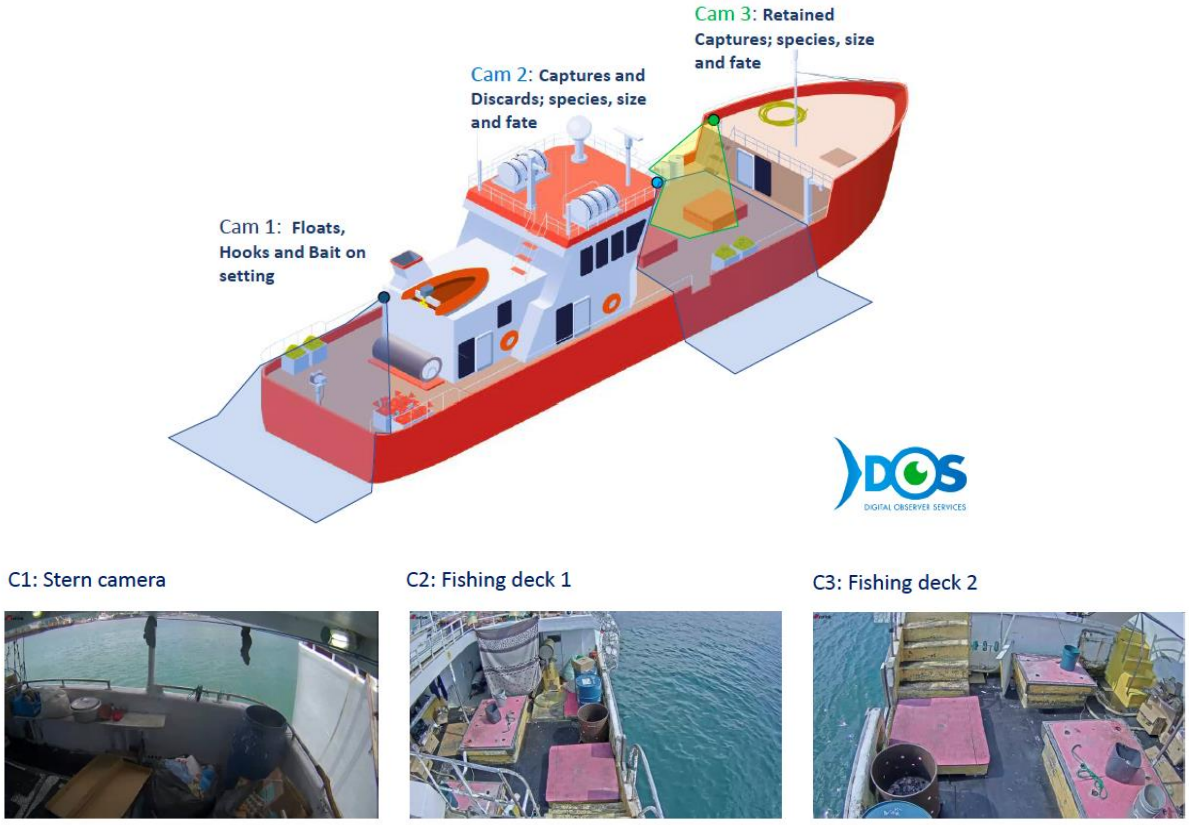


Figure 2. 3-cameras EM equipment installed on a longline covering main areas of fishing and fish handling operations. View of the 3 cameras: (left panel) Stern camera - setting longline providing information on hooks, floats, mitigation techniques and bait; (middle panel) Fishing deck 1 - hauling information, captures and discards, species ID, size and fate; and (right panel) Fishing deck 2 - fate of the species, size, species ID (source: Digital Observer Services).

Table 2 – General configuration and areas/activities covered by the EM system onboard tropical tuna longline vessels

Area covered	Action covered	Minimum data requirements to be monitored
Stern camera of the boat	Start and end setting operation	Position, date, and time
		Total number of hooks set and between floats
		Total number of floats set
		Bait type
		Bait species
		Bait ratio (%)
		Mitigation measures/marine pollution
Work deck	Catch onboard	Length and weight[5] by capture
		Condition
		Fate
		Predator observed

[5] Estimated through length-weight relationships.

	Bycatch discarded, released, or retained	Total bycatch by set and species composition
Processing area	Catch	Total catch by set
		Length and weight1 by capture
		Sex
		Fate
Surrounding water area	Start and end hauling operation	Position, time and date
	Estimation of bycatch discards, releases or retention	Total bycatch by set and species composition
		Species condition and fate

On pole and line vessels, the minimum areas that cameras are recommended to cover are the area of bait fishing activity, the area of the fishing set and pole and line fishing activity (vessel stern site camera) and the working deck where catch is handled. On a typical Indian Ocean pole and line vessels, this will require at least 2 or 3 cameras to cover main fishing activity areas, fish handling operations and bait fishing (**Figure 3**).

Figure 3. 3-cameras EM equipment installed on a Bay of Biscay (Atlantic Ocean) pole and line vessel covering main areas of fishing activity and fish handling operations. View of the 3 cameras: (left panel) Vessel bridge camera stern view – pole and line activity; (middle panel) Fish handling - catch storage; (right panel) Vessel bridge camera bow view - bait and pole and line fishing activity (source: Marine Instruments).

Annex 2 – Vessel Monitoring Plans

The IOTC ROS minimum standard data fields for all fisheries, and fields specific to longline and purse seine fisheries, including an assessment of EM applicability following SPC (2017) and Emery et al. (2018) categories. Some of the items such as vessel capacity and equipment, gear dimensions and configuration, which EM cannot record, should be collected before EM installation. MR: *Mandatory for Reporting* to be mandatorily collected and reported to the IOTC Secretariat; OR: *Optional for Reporting* to be reported to the IOTC Secretariat when the collection is feasible/practical. "---": *Suggested for Collection,* to be collected by national Programs, based on best practice as agreed by the IOTC, but not mandatory to be reported to the IOTC Secretariat.

The categories for assessing EM systems ability to collect the IOTC Observer minimum data requirements are the following:

R1	Ready now or require little work	**P1**	Possible, requires minor work
R2	Ready now but requires significant crew support	**P2**	Possible, requires major work
R3	Ready now but requires dedicated or additional work in the equipment	**NP**	Not possible
R4	Ready Now but inefficient/costly to analyze		

In addition to the above, following the approach of (SPC-OFP, 2017) workshop, the source from and the moment at which each data field could be collected (or not) is identified. These were coded as follows:

- SETUP — Hard-coded or recorded at the time in which the EM equipment is installed on the vessel,
- PRE — Hardcopy reporting or preferably E-Reporting from a pre-trip onsite inspection of the vessel and discussion with owner/captain/crew,
- EM-A — Recorded by an EM-Analyst based on visual reference to images/footage/sensors,
- POST — Hardcopy reporting or preferably E-Reporting from a post-trip onsite inspection of the vessel and discussion with owner/captain/crew,
- AG — Automatically generated by the EM system components,
- EM-A -> AG — A special case of the above where an event is detected by the EM Analyst and the EM system automatically generates the field value,
- CF — A calculated field arithmetically generated from one or more of the above field types

GENERAL VESSEL AND TRIP INFORMATION FOR ALL VESSEL TYPES

Data field name	Data field description	Reporting	EM	Source
Observed trip number	Record trip unique identifier. This is the observed trip unique identifier. This should begin with trip's start date (YYYY-MM-DD), followed by IOTC observer number, and vessel main gear code as per IOTC classification (E.g. 2018/01/23-IOTCFRA001-PS).	**MR**	**R1**	**AG**
OBSERVER IDENTIFICATION				
Observer IOTC registration number	Record observer registration number allocated by the IOTC Secretariat to be used on all observer data submissions.	**MR**	**R1**	**AG**
Observer name	Record the name of the scientific observer(s) that collected the data on-board the fishing vessel. Note: print in full. First name First - Last name Last (do not use initials).	---	**Null**	
Observer nationality	Record the nationality of the scientific observer as it appears in passport (Table 9).	---	**Null**	
OBSERVER TRIP DETAILS				
Location of embarkation	Record the name and/or geographical coordinates of the port where the observer boarded the vessel – also include the country. If the observer embarked via a port launch within port limits, this is still recorded as a port embarkation. If the observer embarked at sea outside port limits via a vessel transfer, record "at sea" and record the position in Latitude and Longitude.	---	**R1**	**AG**

	Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).			
Date / time embarkation	Record the date and time that the observer boarded the vessel. Note: specify units (preferably hh:mm and YYYY/MM/DD).	---	**R1**	**AG**
Location of disembarkation	Record the name and/or geographical coordinates of the port where the observer disembarked– also include the country. If the observer disembarked via a port launch within port limits then this is still recorded as a port of disembarkation. If the observer disembarked at sea outside port limits via a vessel transfer, record "at sea" and record the position in Latitude and Longitude. Note: Latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	---	**R1**	**AG**
Date / time disembarkation	Record the date and time that the observer disembarked from the vessel. Note: specify units (preferably hh:mm and YYYY/MM/DD).	---	**R1**	**AG**
VESSEL IDENTIFICATION				
Name of the vessel	Record the vessel full name as recorded on vessel official documentation and crosschecked with the name recorded on the vessel itself (any discrepancies are to be reported to the IOTC Secretariat). Note: care should be taken to record the correct spelling of the vessel's name including any corresponding numbers. i.e. "Agnes 83".	**MR**	**R1**	**SETUP**
Vessel flag state (or where chartering occurs, chartering state)[6]	Record the name of country in which vessel is registered as shown on its registration documents (Table 9). Where chartering occurs, record name of the chartering country. Note: vessel flag state (or chartering state when chartering occurs) may not be the same as the nationality from which the vessel originates.	**MR**	**R1**	**SETUP**
Vessel IOTC number	Vessel IOTC number as per the IOTC Record of Authorized Vessels[7] and crosschecked with the number recorded on vessel certificates. Note: any discrepancies are to be reported to the IOTC Secretariat.	**MR**	**R1**	**SETUP**
Vessel IMO or Lloyd's number	Record vessel IMO number. This is the number allocated to the vessel when registered to the International Maritime Organization of the United Nations (e.g.: IMO8814275).	**OR**	**R1**	**SETUP**
International radio call sign (IRCS)	Record vessel radio call sign if available. This is the number displayed prominently on the vessel's side or superstructure.	---	**R1**	**SETUP**
Vessel port of registration	Record the name of vessel's port of registry (also called home port) shown on its registration documents and lettered on the stern of the ship's hull – also include the country.	**MR**	**R1**	**SETUP**
Vessel registration number	Record the number issued by country in which the vessel is registered, shown on its registration documents and written on the hull of the vessel. This may be a combination of characters and numbers; record them all (e.g.: CBG303).	---	**R1**	**SETUP**
Vessel phone, fax and email	When available, record vessel contact details, taking note of the ocean region code. A vessel may have several contact numbers and email addresses depending on the satellite communications systems installed onboard; record them all.	---	**NULL**	
Licensed target species	Record licensed target species (FAO spp. 3-alpha code) as specified in vessel licences or permit conditions (Table 1, Table 2, Table 3, Table 4, Table 8). Vessels will generally target a narrow range or aggregation of species, however one or more might not be an IOTC species; record them all.	**OR**	**NULL**	
Main fishing gear	Record vessel main fishing gear (Table 10).	---	**R1**	**AG**
VESSEL OWNER AND PERSONNEL				
Registered owner	Record the owner's name, nationality (Table 9) and contact details in full. These can be obtained or cross-checked on the vessel registration forms.	---	**R1**	**SETUP**

[6] IOTC Res. 18/10

[7] http://www.iotc.org/vessels/current

Charterer / operator	Where the vessel has been chartered and is operated and managed by a company other than the owner, record operator's full name (company or individual as appropriate), nationality (Table 9) and contact details.	---	**NULL**	
Fishing Master	Record the fishing master name and nationality in full (Table 9).	---	**R1**	**POST**
Skipper	Record skipper name and nationality in full (Table 9). Note: in some instances the fishing master and skipper may be the same person. In such cases record here "N/A" for not applicable.	---	**R1**	**POST**
Crew number	Record the number of crew. This should be cross checked against the vessel's crew list.	---	**NULL**	
VESSEL TRIP DETAILS				
Port of departure	Record the name and/or geographical coordinates of the port from where the vessel sailed – also include the country. If the vessel started a new trip at sea following transhipment record 'at-sea' plus the geographical coordinates corresponding to the location the trip started. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	---	**R1**	**AG**
Date / time vessel sailed	Record the date and time the vessel departed from port or from a transhipment location. Note: specify units (preferably YYYY/MM/DD and hh:mm).	---	**R1**	**AG**
Port of return	Record the name and/or geographical coordinates of the port where the vessel returned – also include the country. If the vessel arrived at a transhipment location record 'at-sea' plus the geographical coordinates corresponding to the location the transhipment started. If the observer disembarked before the vessel returned then record expected port of return as provided by the vessel. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	---	**R1**	**AG**
Date / time vessel returned to port	Record the date and time the fishing vessel finishes its fishing campaign. i.e. returns to port or to a transhipment location for unloading. If the observer disembarks before the vessel returns then record expected date and time of arrival (ETA) as provided by the vessel. Note: specify units (preferably YYYY/MM/DD and hh:mm).	---	**R1**	**AG**
VESSEL ATTRIBUTES				
Tonnage	The vessel tonnage as specified in vessel registration papers. Note: specify units, i.e. if the vessel is registered using Gross Tonnage (GT) or Gross Registered Tonnage (GRT).	**MR**	**P1**	**PRE**
Length overall	The vessel overall length (LOA) as specified in vessel registration papers. Note: specify units (preferably metres).	**MR**	**P1**	**PRE**
Hull material	Record the vessel hull material (s) (steel, wood, aluminium, fibre glass, etc.) (Table 11).	**MR**	**P1**	**PRE**
Main engines (make and power)	The make (brand) and power of the main engines. Note: specify units (HP, Kilowatt or BHP).	**MR**	**P1**	**PRE**
Fish storage capacity	The vessel total maximum capacity to store catches. This should include blast freezer(s) capacity. Note: specify units (metric Tons (mT.) or cubic metres (m^3)).	**MR**	**P1**	**PRE**
Fish preservation methods	Fish preservation methods: Record the method(s) used by the vessel to preserve the catch (Table 12).	---	**P1**	**PRE**
Fish storage type	Record the type of structure(s) present on-board used by the vessel to store the catch (Table 13).	---	**P1**	**PRE**
Vessel autonomy / range	Record vessel autonomy, expressed by the time (days) a vessel can spend at sea without refuelling. If this information is not available then record vessel range expressed in cruising distance (nautical miles). If a figure for the range cannot be obtained, the observer should calculate vessel range as follows. <Vessel range (nm)> = <Vessel average cruising distance per metric ton (nm/mT)> : <Tonnage of fuel carried (mT)>	---	**NULL**	

	Note: specify units(days or nautical miles)			
VESSEL ELECTRONICS				
Global Positioning System (GPS)	Indicate Yes if on board No if not sighted. Note: a GPS may be an independent unit or linked or incorporated into track plotters and acoustic systems.	**MR**	**P1**	**PRE**
Vessel Monitoring Systems (VMS)	Indicate Yes if on board No if not sighted	**MR**	**P1**	**PRE**
Radars	Indicate Yes if on board No if not sighted. Note: include high frequency radars used by the vessel to search for seabird activity or activity on the sea surface.	**MR**	**P1**	**PRE**
Track Plotter	Indicate Yes if on board No if not sighted	**MR**	**P1**	**PRE**
Depth Sounder	Indicate Yes if on board No if not sighted	**MR**	**P1**	**PRE**
Sonar	Indicate Yes if on board No if not sighted	**MR**	**P1**	**PRE**
Doppler Current Meter	Indicate Yes if on board No if not sighted Note: acoustic doppler current meter is used to ascertain current speed.	**MR**	**P1**	**PRE**
Expendable bathythermographs (XBT)	Indicate Yes if on board No if not sighted. XTBs are usually mounted on the bridge wings. Note: XTBs are periodically used to determine the depth of the thermocline.	**MR**	**P1**	**PRE**
VHF radios	Indicate Yes if on board No if not sighted	**---**	**P1**	**PRE**
HF radios	Indicate Yes if on board No if not sighted	**---**	**P1**	**PRE**
Satellite communication systems	Indicate Yes if on board No if not sighted.	**---**	**P1**	**PRE**
Sea Surface Temperature (SST) gauge	Indicate Yes if on board No if not sighted. SST gauge is usually mounted on the bridge. Note: the vessel may also have access to SST charts received from Fisheries Information Services systems.	**---**	**P1**	**PRE**
Weather facsimile	Indicate Yes if on board No if not sighted. Note: weather information may also be received from Fisheries Information Services systems.	**---**	**P1**	**PRE**
Fisheries information services	Indicate Yes or No if the vessel has access to a Fisheries information service. Note: Vessels may access fishery information services for instant information on weather and oceanographic features (SST, phytoplankton densities or sea height).	**---**	**P1**	**PRE**
WASTE MANAGEMENT (MARPOL Agreement Annex 5)				
Waste category	Record the category of the waste produced by the vessel (Table 14).	**OR**	**NP (R3&4[8])**	
Storage/Disposal method	Record how the waste was disposed of (Table 15). For example, incinerated, stored in sacks or disposed of overboard.	**OR**	**NP (R3&4[3])**	
OBSERVED TRIP SUMMARY				
Number of fishing events/sets conducted by the vessel while the observer was on-board.	Record the total number of fishing events/sets conducted by the vessel while the observer was on-board, independently of their success and of being sampled or not by the observer. Note: this should not include pole and line bait fishing events/sets.	**MR**	**R1**	**EM-A**

[8] Partially can be recorded with extra cameras and/or costly analisis of EM images (e.g. bait plastic boxes for LL or the material of FADs)

Number of fishing events/sets observed	Record the total number of fishing sets/events monitored by the an observer. Note: this should not include pole and line bait fishing events/sets.	**MR**	**R1**	**EM-A**
Number of days searching	Record the total number of days that the vessel was engaged in actively searching for fish (this includes active fishing days).	**MR**	**R1**	**EM-A**
Number active fishing days	Record the total number of days that the vessel actually fished (i.e. when the vessel had gear in the water). Note: for some fishing events this may be for only a few hours of the day. Alternatively a single fishing event/set may span part of two days."	**MR**	**R1**	**EM-A**
Number of days lost	Record the total number of days where a vessel was unable to fish due to factors such as adverse weather conditions, mechanical failure or other unforeseen events.	**MR**	**R1**	**EM-A**
Reason(s) for days lost	Record the reason(s) a vessel was unable to fish: (i) adverse weather conditions, (ii) mechanical breakdown or inoperative gear or (iii) unforeseen events (specify).	**OR**	**NP**	
Number of days in the fishing area	Record the number of days the vessel spent in the fishing area while the observer was onboard. This does not include transit time even if the area being transited is within the fishing area.	**---**	**R1**	**AG**
Number of days transiting	Record the number of days the vessel spent steaming or transiting to/between/from fishing areas while the observer was onboard.	**---**	**R1**	**AG**

LONGLINE INFORMATION

Gear specifications[9]

Data field name	Data field description	Reporting	EM	Source
SPECIAL EQUIPMENT OR MACHINERY				
Line setter	Indicate Yes if on board No if not sighted. Many long line vessels will be fitted with equipment or machinery that regulates line setting speed allowing the line to be set at uniform depth.	**MR**	**R3**	**AG**
Line hauler	Indicate Yes if on board No if not sighted. Most long line vessel will be fitted with equipment or machinery that hauls the line in after it has been set.	**MR**	**R3**	**AG**
Bait casting machine	Indicate Yes if on board No if not sighted. Most vessels manually deploy branch lines with the bait. However there are a number of vessels that use automatic bait casting machines.	**MR**	**R3**	**AG**
GENERAL GEAR ATTRIBUTES				
Mainline material	Record the material the mainline is made out of, e.g. kevlar, nylon, nylon multifilament (Table 16).	**MR**	**NP**	
Mainline length	Record the total length of the mainline (i.e. mainline maximum length). This information can be obtained from the Captain or Fishing Master. Note: specify units (preferably 'Kilometres')	**MR**	**P2**	
Mainline diameter	Record the diameter of the mainline. This information can be obtained from the Captain or crew and crosschecked by measuring mainline diameter with callipers. Note: specify units (preferably 'millimetres')	---	**NP**	
Branchline configuration number	Unique number for a specific branchline specification as detailed based on the fields below.	MR	**R3**	
Branchline material	Record the branchline material for each of the four sections where section 1 is that closest to the mainline and section 4 is the leader; note that wire trace may be sheathed by a plastic or nylon coating (Table 16).	---	**NP**	
Branchline length	Record the length of the branchline for each of the four sections where section 1 is that closest to the mainline and section 4 is the leader. Note: specify units (preferably 'metres')	**MR**	**NP**	
Branchline diameter	Record the diameter of the branchline for each of the four sections where section 1 is that closest to the mainline and section 4 is the leader. Note: specify units (preferably 'millimetres')	**MR**	**NP**	
Branch line storage	Record if the branch lines are coiled up and packed into baskets (BSK), or layered out in tubs (TBS), or coiled up onto reels (RLS).	---	**R3**	
MITIGATION DEVICES				

[9] Information designed to capture detailed specifications of the different components of the longline gear used by the vessel.

DMDs used	Record depredation mitigation device/s DMDs used by the vessel (if any) (Table 38).	---	**P2**	
TORI LINE DETAILS	If the vessel was equipped with a tori line provide tori line details below. If no tori line was present on-board fill in NA for not applicable.		**R1**	**AG**
Tori line length	Record the total length of the tori line (not including streamers). Note: specify units (preferably metres)	**MR**	**P2**	
Streamer type	Indicate the type of streamers which are used with the tori line (e.g. paired or single)	**MR**	**P2**	
Streamer line length	Record length of individual streamer lines (minimum and maximum where lengths vary). Record only one length if they do not vary. Note: specify units (preferably metres)	**MR**	**NP**	
No. streamers per line	Record the number of streamers that are attached to a single tori line	**MR**	**NP**	
Distance between streamers	Record the distance between streamers. Note: specify units (preferably metres)	---	**NP**	
Attached height	Record the height hat the tori line is attached above the water level. Note: specify units (preferably metres)	**MR**	**P2**	
Streamers reach surface	Indicate Yes if the streamers are long enough to touch the surface of the water in calm conditions and No if they are not.	---	**P2**	
Towed objects	Record the total number and type of towed objects used to maintain tori line tension and achieve aerial extent when deployed.	---	**NP**	
Diagram	Sketch/complete a diagram containing Tori line key features (e.g. Fig. 1 of IOTC Resolution 12/06).	---	**NP**	

Fishing event[10]

Data field name	Data field description	Reporting	EM	Source
Set number	Record set number. This should be a four digit numerical code beginning 0001. Set numbers should be consecutive from the start of the first line set to the last line set of the observed trip. A unique number is to be allocated to each individual set.	**MR**	**R1**	**AG**
SETTING OPERATIONS				
Start setting date and time	Record the date and the time the first dhan buoy and / or radio buoy is deployed to start the setting of the line. Note: specify units (preferably hh:mm and YYYY/MM/DD).	**MR**	**R1**	**AG**
Start setting position	Record the position in latitude and longitude for the start of the setting operation	**MR**	**R1**	**AG**

[10] Information required for every set/operation.

	Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).			
End setting date and time	Record the date and the time that the last dhan buoy and / or radio buoy is deployed. Longline vessels often set lines at the night and the setting operation may continue beyond midnight and into the following day. Note: specify units (preferably hh:mm and YYYY/MM/DD).	**MR**	**R1**	**AG**
End Setting Position	Record the position in latitude and longitude for the end of the setting operation Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	**---**	**R1**	**AG**
Vessel speed	Record the vessel's average speed during setting (knots). Note: Collect vessel speed from the GPS several times during the operation and take the average.	**---**	**R1**	**AG**
Line setter speed	Record the speed setting of the line setter (metres/second).	**---**	**R3**	**AG**
Length of mainline set	Record mainline total set length (i.e. the total deployed length of the mainline for the specific set). Usually calculated by multiplying the total time to set the line and the average line setter speed, taking into account any interruption times. This information can be obtained from the Fishing Master and cross checked against observer calculations. Note: specify units (preferably in Kilometres).	**MR**	**P2**	
Branchline clip on time	Record the average time interval in seconds between the "beeps" that indicate to the crew to clip on a branch line. Note: the timing of this is usually controlled by the Fishing Master.	**---**	**R1**	**AG**
Buoys clip on time	Record the average time interval in seconds between the "beeps" that indicate to the crew to clip on a buoy. Note: the timing of this is usually controlled by the Fishing Master.	**---**	**R1**	**AG**
Total number of hooks set	Record the total number of hooks deployed for the set. Usually calculated by multiplying number of baskets by the average number of hooks between the baskets. This information can be obtained from the Fishing Master and cross checked against observer calculations. Note: total length of line set and spacing between branch lines can also be used to determine the number of hooks set.	**MR**	**R1**	**AG**
Total number of floats set	Record the total number of floats deployed during the set (this should not include the radio/dhan buoys). Usually calculated by subtracting the number of buoys in their holders before setting by the number of buoys in their holders after setting. This information can be obtained from the Fishing Master and cross checked against observer calculations.	**---**	**R1**	**AG**
N° of hooks set between floats	Record the number of hooks set between floats. This will correspond to the number of hooks stored in each basket/tub, or on a reel and will be equivalent to the number of branch lines set.	**---**	**R1**	**AG**
Distance between branchlines	Record the distance between branch lines (i.e. the interval at which they were set along the mainline) in metres. Usually calculated by	**---**	**R3 & R4**	

	multiplying 'Branch line clip on time (s)' by the 'line setter speed' (m/s).			
Floatline lengths (1, 2 and 3)	Record the different lengths of the floatlines used (1, 2 and 3). Note: specify units (preferably metres).	---	**NP**	
Total radio/dhan buoys set	Record the total number of radio and /or dhan buoys deployed.	---	**R4**	
Attached lights	Record number of lights attached to the branchlines per type (Table 22) and colour (Table 23)."	---	**R4**	
Shark lines set	Indicate Y or No if shark lines were set during the operation. Note: shark lines are branch lines running directly off the longline floats or drop lines, specifically for targeting sharks.	**MR**	**R1**	**AG**
N° of shark lines set	Record the number of shark lines set during the operation. If no shark lines are set then record zero (0).	---	**R1**	**AG**
Target species	Record the target species for the set (FAO spp. 3-alpha code), (Table 1, Table 2, Table 3 and Table 4).	**MR**	**R1**	**AG**
VMS on	Indicate Y or No to sign if he VMS was on or not while setting and hauling.	**OR**	**NP**	
Mitigation measures				
Number of Tori lines deployed	The total number of tori lines deployed during the setting operation. Record zero if none were deployed.	**MR**	**R3**	**AG**
Low light night setting	Indicate Y or No for whether minimum deck lighting is used during night setting (as defined in Table 1. Mitigation measures of IOTC Res 12/06). Note: night setting is binary. i.e. if all hooks are set between dusk and dawn, then night setting was used. If some hooks are set outside of nautical darkness, then night setting was not used. [Consistent with IOTC Res 12/06]	**MR**	**R1**	**AG**
Branchline weighted	Indicate Yes or No if the branch line is weighted. [Consistent with IOTC Res 12/06]	**MR**	**NP**	
Sinker average weight	Record the average weight of weights or sinkers attached to the branchlines (weights deployed on the snood prior to setting). Note: specify units (preferably grams (g)). [Consistent with IOTC Res 12/06]	**MR**	**NP**	
% branchlines weighted	Record the proportion of branchlines weighted (%). If all weighted, record 100%.	**MR**	**NP**	
Hook-sinker distance	The distance of the weights/sinkers from the eye of the hook. Note: specify units (preferably centimetres (cm)).	**MR**	**NP**	
Underwater setting	Indicate Yes or No if the bait is protected on the branchlines until they are a certain depth below the surface.	---	**R3**	
Other mitigation	Record any other mitigation measures observed (Table 38).	---	**R3**	

measures used				
N° of branchlines set by type	Record the number of branchlines set by type (branchline configuration number. Branchlinline types must be in accordance to types previously defined under the "Gear specifications" section.	---	**NP**	
Hook type	Record the type of hooks used (Table 17).	**MR**	**NP**	
% hooks set by type	Record the percentage (%) of hooks set by type. [As per SC20.23 recommendations]	**MR**	**NP**	
Variations in hook type[11]	Where possible indicate any variations in hook type, hook material and presence/absence of hook ring (Table 17).	---	**NP**	
Bait type	Record bait type/condition used (Table 25).	**MR**	**R1**	
Bait species	Record the species of bait used (FAO spp. 3-alpha code) (Table 8).	**MR**	**R3**	
Bait ratio (%)	Record the approximate proportion of bait species and condition used across all hooks in the set (%).	**MR**	**R4**	
Bait dye colour	Record the colour or colours that the different baits are dyed (e.g. blue to avoid bird bycatch). If none, write NONE.	---	**R1**	
HAULING OPERATIONS				
Start hauling date and time	Record the date and the time when the first dhan buoy and / or radio buoy is hauled back on-board to start hauling the line. Note: specify units (preferably hh:mm and YYYY/MM/DD).	**MR**	**R1**	**AG**
Start hauling position	Record the position in latitude and longitude for the start of the hauling operation. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	**MR**	**R1**	**AG**
End hauling date and time	Record the date and the time when the when the last component of the longline gear (dhan buoy and / or radio buoy) is hauled back on-board. Note: specify units (preferably hh:mm and YYYY/MM/DD).	---	**R1**	**AG**
End hauling position	Record the position in latitude and longitude for the end of the hauling operation. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	---	**R1**	**AG**
Offal management	Record fate given to the offal (fish heads, guts, etc.) and bait produced during the observed set. Indicate if these are retained for **batch disposal (BD)** at a later stage and/or **disposed of ad hoc (AH)** as they accumulate.	---	**R3**	
Position of offal disposal	Record the position where offal and used bait was disposed. Indicate if these are disposed at port side (BB), starboard (SB) or aft (AF).	---	**NP**	

[11] Hooks used in pelagic fisheries are correctly identified and characterised based on type, type variations, material and presence/absence of hook ring. Standardization of hook types and characteristics is therefore very important for data recording and analysis and for scientific studies on their effects on catch rates and post-capture survival.

Method/s to stun fish	Record the method/s used to stun fish during hauling (Table 24).	---	**R1**	**AG**
Bird scaring device at hauler	Indicate Yes if a bird scaring device was deployed during hauling operations and No if not. Note: report on the construction and effectiveness of all devices used in the comments section and trip report.	---	**R3**	
Number of bite-offs (by branchline type)	Record for each type of branchline set up previously identified how many have had the hook bitten off. This only includes bite-offs observed while the observer was in a position to observe and record the hooks coming directly out of the water.	---	**R4**	
Number of retrieved hooks observed	Record the number of hooks observed.	**MR**	**R1**	**AG**
Sampling protocol	Indicate sampling protocol followed by the observer (Table 39).	**MR**	**R1**	**EM-A3**
CATCH DETAILS				
Set number	Unique within a specific trip	**MR**	**R1**	**AG**
Catch detail number	Unique within a specific set	**MR**	**R1**	**AG**
Species	Record the species code for each specimen observed using FAO three figure alpha codes (Table 1, Table 2, Table 3, Table 4, Table 5, Table 6 and Table 7). If species FAO code is not available, record the species scientific name. Note: Record "unknown" for species that cannot be positively identified and give it a reference number. Use the same reference number throughout the trip for that species. Retain a sample and / or take a photograph of the unidentified organism for latter identification.	**MR**	**R1**	**AG**
Fate	Specify the fate which includes whether it was retained or discarded and the reason, e.g. "Discarded – too small" (Table 41).	**MR**	**R1**	**AG**
Sampling methods for obtaining total catch estimates per species	Indicate the sampling method used to obtain total catch estimates per species for the catch detail (Table 40).	**MR**	**R1**	**EM-A**
Number	Record the number of individuals per species for each specified fate. If weight is recorded, insert NA here (for large fish, record number of individuals).	**MR**	**R1**	**AG**
Weight	Record the weight corresponding to the specified species and fate category. If number of individuals is recorded, insert NA here (for small fish, record weight). Note: specify units (preferably tons).	**MR**	**R1**	**AG**
Weight estimation method	Indicate the weight estimation method used to collect weight (Table 43). Note: If number of individuals is recorded, insert NA here.	**MR**	**R1**	**EM-A**

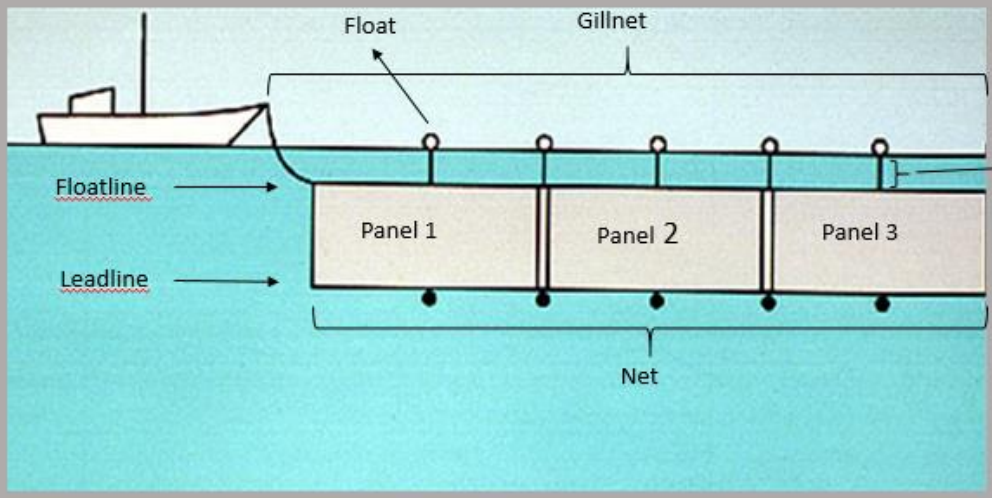
Weight code	The code corresponding to the type of processing the specimen underwent prior to weighing (Table 44). If the fish has not been processed, record code for unprocessed (or round, whole, live) weight (i.e. RD). Note: If number of individuals is recorded, insert NA here.	**MR**	**R1**	**EM-A**
SPECIMEN INFORMATION				
Set number	Unique within a specific trip	**MR**	**R1**	**AG**
Catch detail number	Unique within a specific set	**MR**	**R1**	**AG**
Specimen number	Unique within a specific catch detail	**MR**	**R1**	**AG**
Depredation details	[In agreement with SC18.16 (para. 53)]			
Depredation source	For depredated specimens, record the depredation source based on depredation scar characteristics (Table 45). For non-depredated specimens record NA.	**MR**	**NP**	
Predator Observed	For depredated specimens, record the predator species directly observed and identified (FAO spp. 3-alpha code). If the predator was not observed record UNK (unknown). For non-depredated specimens record NA. Note: species observed in the area may not necessarily be associated with depredation unless directly observed. Similarly for shark and squid damage the species may be difficult to determine.	**MR**	**NP**	
Additional details on non-target species	Catch details on non-target species to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.			
Condition at capture	State the condition of the specimen at capture (Table 46).	**OR**	**R3/R4**	
Condition at release	State the condition of the specimen at the time of release (Table 46).	**OR**	**R3/R4**	
Additional catch details on SSIs	Additional catch details on Species of Special Interest (Table 47) to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.			
Gear interaction	For SSI only, specify the type of interaction of the specimen with the fishing gear (Table 48).	**OR**	**R1**	**AG**
Hook type	For SSI only, record the type of hook the individual was hauled on (Table 17) [Consistent with IOTC Res 12-04]	**OR**	**NP**	
Bait type	For SSI only, record the type/condition of bait the individual was hauled on (Table 25). [Consistent with IOTC Res 12-04]	**OR**	**R1**	**AG**

Leader material	For SSI only, record the leader material the individual was hauled on (Table 16). [Consistent with IOTC Res 12-04 and IOTC Res. 17/05]	**OR**	**NP**	
Leader thickness	For SSI only, record the thickness of the leader the individual was hauled on. Note: precise units (preferably millimetres (mm)). [Consistent with IOTC Res 12-04 and IOTC Res. 17/05]	**OR**	**NP**	
De-hooker/line cutter	Specify de-hooking or line cutting device used to extract the hook (Table 50). [Consistent with IOTC Res 12-04]	**OR**	**R3**	
Brought on board	Indicate Yes or No, if the specimen was brought on board. [Consistent with IOTC Resolutions 13/04; 13/05; 12/04; 12/06; 12/09]	**OR**	**R1**	**AG**
Hauling method	Detail how the specimen was brought on-board (Table 49). [Consistent with IOTC Res 12-04]	**OR**	**R1**	**AG**
Resuscitation (for turtles only)	For turtles indicate Yes if the release took place with resuscitation and No if not.	---	**R1/R3**	
Photo ID	If a photo is taken, record photo number/code so that it can be linked back to the specimen for onshore examination.	**---**	**R1**	**AG**
BIOMETRIC INFORMATION Details concerning any extra biometric measurements, sex, maturity and the collection of biological samples.				
Sampling methods for the collection of biological information	Indicate the sampling method used for the collection of biological sub-sample (Table 42).	**MR**	**NULL**	
Length code 1	Specify the length code used for the measurement (Table 53).	**MR**	**R1**	**AG**
Length 1	Record the length corresponding to the length type taken rounded to the lower centimetre.	**MR**	**R1**	**AG**
Length code 2	When an additional length measurement is taken, the corresponding length code should be recorded (Table 53).	**OR**	**R1**	**AG**
Length 2	When an additional length measurement is taken, the corresponding length should be recorded rounded to the lower centimetre.	**OR**	**R1**	**AG**
Weight code	Record the code corresponding to the type of processing the specimen underwent prior to weighing (Table 44).	**OR**	**R1**	**CF**
Weight	Record the specimen's weight (in kilograms) corresponding to the specified product type recorded in 'weight code'. If the fish has not been processed, record the unprocessed (or round, whole, live) weight (i.e. RD).	**OR**	**R1**	**CF**
Weight estimation method	Specify the weight estimation method used to obtain the weight (Table 43).	**OR**	**R1**	**EM-A**
Sex	Record the sex of the sampled fish specimen (Table 51). If unknown record UNK.	**OR**	**NP**	

Maturity stage[12]	Record the stage of maturity of the sampled fish specimen according to standard maturity scales approved by the IOTC. If unknown record UNK.	**OR**	**NP**	
Sample collected	Record the following details on the collection of samples: *a)* type (e.g. otoliths, spine clippings, and genetic samples) *b)* preservation method (e.g. alcohol, frozen, etc.) c) destination (i.e. location to be sent/stored)	**OR**	**NP**	
TAG DETAILS Note that all tagged specimens are to be identified to species level and to be sampled for length. Elasmobranches and turtles are also to be sexed and ascertained for maturity.				
Tag release	Indicate Yes or No, whether this individual was re-released with a tag attached.	**MR**	**R1**	**AG**
Tag recovery	Indicate Yes or No, whether a tag was recovered from this individual.	**MR**	**R2**	**AG**
Tag number	Provide the tag number. If a turtle, provide both tag numbers (right and left flipper).	**MR**	**NP**	
Tag type	Record the type of tag used (Table 52).	**MR**	**R2**	**AG**
Tag finder	Record the name and contact details of the person who recovered the tag.	**MR**	**NP**	

[12] Until a standard maturity stage has been approved by the Scientific Commitee, record both stage and scale used.

GILLNET INFORMATION[13]



Gillnet: A vertical panel(s) of netting suspended in the water column which may be attached to free floating buoys and/or a high flier at one end, and tied off to the vessel at the other end. Large mesh netting is stretched between a floatline at the top and a leadline at the bottom, and supported by vertical endlines, or up and down lines on each end. Panels of netting may be separated by a space or escape panel.

Net: A string of panels sewn together. The entire string may be referred to as "the net".

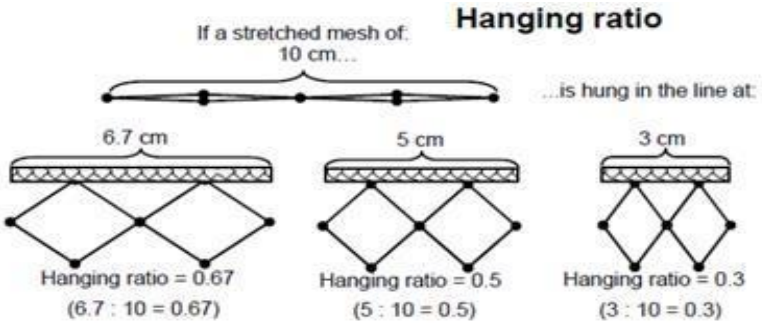
Panel: A section of continuous netting of exactly the same characteristics between two endlines (up and down lines).

Source: Scott.Fish.Inf.Pamp. Fig.30, p.40

Gear specifications

Data field name	Data field description	Rep. Req.
SPECIAL EQUIPMENT OR MACHINERY		
Net drum/hauler	Indicate Yes if on board No if not sighted. Vessels are normally equipped with a hydraulic net hauler; However they can also use net drums to both haul and store the net.	**MR**
GILLNET ATTRIBUTES Detail the specifications of each gillnet present on-board during the observed trip.		
Gillnet sequential number	Specify gillnet sequential number. Note: a unique sequential number is allocated to link each gillnet to its specifications. Any changes to individual gillnet specifications are to be	**MR**

[13] To be completed as soon as EM pilots from Regional Observer Project are available

	considered a change of gillnet and the "new" gillnet will need to be characterised accordingly.	
Total number of panels	Record the number of panels making up the net.	**MR**
Panels stacked	Indicate Yes or No if there are any panels stacked. Note: stacked panels is defined as two or more panels of netting sewn together vertically, one on top of the other, to intentionally fish "double deep".	**MR**
Net length	Record the net string length. Usually calculated by multiplying the panel average length by the number of panels used in the net. Note: specify units (preferably kilometres)	**MR**
Net depth	Record the vertical height of the net (depth). Usually obtained by measuring the length of the end-line, or up and down line, on the end of a net where the meshes are attached. This information may be used to cross check information provided by the crew. Note: specify units (preferably metres)	---
Net material	Record the material of the net webbing (Table 18).	---
Stretched mesh size(s)	Record the mesh average stretched lengths (knot to knot) and range. Usually calculated by measuring at least 10 meshes from 5 panels in different areas of the net. Note: specify units (preferably millimetres)	**MR**
Mesh count, vertical	Record the number of vertical meshes of a net in this gear. Usually obtained by counting the number of meshes of the end-line, or up and down line, on the end of a net where the meshes are attached. This information may be used to cross check information provided by the crew.	---
Hanging ratio (%)	Record the ratio between the length of the float line and the length of the stretched mesh hanging on the float line. Usually obtained by the following process: 1) counting 10 or 12 meshes horizontally, 2) multiplying the number of counted meshes by average stretched mesh length; 3) measuring the length of the floatline they are attached to, 3) dividing the length of the floatline the meshes are attached to by the length of the stretched meshes counted (see e.g. below). 	**MR**
Net web colour	The colour(s) of the net webbing (Table 19). Note: Different net colours can have an impact on cetacean and turtle bycatch as some colours are more visible than others. [Consistent with SC16.24 (para. 53)].	**MR**
Float type	Record the type of buoyancy aid that is attached to the head-rope (Table 20).	---

Float number	Record an approximate total number of floats used on this gillnet. This number must include the number of floats across a space that may occur at the bridle at the end of a net. This information may be obtained from the crew.	---
Distance between floats	Record the average distance (measured along the head-rope) between the floats used on this gillnet. Note: specify units (preferably metres).	---
Droplines used	Indicate Yes if droplines are used in this gillnet and No if not.	---
Droplines length	If droplines are used in this gillnet, record the length of the droplines. Usually obtained by measuring the distance from the floats (at the water's surface) to the float-line. This information may be used to cross check information provided by the crew. Note: specify units (preferably metres).	---
Sinker type	Record the sinker type (defined accordingly to the material they are made of) attached to the footrope (Table 21).	---
Sinker Number	Record an approximate total number of sinkers attached to footrope. If more than one type of sinker is used, record approximate total number of sinkers/weights per sinker type. This information may be obtained from the crew.	---
Sinker average weight	Record sinker average weight. If more than one type of sinker is used, record sinker average weight per sinker type. Note: specify units (preferably kilograms).	---

Fishing event

Data field name	Data field description	Rep. Req.
Set number	Record set number. This should be a four digit numerical code beginning 0001. Set numbers should be consecutive from the start of the first line set to the last line set of the observed trip. A unique number is to be allocated to each individual set.	**MR**
Gillnet sequential number	Specify gillnet used on this set by recording its sequential number. Note: a unique sequential number is allocated to link each gillnets to its specifications.	**MR**
SETTING OPERATIONS		
Start setting date and time	Record the date and the time that first panel enters the water (i.e. start of the setting of the net). Note: specify units (preferably hh:mm and YYYY/MM/DD).	**MR**
Start setting position	Record the position in latitude and longitude for the start of the setting operation. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	**MR**
End setting date and time	Record the date and the time the gillnet is secured to the vessel, to an anchoring device, or completely deployed (i.e. end of net setting). Gillnet	**MR**

	vessels often set dusk and the setting operation may continue beyond midnight and into the following day. Note: specify units (preferably hh:mm and YYYY/MM/DD).	
End setting position	Record the position in latitude and longitude for the end of the setting operation Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	---
Vessel speed	Record the vessel's average speed in knots during setting. Note: Collect vessel speed from the GPS several times during the operation and take the average.	---
Vertical set	Indicate the level the gillnet is set at vertically in the water column, i.e., if the net is set at the surface or sub-surface (Table 27).	**MR**
Setting strategy	Indicate how the gillnet was set (Table 29).	**MR**
Setting shape	Indicate the spatial configuration in which the gillnet was set (Table 28). Note: gillnets can be set in a range of configurations such as pulled straight, in a semi-circle or v-shape as well as many others.	---
Mitigation measures		
Mitigation measures	Indicate Yes or No if any bycatch mitigation devices were used during the set.	**MR**
Mitigation devices	Record any mitigation device(s) used during the set (Table 38).	---
HAULING OPERATIONS		
Start hauling date and time	Record the date and time at the start of net hauling. This is the time when the hauling equipment is put into gear or when the net starts being hauled. Vessels often haul nets in the early morning after a night soak period. Note: specify units (preferably hh:mm and YYYY/MM/DD).	**MR**
Start hauling position	Record the position in latitude and longitude for the start of the hauling operation. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	**MR**
End hauling date and time	Record the date and time at the end of net hauling. This is the time when the gillnet is completely retrieved and onboard the vessel. Note: specify units (preferably hh:mm and YYYY/MM/DD).	---
End hauling position	Record the position in latitude and longitude for the end of the hauling operation. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	---
Net condition	Indicate the condition of the net at haul-back, even if the condition was the same at setting (Table 26).	**MR**
Number of net panels retrieved	Record the total number of net panels retrieved at haul.	**MR**

Number of net panels observed	Record the total number of hauled net panels that are observed.	**MR**
Sampling protocol	Indicate sampling protocol followed by the observer to select which net panels to observe (Table 39).	**MR**
CATCH DETAILS		
Set number	Unique within a specific trip	**MR**
Catch detail number	Unique within a specific set	**MR**
Species	Record the species code for each specimen observed using FAO three figure alpha codes (Table 1, Table 2, Table 3, Table 4, Table 5, Table 6 and Table 7). If species FAO code is not available, the species scientific name. Note: Record "unknown" for species that cannot be positively identified and give it a reference number. Use the same reference number throughout the trip for that species. Retain a sample and / or take a photograph of the unidentified organism for latter identification.	**MR**
Fate	Specify the fate which includes whether it was retained or discarded and the reason, e.g. "Discarded – too small" (Table 41).	**MR**
Sampling methods for obtaining total catch estimates per species	Indicate the sampling method used to obtain total catch estimates per species (Table 40).	**MR**
Number	Record the number of individuals per species for each specified fate. If weight is recorded, insert NA here (for large fish, record number of individuals).	**MR**
Weight	Record the weight corresponding to the specified species and fate category. If number of individuals is recorded, insert NA here (for small fish, record weight). Note: specify units (preferably tons).	**MR**
Weight estimation method	Indicate the weight estimation method used to collect weight (Table 43). Note: If number of individuals is recorded, insert NA here.	**MR**
Weight code	Record the type of processing the species underwent prior to weighing (Table 44). If the species has not been processed, record the code for unprocessed (or round, whole, live) weight (i.e. RD). Note: If number of individuals is recorded, insert NA here.	**MR**
Depredation details		
Depredation source	For depredated specimens, indicate the depredation source based on depredation scar characteristics (Table 45). For non-depredated specimens record NA.	**MR**
Predator Observed	For depredated specimens, record the predator species directly observed and identified (FAO spp. 3-alpha code). If the predator was not observed record UNK (unknown). For non-depredated specimens record NA.	**MR**

	Note: species observed in the area may not necessary be associated with depredation unless directly observed. Similarly for shark and squid damage the species may be difficult to determine.	
SPECIMEN INFORMATION		
Set number	Unique within a specific trip	**MR**
Catch detail number	Unique within a specific set	**MR**
Specimen number	Unique within a specific catch detail	**MR**
Additional details on non-target spp.	Catch details on non-target species to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.	
Condition at capture	State the condition of the specimen at capture (Table 46).	**OR**
Condition at release	State the condition of the specimen at the time of release (Table 46).	**OR**
Additional catch details on SSIs	Additional catch details on Species of Special Interest (Table 47) to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.	
Gear interaction	For SSI only, specify the interaction of the specimen with the fishing gear (Table 48).	**OR**
Brought on board	Indicate Yes or No, if the specimen was brought on board. [Consistent with IOTC Resolutions 13/04; 13/05; 12/04; 12/06; 12/09]	**OR**
Hauling method	Specify how the specimen was brought on-board (Table 49). [Consistent with IOTC Res 12-04]	**OR**
Resuscitation (for turtles only)	For turtles indicate Yes if the release took place with resuscitation and No if not.	---
Photo ID	If a photo is taken, record photo number/code so that it can be linked back to the specimen for onshore examination.	**---**
BIOMETRIC INFORMATION Details concerning any extra biometric measurements, sex, maturity and the collection of samples.		
Sampling methods for the collection of biological information	Indicate the sampling method used for the collection of biological sub-sample (Table 42).	**MR**
Length code 1	Specify the length code used for the measurement (Table 53).	**MR**
Length 1	Record the length corresponding to the length type taken rounded to the lower centimetre.	**MR**
Length code 2	When an additional length measurement is taken, the corresponding length code should be recorded (Table 53).	**OR**
Length 2	When an additional length measurement is taken, the corresponding length should be recorded rounded to the lower centimetre.	**OR**

Weight	Record the weight corresponding to the specified species and fate category. If number of individuals is recorded, insert NA here (for small fish, record weight). Note: specify units (preferably tons).	**OR**
Weight estimation method	Indicate the weight estimation method used to collect weight (Table 43). Note: If number of individuals is recorded, insert NA here.	**OR**
Weight code	Record the type of processing the species underwent prior to weighing (Table 44). If the species has not been processed, record the code for unprocessed (or round, whole, live) weight (i.e. RD). Note: If number of individuals is recorded, insert NA here.	**OR**
Sex	Record the sex of the sampled fish specimen (Table 51).	**OR**
Maturity stage[14]	Record the stage of maturity of the sampled fish specimen according to standard maturity scales approved by the IOTC. If unknown record UNK.	**OR**
Sample collected	Record the following details on the collection of samples: *d)* type (e.g. otoliths, spine clippings, and genetic samples) *e)* preservation method (e.g. alcohol, frozen, etc.) f) destination (i.e. location to be sent/stored)	**OR**
TAG DETAILS Note that all tagged specimens are to be identified to species level and to be sampled for length. Elasmobranches and turtles are also to be sexed and ascertained for maturity.		
Tag release	Indicate Yes or No, whether this individual was re-released with a tag attached.	**MR**
Tag recovery	Indicate Yes or No, whether a tag was recovered from this individual.	**MR**
Tag number	Provide the tag number. If a turtle, provide both tag numbers (right and left flipper).	**MR**
Tag type	Record the type of tag used (Table 52).	**MR**
Tag finder	Record the name and contact details of the person who recovered the tag.	**MR**

PURSE-SEINE INFORMATION

Gear specifications

Data field name	Data field description	Reporting	EM	Source
SPECIAL EQUIPMENT OR MACHINERY				
Power block	Indicate Yes if on board No if not sighted.	**MR**	**R1**	**AG**
Purse winch	Indicate Yes if on board No if not sighted.	**MR**	**R1**	**AG**
GENERAL GEAR ATTRIBUTES				

[14] Until a standard maturity stage has been approved by the Scientific Commitee, record both stage and scale used.

Maximum length of the net	Record the maximum length of the net according to the net specifications. This corresponds to the length of the topline. Note: specify units (preferably metres)	**MR**	**P1**	**POST**
Maximum depth of the net	Record the maximum fishing depth according to the net specifications. Note: specify units (preferably metres)	**MR**	**P1**	**POST**
Bag stretched mesh size	Record the mesh average stretched lengths (knot to knot) of the bag of the net. Usually calculated by measuring 3 stretched mesh lengths and calculating the average. Note: specify units (preferably centimetres)	**MR**	**P1**	**POST**
Mid-net stretched mesh size	Record the mesh average stretched lengths (knot to knot) of the mid-net. Usually calculated by measuring 3 stretched mesh lengths and calculating the average. Note: specify units (preferably centimetres)	**MR**	**P1**	**POST**
Maximum Brail Capacity	Record the maximum weight capacity of a full brail in metric tonnes (Mt).	**MR**	**R1**	**SETUP/ PRE**
Skiff Power	Record the skiff engine power. Note: specify units (HP, KW).	**---**	**P1**	**POST**

Fishing event

Data field name	Data field description	Reporting	EM	Source
Set number	Record set number. This should be a four digit numerical code beginning 0001. Set numbers should be consecutive from the start of the first line set to the last line set of the observed trip. A unique number is to be allocated to each individual set.	**MR**	**R1**	**AG**
OPERATIONS				
Set type[15]	Free school set, FAD set, etc. (table 34)	**MR**	**R1**	**AG**
Start setting date and time	Record the date and time the skiff is launched to start the setting operation. Note: specify units (preferably hh:mm and YYYY/MM/DD).	**MR**	**R1**	**AG**
Start setting position	Record the position in latitude and longitude for the start of the setting operation. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	**MR**	**R1**	**AG**
Beaufort	Record the force of the wind according to the Beaufort scale (Table 37).	---	**R1**	**AG**

[15] This is included in the ROS Minimum Data Requirements collectively with “school sighting cue” (see below) data field name but it would be better to identify the school type separatedly from the “school sighting cue”.

School sighting cue and school type	Report up to the first three cues which lead the vessel to detect the presence of the tuna school and specify the type of tuna school detected (Table 35).	**MR**	**NP/R4** [16]	**EM-A**
First detection method	Record how the vessel first detects the tuna school, floating object or birds (Table 30). If more than one method is used record only what first made the vessel change course.	**---**	**NP**	
School size	Provide an estimation of the size of the tuna school being targeted (in tonnes). This information can be requested from the bridge officers.	**---**	**NP**	
Time net pursed	Record the time (hh:mm) when the net is fully pursed. All rings are up.	**MR**	**R1**	**AG**
Time start brailing	Record the time that brailing starts (hh:mm).	**---**	**R1**	**AG**
Time end brailing	Record the time that brailing ends (hh:mm).	**---**	**R1**	**AG**
Time skiff onboard	Record the time when the skiff comes on board and the set is over (hh:mm).	**---**	**R1**	**AG**
Maximum closing net depth (m)	Record the real, measured, closed net depth (m). To be recorded only if depth gauge is used. Use information from middle gauge if more than one gauge is present.	**---**	**NP**	
Object Details	For sets conducted on FADs (natural or artificial), the following detailed information should be collected where possible and reported to the IOTC Secretariat.			
Buoy ID	For every activity involving artificial or a natural FADs equipped with a buoy report BUOY ID (i.e. Buoy marking or any information allowing identifying the owner). [Consistent with IOTC Res 18/08]	**OR**	**NP/P2**	
Buoy equipped with artificial lights	Report if devices equipped with artificial lights are deployed and/or recovered. [Consistent with IOTC Res 16/07]	**OR**	**R3/R4**	
Artificial FAD design	Characterize artificial FAD design using codes provided to describe raft (floating part) and tail (underwater hanging structure) materials (Table 36). [Consistent with IOTC Res. 12/04 and Res 18/08]	**OR**	**R1/R2**	**AG**
Cetaceans and whale sharks sightings during setting	Details on cetaceans and whale sharks sightings during purse-seine setting are to be collected where possible and reported to the IOTC Secretariat. [Consistent with IOTC Res 13/04 and 13/05]			
Sighting occurred before setting	Indicate YES if the sighting occurred before setting or NO if it occurred after.	**OR**	**NP**	
Species	The species code for the sighted specimen/s (FAO spp. 3-alpha code). If species FAO code is not available, the species scientific name.	**OR**	**NP**	
N° sighted	The number of individuals sighted per species.	**OR**	**NP**	

[16] Could be inferred from post-hoc analysis of speed, direction, and ancilliary information from EM System collected data.

Caught inside the net	Indicate YES or NO whether sighted specimen/s was/were caught inside the net once the purse line was closed.	**OR**	**R1**	**AG**
Support vessel details	Details on support vessel/s present/participating to the observed fishing set.			
Support vessel presence	Record if a supply vessel is present during the observed set.	---	**NP**	
Support vessel name	Record the name of the support vessel present during the observed set.	---	**NP**	
Support vessel participation	Support vessel participation: Record if the Supply Vessel takes part in the setting operation (YES/NO). If YES, describe it (e.g. acting as floating objet, etc.).	---	**NP**	
Details on the current	Details on sea current that might influence set performance.			
Current direction	Record current direction using cardinal points (E, W, SW, SSW, etc.). This information is to be requested from bridge officers.	---	**NP**	
Current speed	Record current speed in knots. This information is to be requested from bridge officers.	---	**NP**	
Current depth	Record current depth in metres. This information is to be requested from bridge officers.	---	**NP**	
CATCH DETAILS				
Set number	Unique within a specific set	**MR**	**R1**	**AG**
Catch detail number	Unique within a specific catch detail	**MR**	**R1**	**AG**
Species	Record the species code for each specimen observed using FAO three figure alpha codes (Table 1, Table 2, Table 3, Table 4, Table 5, Table 6 and Table 7). If species FAO code is not available, the species scientific name. Note: Record "unknown" for species that cannot be positively identified and give it a reference number. Use the same reference number throughout the trip for that species. Retain a sample and / or take a photograph of the unidentified organism for latter identification.	**MR**	**R1/R3**	**AG**
Fate	Specify the species fate which includes whether it was retained or discarded and the reason, e.g. "Discarded – too small" (Table 41).	**MR**	**R1**	**AG**
Sampling methods for obtaining total catch estimates per species	Indicate the sampling method used to obtain total catch estimates per species for the catch detail (Table 40).	**MR**	**R1**	**EM-A**
Number	Record the number of individuals per species for each specified fate. If weight is recorded, insert NA here (for large fish, record number of individuals).	**MR**	**R1**	**AG**
Weight	Record the weight corresponding to the specified species and fate category. If number of individuals is recorded, insert NA here (for small fish, record weight).	**MR**	**R1**	**AG**

	Note: specify units (preferably tons).			
Weight estimation method	Indicate the weight estimation method used to collect weight (Table 43). Note: If number of individuals is recorded, insert NA here.	**MR**	**R1**	**EM-A**
Weight code	The code corresponding to the type of processing the specimen underwent prior to weighing (Table 44). If the fish has not been processed, record code for unprocessed (or round, whole, live) weight (i.e. RD). Note: If number of individuals is recorded, insert NA here.	**MR**	**R1**	**EM-A**
Additional details on non-target spp.	Catch details on non-target species to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.			
Condition at capture	State the condition of the specimens at capture (Table 46).	**OR**	**R1**	**AG**
Condition at release	State the condition of the specimens at the time of release (Table 46).	**OR**	**R1**	**AG**
SPECIMEN INFORMATION				
Set number	Unique within a specific trip	**MR**	**R1**	**AG**
Catch detail number	Unique within a specific set	**MR**	**R1**	**AG**
Specimen number	Unique within a specific catch detail	**MR**	**R1**	**AG**
Additional details on non-target spp.	Catch details on non-target species to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.			
Condition at capture	State the condition of the specimen at capture (Table 46).	**OR**	**R1**	**AG**
Condition at release	State the condition of the specimen at the time of release (Table 46).	**OR**	**R1**	**AG**
Additional catch details on SSIs	Additional catch details on Species of Special Interest (Table 47) to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.			
Gear interaction	For SSI only, specify the interaction of the specimen with the fishing gear (Table 48).	**OR**	**R1**	**AG**
Brought on board	Indicate Yes or No, if the specimen was brought on board. [Consistent with IOTC Resolutions 13/04; 13/05; 12/04; 12/06; 12/09]	**OR**	**R1**	**AG**
Hauling method	Specify how the specimen was brought on-board (Table 49). [Consistent with IOTC Res 12-04]	**OR**	**R1**	**AG**
Resuscitation (for turtles only)	For turtles indicate Yes if the release took place with resuscitation and No if not.	---	**R1**	**AG**
Photo ID	If a photo is taken, record photo number/code so that it can be linked back to the specimen for onshore examination.	**---**	**R1**	**AG**
BIOMETRIC INFORMATION Details concerning any extra biometric measurements, sex, maturity and the collection of samples.				

Sampling methods for the collection of biological information	Indicate the sampling method used for the collection of biological sub-sample (Table 42).	**MR**	**NP**	
Length code 1	Specify the length code used for the measurement (Table 53).	**MR**	**R3/R4**	
Length 1	Record the length corresponding to the length type taken rounded to the lower centimetre.	**MR**	**R3/R4**	
Length code 2	When an additional length measurement is taken, the corresponding length code should be recorded (Table 53).	**OR**	**R3/R4**	
Length 2	When an additional length measurement is taken, the corresponding length should be recorded rounded to the lower centimetre.	**OR**	**R3/R4**	
Weight code	Record the code corresponding to the type of processing the specimen underwent prior to weighing (Table 44).	**OR**	**R3/R4**	
Weight	Record the specimen's weight (in kilograms) corresponding to the specified product type recorded in 'weight code'. If the fish has not been processed, record the unprocessed (or round, whole, live) weight (i.e. RD).	**OR**	**R3/R4**	
Weight estimation method	Specify the weight estimation method used to obtain the weight (Table 43).	**OR**	**R1**	**EM-A**
Sex	Record the sex of the sampled fish specimen (Table 51).	**OR**	**NP/R3** [17]	
Maturity stage	Record the stage of maturity of the sampled fish specimen according to standard maturity scales approved by the IOTC. If unknown record UNK.	**OR**	**NP**	
Sample collected	Record the following details on the collection of samples: *g)* type (e.g. otoliths, spine clippings, and genetic samples) *h)* preservation method (e.g. alcohol, frozen, etc.) i) destination (i.e. location to be sent/stored)	**OR**	**NP**	
TAG DETAILS Note that all tagged specimens are to be identified to species level and to be sampled for length. Elasmobranches and turtles are also to be sexed and ascertained for maturity.				
Tag release	Indicate Yes or No, whether this individual was re-released with a tag attached.	**MR**	**R2**	**AG**
Tag recovery	Indicate Yes or No, whether a tag was recovered from this individual.	**MR**	**R2**	**AG**
Tag number	Provide the tag number. If a turtle make sure to provide both tag numbers (right and left flipper).	**MR**	**NP**	
Tag type	Record the type of tag used (Table 52).	**MR**	**R2**	**AG**

[17] NP for target tuna species and other fish bycatch but it could be ready (R2) for some bycatch species such as sharks

Tag finder	Record the name and contact details of the person who recovered the tag.	**MR**	**NP**	
Well	The well number from which the tagged fish has been recovered, if the fish is recovered during shifting, transhipping or unloading. (Note: this information will allow tracing back tagged fish to the location where it was caught).	**MR**	**NP**	

Purse-seine vessel daily activity information

The following information is to be collected on a daily basis for every fishing set and at every 2 hours (from sunrise to sunset) to allow to reconstruct vessel route and for every fishing set.

Data field name	Data field description	Reporting	EM	Source
Date	Record the date. Note: specify units (preferably YYYY/MM/DD).	---	R1	AG
Time	Record time at the start of every fishing activity and every two hours from sunrise to sunset. Note: specify units (preferably hh:mm).	---	R1	AG
Position	Record vessel position at the start of every fishing activity and every two hours from sunrise to sunset. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	---	R1	AG
Activity	Record vessel activity at the start of every fishing activity and every two hours from sunrise to sunset (Table 33).	---	R1/NP [18]	AG
Comments	Record short commentaries on exceptional events that could not be described by the previous data fields.	---	NP	

Purse-seine FAD activities

The following information is not included in the ROS Minimum Data Requirements but are requested under FAD related IOTC Data Requirements (Resolution 15/02, 19/01 and 19/02). ROS Minimum Data Requirements could also be updated to request observer to collect these data, whenever possible.

Data field name	Data field description	Reporting	EM	Source
Set number	As above	MR	R1	AG
Type	Type of floating object (flotsam, natural object, FAD)	---	R1	AG
Floating structure: dimensions	Length, width and height of the floating structure		R1	AG
Submerged structure: shape			R2	AG
Submerged structure: depth			R2	AG

[18] Not all activites from Table 33 could be recorded by EM

Components when encountered	Components of floating and submerged structures when encountered		R2	AG
Components when left	Components of floating and submerged structures when left		R2	AG
Object encounter	Date, time, position		R1	AG
FAD activity: deployment	Date, time, position		R1	AG
FAD activity: visit	Date, time, position		R1	AG
FAD activity: hauling	Date, time, position		R1	AG
FAD activity: retrieving/removed	Date, time, position		R1	AG
FAD ID	If FAD is marked		NP	
Buoy ID	Serial number of satellite buoy		NP	
Origin	Origin of object (e.g. FAD ownership)		P2	
Operational buoys followed by vessel			NP	
Operational buoy lost by vessel			NP	

POLE AND LINE INFORMATION[19]

Gear specifications

Data field name	Data field description	Reporting	EM	Source
SPECIAL EQUIPMENT OR MACHINERY				
Live bait tanks capacity	Record the total volume of the tanks used to keep the live bait, in cubic metres (m3).	**MR**	**NP**	**SETUP/ PRE**
Number of automatic poles	Record the total number of automatic poles that are fixed on a vessel.	**MR**	**NP**	**SETUP/ PRE**
GENERAL GEAR ATTRIBUTES				
Number of anglers	Record the maximum number of anglers observed during the trip.	**MR**	**R1**	***EM-A***
Pole material	Specify the material the pole is made of: bamboo, fibre glass or carbon. If made of another material, describe it.	**MR**	**NP**	**SETUP/ PRE**
Hook type	Indicate the type of hooks used for the observed trip (Table 17).	**MR**	**NP**	**SETUP/ PRE**

[19] To be completed as soon as EM pilots from Regional Observer Project are available

Type of lures used	Record Yes if the vessel uses lures or jiggers during the observed trip and No if it doesn't. If Yes, record lures or jiggers type, make (brand) and hook type (Table 17).	---	**NP**	**SETUP/ PRE**

Fishing event

Tuna fishing event

Data field name	Data field description	Reporting	EM	Source
Event number	Record event number. This should be a four digit numerical code beginning 0001. Event numbers should be consecutive from the start to the end of the observed trip. Note: Each time the vessel activates its sprayers, starts chumming and/or actively catching fish, the observer should record this as event even if no fish is caught.	**MR**	**R1**	***EM-A***
TUNA FISHING OPERATIONS				
Event date and time	Record the data and time that the first line enters the water. Note: specify units (preferably hh:mm and YYYY/MM/DD).	**MR**	**R1**	***AG-A***
Event start position	Record the position in latitude and longitude at the start of the fishing event. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	**MR**	**R1**	***AG-A***
Beaufort	Record the force of the wind according to the Beaufort scale (Table 37).	---	**NULL**	
Event end time	The time when the last line comes out of the water. Note: If the vessel stops fishing for a period of at least 10 minutes then it should be considered that the fishing event ended, even if fishing is to restart shortly after wards on the same school.	**MR**	**R1**	***AG-A***
School sighting cue and school type	Record up to the first three cues which leads the vessel to detect the presence of a tuna school and the type of school detected (Table 30).	**MR**	**NP**	
Target Species	Record the species in the school being targeted using FAO three figure alpha codes (Table 1).	**---**	**R1**	***EM-A***
Maximum lines fishing at the same time	Record maximum number of lines fishing at the same time. These should include lines deployed from manual and automatic poles. Specify if other lines are deployed and include them in the total count. Note: This should be one count taken when the fishing activity is well established (not right at the beginning or right at the end).	**MR**	**R1**	***EM-A***
Bait used	Indicate Yes or No regarding whether any bait was used during the fishing event.	**MR**	**R1**	***EM-A***
Bait type	Specify the bait type/condition used during the fishing event (Table 25).	**MR**	**R3**	***PRE/EM-A***
Bait species	Record the species of bait used during the fishing event using FAO three figure alpha codes (Table 8).	**MR**	**NP**	
Number of hooks lost	Record the total number of hooks lost during the poling operation.	**MR**	**NP**	

Weight of bait used	Record the estimated quantity of bait used in the poling operation (in kg). If no bait was used record zero (0). Note: Request this information from the fishers in charge of live bait.	---	NP	
Object ID	For every activity involving artificial FAD (DFAD/AFAD) report FAD identifier (i.e. FAD marking or beacon ID or any information allowing identifying the owner).	OR	NP	
Buoys equipped with artificial lights	For every activity involving FADs (natural and/or artificial) report if device is equipped with artificial lights.	OR	NP	
Sampling protocol	Indicate sampling protocol followed by the observer to select which lines to observe (Table 39).	MR	R1	
CATCH DETAILS				
Event number	Unique within a specific observed trip	MR	R1	***AG-A***
Catch detail number	Unique within a specific event	MR	R1	***AG-A***
Species	Record the species code for each specimen observed using FAO three figure alpha codes (Table 1, Table 2, Table 3, Table 4, Table 5, Table 6 and Table 7). If species FAO code is not available, the species scientific name. Note: Record "unknown" for species that cannot be positively identified and give it a reference number. Use the same reference number throughout the trip for that species. Retain a sample and / or take a photograph of the unidentified organism for latter identification.	MR	R1	***EM-A***
Fate	Specify the fate which includes whether it was retained or discarded and the reason, e.g. "Discarded – too small" (Table 41).	MR	R1	***EM-A***
Sampling methods for obtaining total catch estimates per species	Indicate the sampling method used to obtain total catch estimates per species for the observed set (Table 40).	MR	R1	
Number	Record the number of individuals per species for each specified fate. If weight is recorded, insert NA here (for large fish, record number of individuals).	MR	R1	***EM-A***
Weight	Record the weight corresponding to the specified species and fate category. If number of individuals is recorded, insert NA here (for small fish, record weight). Note: specify units (preferably tons).	MR	R1	CF
Weight estimation method	Indicate the method used to estimate weight (Table 43). Note: If number of individuals is recorded, insert NA here.	MR	R1	EM-A
Weight code	The code corresponding to the type of processing the specimen underwent prior to weighing (Table 44). If the fish has not been processed, record code for unprocessed (or round, whole, live) weight (i.e. RD). Note: If number of individuals is recorded, insert NA here.	MR	R1	EM-A
Depredation details	[In agreement with SC18.16 (para. 53)]			

Depredation source	For depredated specimens, indicate the depredation source based on depredation scar characteristics (Table 45). For non-depredated specimens record NA.	**MR**	**NP**	
Predator Observed	For depredated specimens, record the predator species directly observed and identified (FAO spp. 3-alpha code). If the predator was not observed record UNK (unknown). For non-depredated specimens record NA. Note: species observed in the area may not necessary be associated with depredation unless directly observed. Similarly for shark and squid damage the species may be difficult to determine.	**MR**	**NP**	
SPECIMEN INFORMATION				
Additional details on non-target spp.	Catch details on non-target species to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.			
Condition at capture	State the condition of the specimen at capture (Table 46).	**OR**	**R1**	***EM-A***
Condition at release	State the condition of the specimen at the time of release (Table 46).	**OR**	**R1**	***EM-A***
Additional catch details on SSIs	Additional catch details on Species of Special Interest (Table 47) to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.			
Gear interaction	For SSI only, specify the interaction of the specimen with the fishing gear (Table 48).	**OR**	**R1**	***EM-A***
Brought on board	Indicate Yes or No, if the specimen was brought on board. [Consistent with IOTC Resolutions 13/04; 13/05; 12/04; 12/06; 12/09]	**OR**	**R1**	***EM-A***
Hauling method	Specify how the specimen was brought on-board (Table 49). [Consistent with IOTC Res 12-04]	**OR**	**R1**	***EM-A***
Resuscitation (for turtles only)	For turtles indicate Yes if the release took place with resuscitation and No if not.	---	**NULL**	
Photo ID	If a photo is taken, record photo number/code so that it can be linked back to the specimen for onshore examination.	**---**	**NP**	
BIOMETRIC INFORMATION Details concerning possible extra biometric measurements, sex, maturity and the collection of samples.				
Sampling methods for the collection of biological information	Indicate the sampling method used for the collection of biological sub-sample (Table 42).	**MR**	**R1**	***EM-A***
Length code 1	Specify the length code used for the measurement (Table 53).	**MR**	**R1**	***EM-A***
Length 1	Record the length corresponding to the length type taken rounded to the lower centimetre.	**MR**	**R1**	***AG-A***
Length code 2	When an additional length measurement is taken, the corresponding length code should be recorded (Table 53).	**OR**	**R1**	
Length 2	When an additional length measurement is taken, the corresponding length should be recorded rounded to the lower centimetre.	**OR**	**R1**	***AG-A***

Weight code	Record the code corresponding to the type of processing the specimen underwent prior to weighing (Table 44).	**OR**	**R1**	
Weight	Record the specimen's weight (in kilograms) corresponding to the specified product type recorded in 'weight code'. If the fish has not been processed, record the unprocessed (or round, whole, live) weight (i.e. RD).	**OR**	**R1**	***CF***
Weight estimation method	Specify the weight estimation method used to obtain the weight (Table 43).	**OR**	**R1**	***EM-A***
Sex	Record the sex of the sampled fish specimen (Table 51).	**OR**	**NP**	
Maturity stage[20]	Record the stage of maturity of the sampled fish specimen according to standard maturity scales approved by the IOTC. If unknown record UNK.	**OR**	**NP**	
Sample collected	Record the following details on the collection of samples: *j)* type (e.g. otoliths, spine clippings, and genetic samples) *k)* preservation method (e.g. alcohol, frozen, etc.) l) destination (i.e. location to be sent/stored)	**OR**	**NP**	
TAG DETAILS Note that all tagged specimens are to be identified to species level and to be sampled for length. Elasmobranches and turtles are also to be sexed and ascertained for maturity.				
Tag release	Indicate Yes or No, whether this individual was re-released with a tag attached.	**MR**	**R1**	**AG**
Tag recovery	Indicate Yes or No, whether a tag was recovered from this individual.	**MR**	**R2**	**AG**
Tag number	Provide the tag number. If a turtle make sure to provide both tag numbers (right and left flipper).	**MR**	**NP**	
Tag type	Record the type of tag used (Table 52).	**MR**	**R2**	**AG**
Tag finder	Record the name and contact details of the person who recovered the tag.	**MR**	**NP**	

Bait fishing event

Data field name	Data field description	Reporting	EM	Source
Event number	Record event number. This should be a four digit numerical code beginning 0001. Event numbers should be consecutive from the start to the end of the observed trip.	**MR**	**R1**	***EM-A-AG***
Event start date and time	Record the data and time when chumming for bait starts. Note: specify units (preferably hh:mm and YYYY/MM/DD).	**MR**	**R1**	***EM-A-AG***
Event start position	Record the position in latitude and longitude at the start of the fishing event. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	**MR**	**R1**	***EM-A-AG***

[20] Until a standard maturity stage has been approved by the Scientific Commitee, record both stage and scale used.

Event end date and time	Record the data and time at the end of the bait fishing event, when the last brail is scooped from the net. Note: specify units (preferably hh:mm and YYYY/MM/DD).	---	**R1**	***EM-A-AG***
Event depth	Record the depth of the place where the net is being deployed. Note: specify units (preferably metres).	**MR**	**NP**	
Distance from the coast	Record the distance from the coast to which the bait fishing is being carried out. Note: specify units (preferably nautical miles).	---	**R1**	***CF***
Beaufort	Record the force of the wind according to the Beaufort scale (Table 37).	---	**NP**	
School sighting cue and school type	Record up to the first three cues which leads the vessel to detect the presence of a tuna school and type of school detected (Table 30).	**MR**	**R1**	***EM-A***
Detection method	Select the detection method/s used to detect bait fish school (Table 31).	---	**R1**	***PRE***
Fishing method	Indicate the fishing method during the specific bait fishing event (Table 32).	---	**R1**	***EM-A***
N° of fishers	Number of fishers that participate to the bait fishing event.	---	**R1**	***EM-A***
Object ID	For every activity involving artificial FAD (DFAD/AFAD) report FAD identifier (i.e. FAD marking or beacon ID or any information allowing identifying the owner).	**OR**	**NP**	
Buoys equipped with artificial lights	For every activity involving FADs (natural and/or artificial) report if device is equipped with artificial lights.	**OR**	**NP**	
Sampling protocol	Indicate sampling protocol followed by the observer to select which lines to observe (Table 39).	**MR**	**NULL**	
CATCH DETAILS				
Event number	Unique within a specified trip	**MR**	**R1**	***EM-A-AG***
Catch detail number	Unique within a specified event	**MR**	**R1**	***EM-A-AG***
Species	Record the species code for each specimen observed using FAO three figure alpha codes (Table 1, Table 2, Table 3, Table 4, Table 5, Table 6, Table 7 and Table 8). If species FAO code is not available, the species scientific name. Note: Record "unknown" for species that cannot be positively identified and give it a reference number. Use the same reference number throughout the trip for that species. Retain a sample and / or take a photograph of the unidentified organism for latter identification.	**MR**	**R1**	***EM-A***
Fate	Specify the species fate which includes whether it was retained or discarded and the reason, e.g. "Discarded – too small" (Table 41).	**MR**	***R1***	***EM-A***
Sampling methods for obtaining total catch estimates per species	Indicate the sampling method used to obtain total catch estimates per species for the observed set (Table 40).	**MR**	***R1***	***EM-A***
Number	Record the number of individuals per species for each specified fate. If weight is recorded, insert NA here (for large individuals, record numbers).	**MR**	**NULL**	

Weight	Record the weight corresponding to the specified species and fate category. If number of individuals is recorded, insert NA here (for small fish, record weight). Note: specify units.	**MR**	***R1***	***EM-A***
Weight estimation method	Indicate the method used to estimate weight (Table 43). Note: If number of individuals is recorded, insert NA here.	**MR**	**R1**	***EM-A***
SPECIMEN INFORMATION				
Event number	Unique within a specified trip	**MR**	***R1***	***EM-A-AG***
Catch detail number	Unique within a specified event	**MR**	***R1***	***EM-A-AG***
Specimen number	Unique within a specified catch detail	**MR**	***R1***	***EM-A-AG***
Additional details on non-target spp.	Catch details on non-target species to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.			
Condition at capture	State the condition of the specimen at capture (Table 46).	**OR**	**R1**	***EM-A-AG***
Condition at release	State the condition of the specimen at the time of release (Table 46).	**OR**	**R1**	***EM-A-AG***
Additional catch details on SSIs	Additional catch details on Species of Special Interest (Table 47) to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.			
Gear interaction	For SSI only, specify the interaction of the specimen with the fishing gear (Table 48).	**OR**	**R3**	***EM-A***
Brought on board	Indicate Yes or No, if the specimen was brought on board. [Consistent with IOTC Resolutions 13/04; 13/05; 12/04; 12/06; 12/09]	**OR**	**R3**	***EM-A***
Hauling method	Specify how the specimen was brought on-board (Table 49). [Consistent with IOTC Res 12-04]	**OR**	**R3**	***EM-A***
Resuscitation (for turtles only)	For turtles indicate Yes if the release took place with resuscitation and No if not.	---	**NULL**	
Photo ID	If a photo is taken, record photo number/code so that it can be linked back to the specimen for onshore examination.	**---**	**NP**	
BIOMETRIC INFORMATION Details concerning any extra biometric measurements, sex, maturity and the collection of samples.				
Sampling methods for the collection of biological information	Indicate the sampling method used for the collection of biological sub-sample (Table 42).	**OR**	**NP**	
Length code 1	Specify the length code used for the measurement (Table 53).	**OR**	**NP**	
Length 1	Record the length corresponding to the length type taken rounded to the lower centimetre.	**OR**	**NP**	

Length code 2	When an additional length measurement is taken, the corresponding length code should be recorded (Table 53).	**OR**	**NP**	
Length 2	When an additional length measurement is taken, the corresponding length should be recorded rounded to the lower centimetre.	**OR**	**NP**	
Weight code	Record the code corresponding to the type of processing the specimen underwent prior to weighing (Table 44).	**OR**	**NP**	
Weight	Record the specimen's weight (in kilograms) corresponding to the specified product type recorded in 'weight code'. If the fish has not been processed, record the unprocessed (or round, whole, live) weight (i.e. RD).	**OR**	**NP**	
Weight estimation method	Specify the weight estimation method used to obtain the weight (Table 43).	**OR**	**NP**	
Sex	Record the sex of the sampled fish specimen (Table 51).	**OR**	**NP**	
Maturity stage	Record the stage of maturity of the sampled fish specimen according to standard maturity scales approved by the IOTC. If unknown record UNK.	**OR**	**NP**	
Sample collected	Record the following details on the collection of samples: *m)* type (e.g. otoliths, spine clippings, and genetic samples) *n)* preservation method (e.g. alcohol, frozen, etc.) o) destination (i.e. location to be sent/stored)	**OR**	**NP**	
TAG DETAILS Note that all tagged specimens are to be identified to species level and to be sampled for length. Elasmobranches and turtles are also to be sexed.				
Tag release	Indicate Yes or No, whether this individual was re-released with a tag attached.	**OR**	**NULL**	
Tag recovery	Indicate Yes or No, whether a tag was recovered from this individual.	**OR**	**NULL**	
Tag number	Provide the tag number. If a turtle make sure to provide both tag numbers (right and left flipper).	**OR**	**NULL**	
Tag type	Record the type of tag used (Table 52).	**OR**	**NULL**	
Tag finder	Record the name and contact details of the person who recovered the tag.	**OR**	**NULL**	

Pole and line vessel daily activity information

The following information is to be collected on a daily basis for every fishing event and every 2 hours (from sunrise to sunset)

Data field name	Data field description	Reporting	EM	Source
Date	Record the date. Note: specify units (preferably YYYY/MM/DD).	**MR**	**R1**	**AG**
Time	Record the time every two hours (from sunrise to sunset) and at the start of every fishing activity. Note: specify units (preferably hh:mm).	**MR**	**R1**	**AG**
Position	Record vessel position every two hours (from sunrise to sunset) and at the start of every fishing activity. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	**MR**	**R1**	**AG**
Activity	Record vessel activity every two hours (from sunrise to sunset) and at the start of every fishing activity (Table 33).	**MR**	**R1/NP** [21]	**AG**
Comments	Record short commentaries on exceptional events that could not be described by the previous data fields.	---	**R4**	

[21] Not all activites from Table 33 could be recorded by EM

VESSEL TRANSHIPMENT INFORMATION[22]

Information on all transhipments that take place during the trip should be collected. Most commonly this will entail transhipping processed catch to a carrier vessel or another fishing vessel. If fish or fish products are move to or from another vessel (carrier or fishing vessel), observers must record details of the transhipment.

Bear in mind that the collecting this information is not necessary if an observer is present on a carrier vessel monitoring the transhipment for the IOTC Regional Observer Program (ROP)[23].

Data field name	Data field description	Reporting	EM	Sourcne
Date	Record the date the transhipment takes place. Note: specify units (preferably YYYY/MM/DD).	---	**R1**	**EM-A-AG**
Start time	Record the time the transhipment of fish starts. Note: specify units (preferably hh:mm).	---	**R1**	**EM-A-AG**
End time	Record the time the transhipment of fish ends. Stores, bait or fuel may also be transhipped. The time and details of this must not be confused with the time that fish or fish products are being transhipped. Note: specify units (preferably hh:mm).	---	**R1**	**EM-A-AG**
Position	Record the position of your vessel, during transhipment. Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably ±(d)dd.dddd°).	---	**R1**	**EM-A-AG**
Category	Record if your vessel is transhipping to or from, (i.e. receiving fish from) another vessel (carrier/fishing vessel) or if loading or allowing to load fish from the net (this may occur if a purse seiner has pursed more fish than its present loading capacity).	---	**R1**	**EM-A-AG**
Product transhipped	Observers deployed on-board a purse-seine, pole and line or gillnet vessel are to record the quantity of fish products transhipped (per species) using FAO spp.3-Alpha and IOTC "Product" categories (Table 44). Observers deployed on-board longline vessels are only to request to their vessel Captain a copy of the signed declaration form, which will have all the required information. Note: specify units (preferably tonnes).	---	**R1/P2**[24] **NP**	
Name of carrier/fishing vessel	Observers deployed on-board a purse-seine, pole and line or gillnet vessel are to record the name and registration details of the carrier/fishing vessel they are transhipping to/from (i.e. name, national registration number, port of registry, flag and call sign). Observers deployed on-board longline vessels are only to request to their vessel Captain a copy of the signed declaration form, which will have all the required information.	---	**R4/P1**	

[22] Information designed to capture information on all transhipments that take place during the trip.
[23] As per SC14 (para. 104)

[24] R1: total weight transshiped and P2: total weight transhipped by species

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 2023	2nd term
	Vice-Chair	Dr Denham Parker	South Africa	10–Dec–19	End of SC in 2023	2nd term
WPB	Chair	Dr Denham Parker	South Africa	12–Sept–19	End of WPB in 2023	2nd term
	Vice-Chair	Dr Jie Cao	China	12–Sep–19	End of WPB in 2023	2nd 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–18	End of WPTT in 2023	2nd term
	Vice-Chair	Dr Shiham Adam	Maldives, Rep. of	13–Nov–18	End of WPTT in 2023	2nd term
WPEB	Chair	Dr Mariana Tolotti	EU,France	10–Sept–21	End of WPEB in 2023	1st term
	1st Vice-Chair	Dr Mohamed Koya	India	10–Sept–21	End of WPEB in 2023	1st term
	2nd Vice-Chair	Dr Charlene da Silva	South Africa	10–Sept–21	End of WPEB in 2023	1st term
WPNT	Chair	Ms Ririk Sulistyaningsih	Indonesia	5–July–19	End of WPNT in 2023	2nd term
	Vice-Chair	Dr Farhad Kaymaram	I.R. Iran	5–July–19	End of WPNT in 2023	2nd 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	19–Oct–19	End of WPM in 2023	2nd term
	Vice-Chair	Vacant	Vacant	NA	NA	NA
WGFAD	Co-Chair	Dr Gorka Merino	EU,Spain	06-Oct-21	End of WGFAD in 2023	1st term
	Co-Chair	Mr Avelino Munwane	Tanzania	03-Oct-22	End of WGFAD in 2024	1st term
WGEMS	Chair	Dr Hilario Murua	ISSF	17-Nov-21	End of WGEMS in 2023	1st term
	Vice-Chair	Dr Don Bromhead	Australia	17-Nov-21	End of WGEMS in 2023	1st term

APPENDIX 8
EXECUTIVE SUMMARY: ALBACORE (2022)

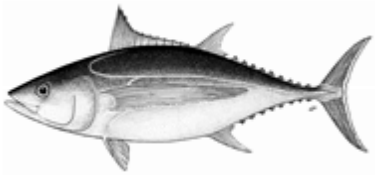


Table 1. Status of albacore (*Thunnus alalunga*) in the Indian Ocean

Area	Indicators – 2022 assessment		Status[3]
Indian Ocean[1]	Catch (2021) (t)[2]	34,864	**85%**
	Mean annual catch (2016-2020) (t)	39,218	
	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 2021: 20.2%;
[2]Status relates to the final year data are available for 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		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new stock assessment was carried out for albacore in 2022 to update the assessment undertaken in 2019. 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 (41,051t for the statistical year 2020; **Table 3**) are just below 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 2020 (41,051 t) are below 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**: current fishing mortality is 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**: 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. 3**)
- **Main fisheries (mean annual catch 2016-2020)**: albacore are caught using longline (87.1%), followed by line (10.3%) and purse seine (1.4%). The remaining catches taken with other gears contributed to 1.2% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2016-2020)**: the majority of albacore catches are attributed to vessels flagged to Taiwan,China (57.7%) followed by Indonesia (18.6%) and China (8.8%). The 28 other fleets catching albacore contributed to 14.8% of the total catch in recent years (**Fig. 2**).

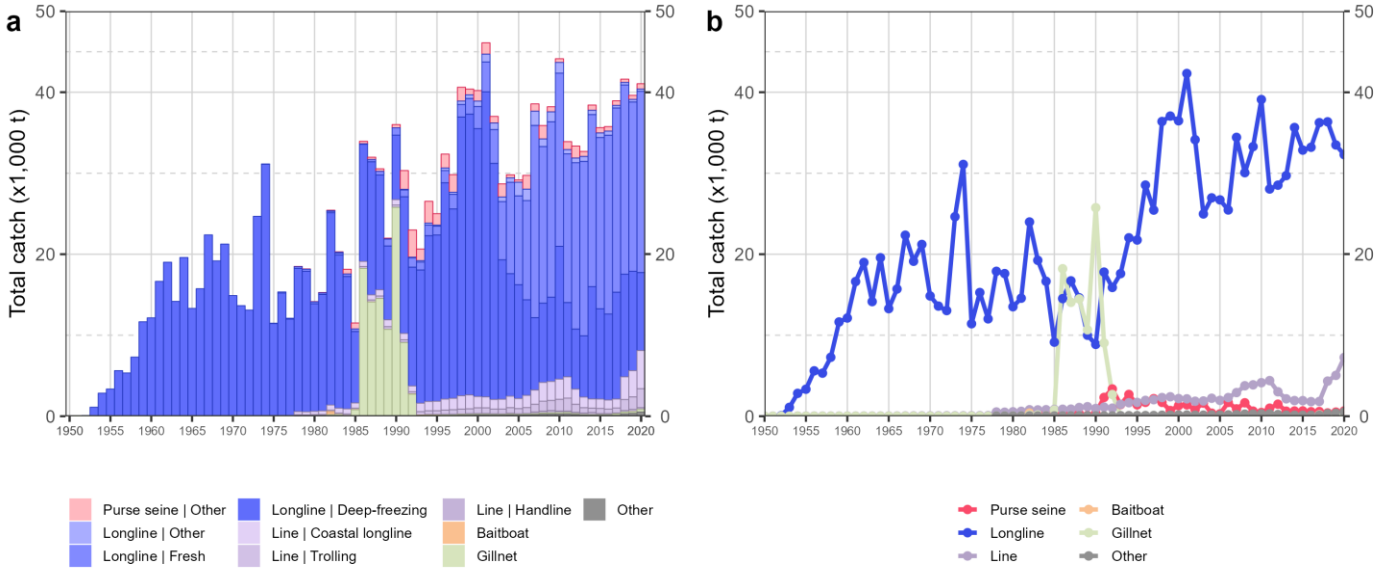


Figure 1: Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for albacore during 1950-2020

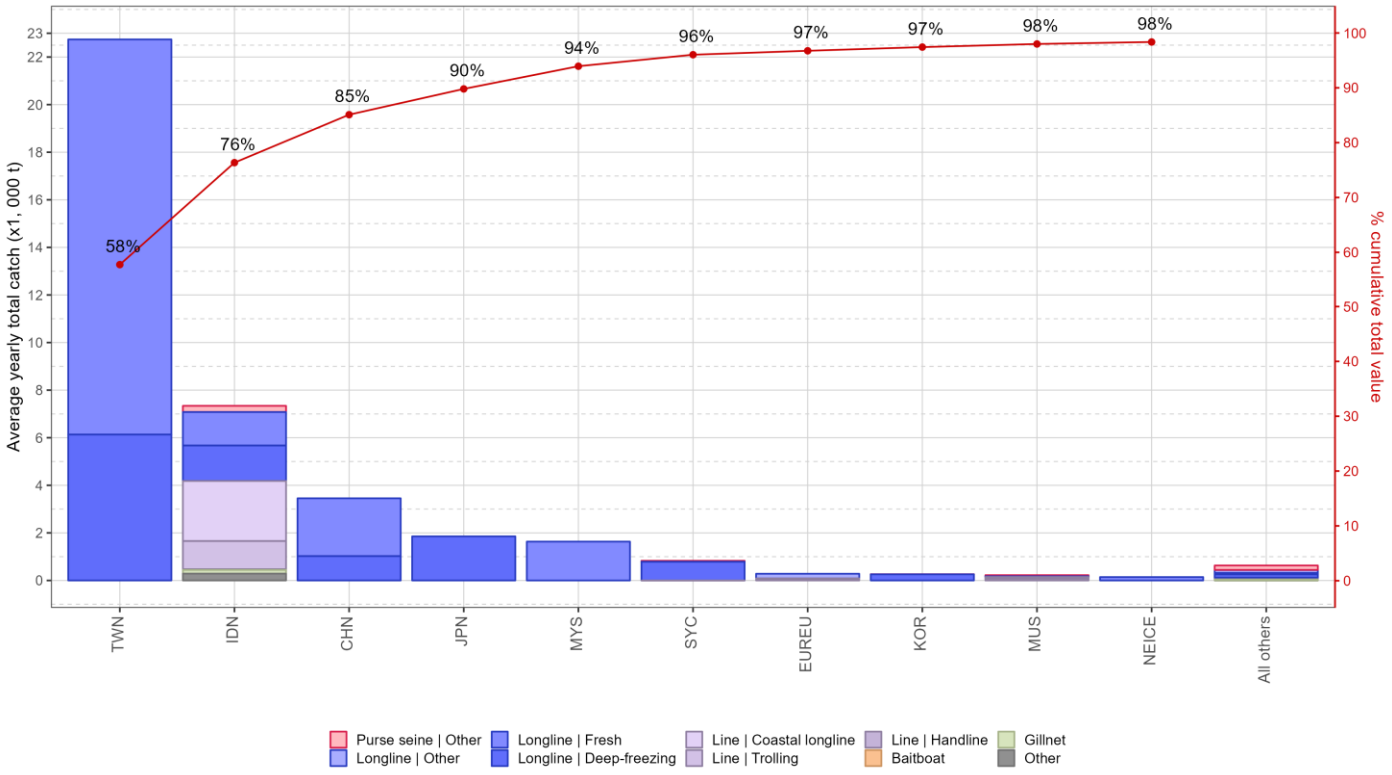


Figure 2: Mean annual catches (t) of albacore by fleet and fishery between 2016 and 2020, with indication of cumulative catches by fleet

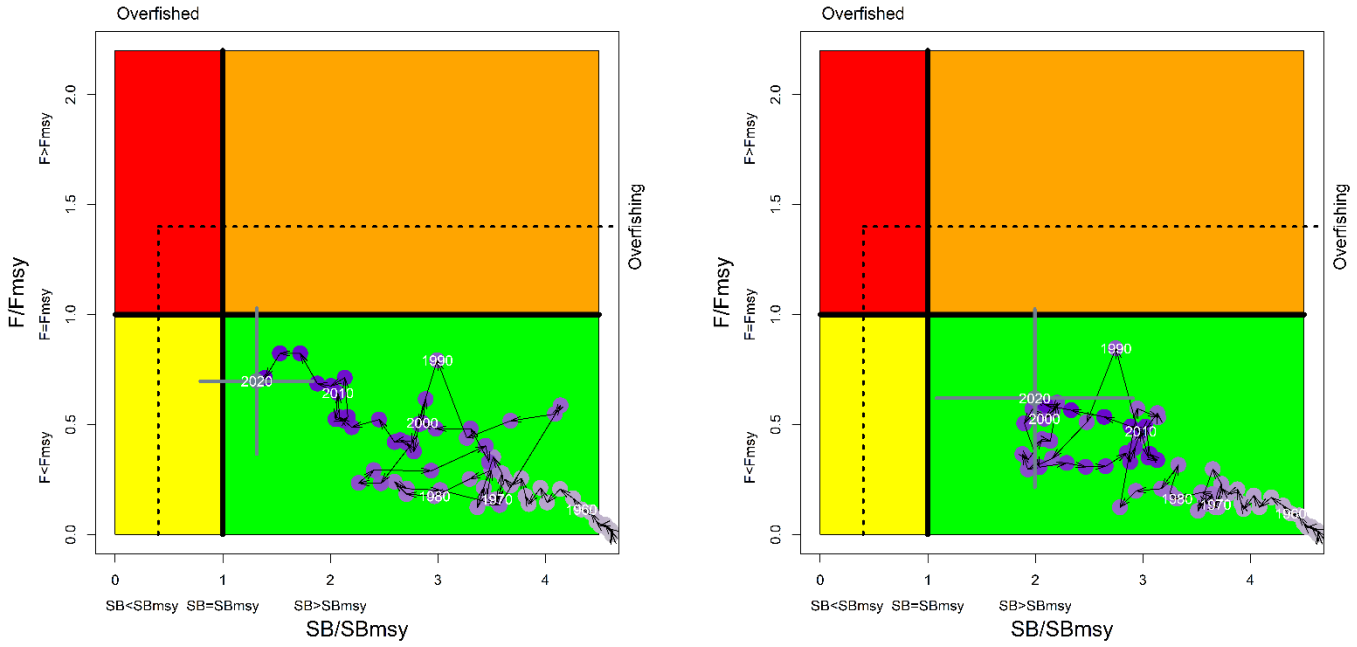


Fig. 3. Albacore: SS3 Indian Ocean assessment Kobe plot for the two model options considered: (i) Model fitted to the North-western CPUE; (ii) Model fitted to the South-western CPUE. Purple circles indicate the trajectory of the point estimates for the spawning biomass (SB) ratio and fishing mortality (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 (2022)

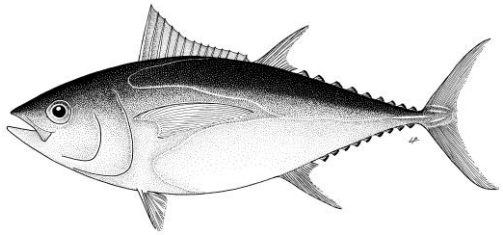


Table 1. Status of bigeye tuna (*Thunnus obesus*) in the Indian Ocean

Area[1]	Indicator	Value	Status[4]
Indian Ocean[1]	Catch in 2021 (t)[2]	94,803	79%*
	Average catch 2017-2021 (t)[3]	87,488	
	MSY (1,000 t) (80% CI)	96 (83 –108)	
	F_{MSY} (80% CI)	0.26 (0.18–0.34)	
	SB_{MSY} (1,000 t) (80% CI)	513 (332–694)	
	F_{2021} / F_{MSY} (80% CI)	1.43 (1.10–1.77)	
	SB_{2021} / SB_{MSY} (80% CI)	0.90 (0.75–1.05)	
	SB_{2021} / SB_0 (80% CI)	0.25 (0.23–0.27)	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2]Proportion of 2021 catch fully or partially estimated by IOTC Secretariat: 20.4%
[3]Including re-estimations of EU PS species composition for 2018 (only requested for stock assessment purposes)
[4]The stock status refers to the most recent years' data used in the assessment conducted in 2022, i.e., 2021
*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.

Colour key	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		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. In 2022 a new stock assessment was carried out for bigeye tuna in the IOTC area of competence to update the stock assessment undertaken in 2019. 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 in 2021 (**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 1**).
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) of bigeye tuna is 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 is 80,583t / year for the period 2024-2025. The recommended TAC is 15% below the 2021 catch.

The following key points should also be noted:

- **Main fisheries (mean annual catch 2017-2021)**: bigeye tuna are caught using purse seine (41.7%), followed by longline (37%) and line (13.5%). The remaining catches taken with other gears contributed to 7.8% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2017-2021)**: the majority of bigeye tuna catches are attributed to vessels flagged to Indonesia (23.7%) followed by Taiwan,China (15.4%) and Seychelles (15.3%). The 30 other fleets catching bigeye tuna contributed to 45.8% of the total catch in recent years (**Fig. 2**).

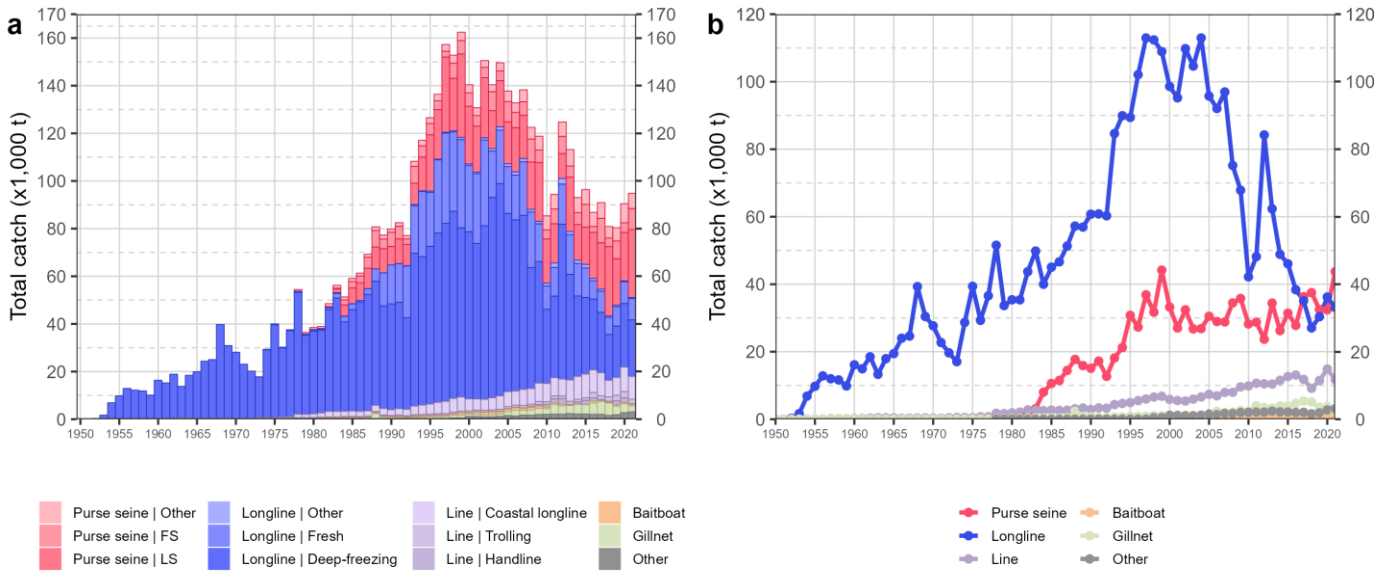


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tonnes; t) by fishery group and (b) individual nominal catches (metric tonnes; t) by fishery for bigeye tuna during 1950–2021. FS = free-swimming school; LS = schools associated with drifting floating objects; Purse seine | Other: coastal purse seine, purse seine of unknown school association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

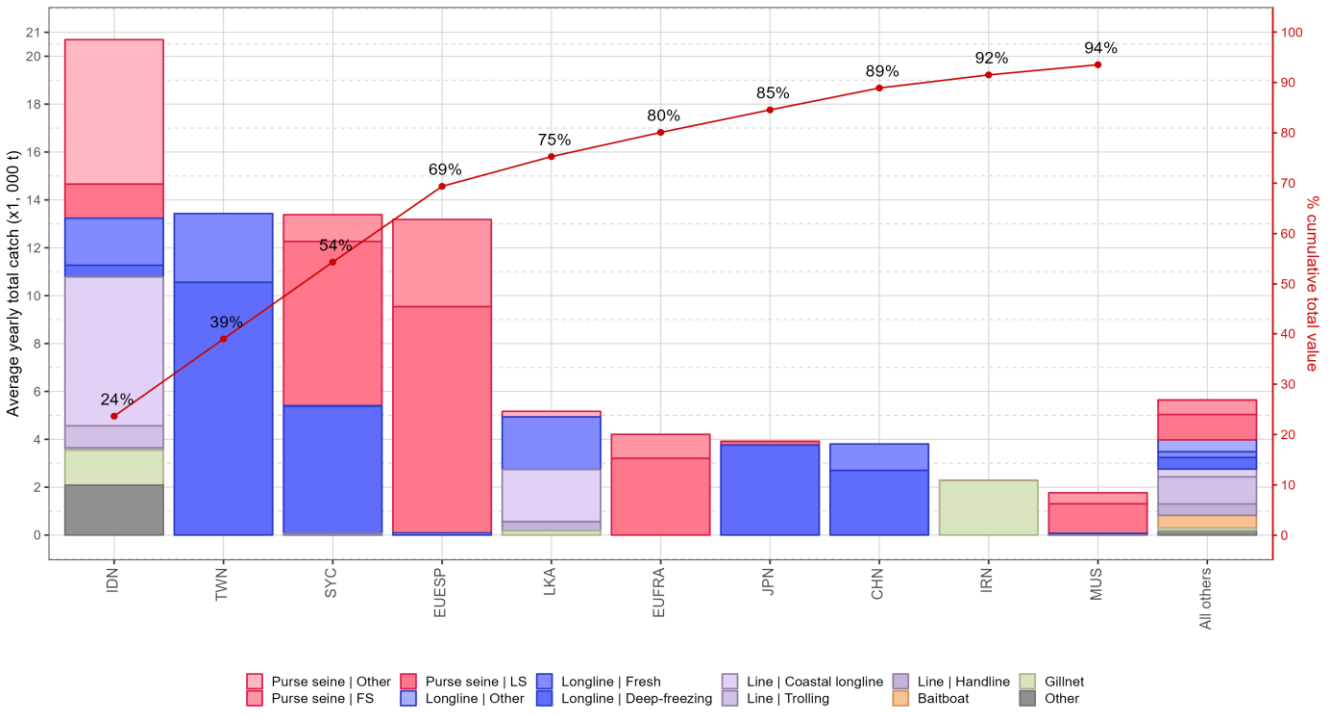


Fig. 2. Mean annual catches (metric tonnes; t) of bigeye tuna by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet. FS = free-swimming school; LS = school associated with drifting floating objects. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

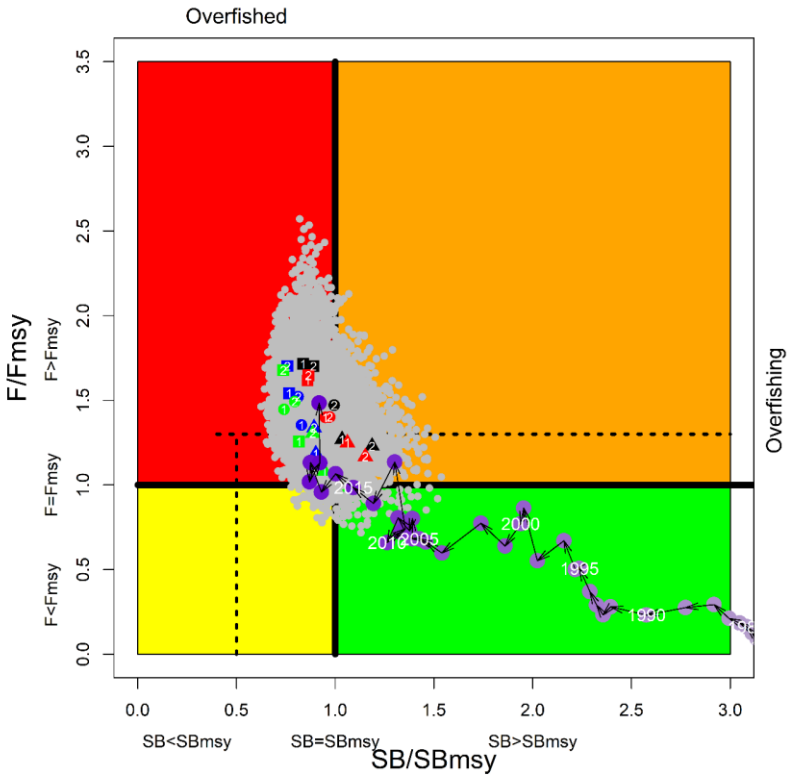


Fig. 3. Bigeye tuna: SS3 Aggregated Indian Ocean assessment Kobe plot. The coloured points represent stock status estimates from the 24 model options. Coloured symbols represent Maximum posterior density (MPD) estimates from individual models: square, circle, and Triangles represents alternative steepness 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 (2022)

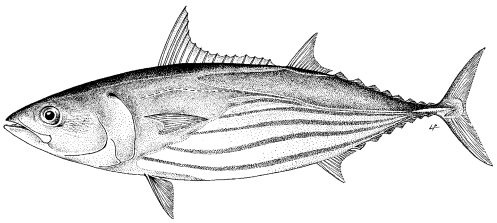


Table 1. Status of skipjack tuna (*Katsuwonus pelamis*) in the Indian Ocean

Area[1]	Indicator	Value	Status[3,4]
Indian Ocean	Catch in 2021 (t)[2]	650,331	60.4%*
	Average catch 2017-2021 (t)[3]	580,408	
	$C_{40\%SB0}$ (t) (80% CI)	535,964 (461,995–674,536)	
	C_{2019} / $C_{40\%SB0}$ (80% CI)	1.02 (0.81–1.18)	
	$E_{40\%SB0}$ [3] (80% CI)	0.59 (0.53–0.66)	
	E_{2019} / $E_{40\%SB0}$ (80% CI)	0.92 (0.67-1.21)	
	SB_0 (t) (80% CI)	1,992,089 (1,691,710–2,547,087)	
	SB_{2019} (t) (80% CI)	870,461 (660,411–1,253,181)	
	$SB_{40\%SB0}$ (t) (80% CI)	794,310 (672,825–1,019,056)	
	$SB_{20\%SB0}$ (t) (80% CI)	397,155 (336,412–509,528)	
	SB_{2019} / SB_0 (80% CI)	0.45 (0.38-0.5)	
	SB_{2019} / $SB_{40\%SB0}$ (80% CI)	1.11 (0.95-1.29)	
	SB_{2019} / SB_{MSY} (80% CI)	1.99 (1.47-2.63)	
	MSY (t) (80% CI)	601,088 (500,131–767,012)	
	E_{2019} / E_{MSY} (80% CI)	0.48 (0.35-0.81)	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2]Proportion of 2021 catch fully or partially estimated by IOTC Secretariat: 17.7%
[3]Including re-estimations of EU PS species composition for 2018 (only requested for stock assessment purposes)
[4]The status refers to the most recent years' data used in the assessment conducted in 2020, i.e., 2019
[5] $E_{40\%SB0}$ is the equilibrium annual exploitation rate (Etarg) associated with the stock at Btarg, and is a key control parameter in the skipjack harvest control rule as stipulated in Resolution 16/02. Note that Resolution 16/02 did not specify the exploitation rate associated with the stock at Blim
*Estimated probability that the stock is in the respective quadrant of the Kobe plot (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

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was conducted in 2022 and so the advice is based on the 2020 assessment using Stock Synthesis with data up to 2019. The outcome of the 2020 stock assessment model does not differ substantially from the previous assessment (2017) despite the large catches recorded in the period 2018-2019, which exceeded the catch limits established in 2017 for this period.

The final overall estimate of stock status indicates that the stock is above the adopted target for this stock and that the current exploitation rate is just below the target. Also, the models estimate that the spawning biomass remains above its SB_{MSY} and the fishing mortality remains below E_{MSY} with very high probability. Over the history of the fishery, biomass has been well above the adopted limit reference point ($0.2*SB_0$). The recent catches have been within the range of estimated target yield (see $C_{40\%SB0}$). Current spawning biomass relative to unexploited levels is estimated at 45% (**Table 1**). Thus, on the weight-of-evidence available in 2020, the skipjack tuna stock is determined to be: (i) above the adopted biomass target reference point; (ii) **not overfished** ($SB_{2019}>SB_{40\%SB0}$); (iii) with fishing mortality below the adopted target fishing mortality, and (iv) **not subject to overfishing** ($E_{2019}<E_{40\%SB0}$) (**Table 2**).

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

Management advice. The catch limit calculated applying the HCR specified in Resolution 16/02 is 513,572 t for the period 2021-2023. Total catches in 2021 were 27% higher than the resulting catch limit. The SC noted that this catch limit is higher than for the previous period. This is attributed to the new stock assessment which estimates a higher productivity of the stock and a higher stock level relative to the target reference point, possibly due to skipjack life history characteristics and favourable environmental conditions. Thus, it is likely that the recent catches that have exceeded the limits established for the period 2018-2020 have been sustained by favourable environmental conditions. The catch in 2021 (650,331t) exceeded the 2020 level by 17% and provides a need for the Commission to ensure that catches of skipjack tuna do not exceed the agreed limit and ensuring that the impact on associated tuna stocks (bigeye and yellowfin tuna) is reduced.

The following key points should also be noted:

- **Reference points**: Commission in 2016 agreed to Resolution 16/02 on *harvest control rules for skipjack tuna in the IOTC area of competence*.
- **Biomass**: Spawning biomass in 2019 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 2017-2021)**: skipjack tuna are caught using purse seine (54.4%), followed by baitboat (19%) and gillnet (17.8%). The remaining catches taken with other gears contributed to 8.8% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2017-2021)**: the majority of skipjack tuna catches are attributed to vessels flagged to Indonesia (18.4%) followed by EU (Spain) (17.8%) and Maldives (17.2%). The 31 other fleets catching skipjack tuna contributed to 46.3% of the total catch in recent years (**Fig. 2**).

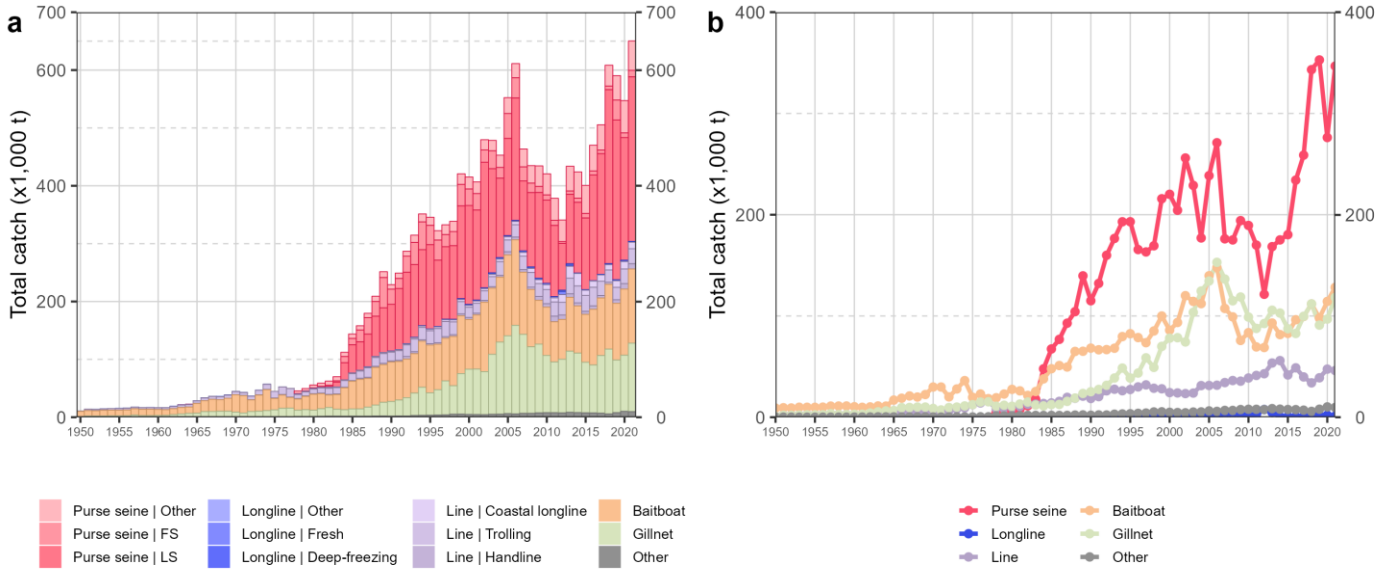


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tonnes; t) by fishery and (b) individual nominal catches (metric tonnes; t) by fishery group for skipjack tuna during 1950–2021. FS = free-swimming schools; LS = schools associated with drifting floating objects. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

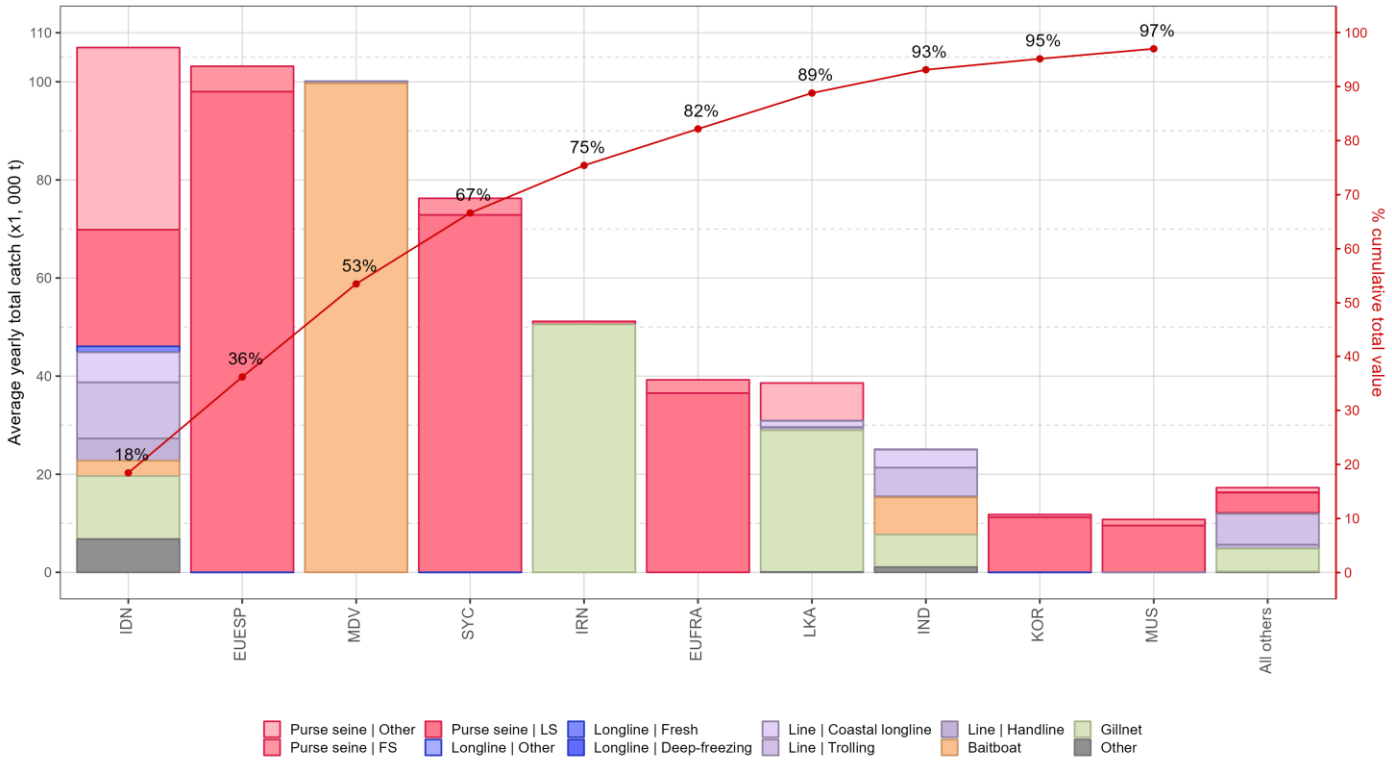


Fig. 2. Mean annual catches (metric tonnes; t) of skipjack tuna by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet. FS = free-swimming schools; LS = schools associated with drifting floating objects. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

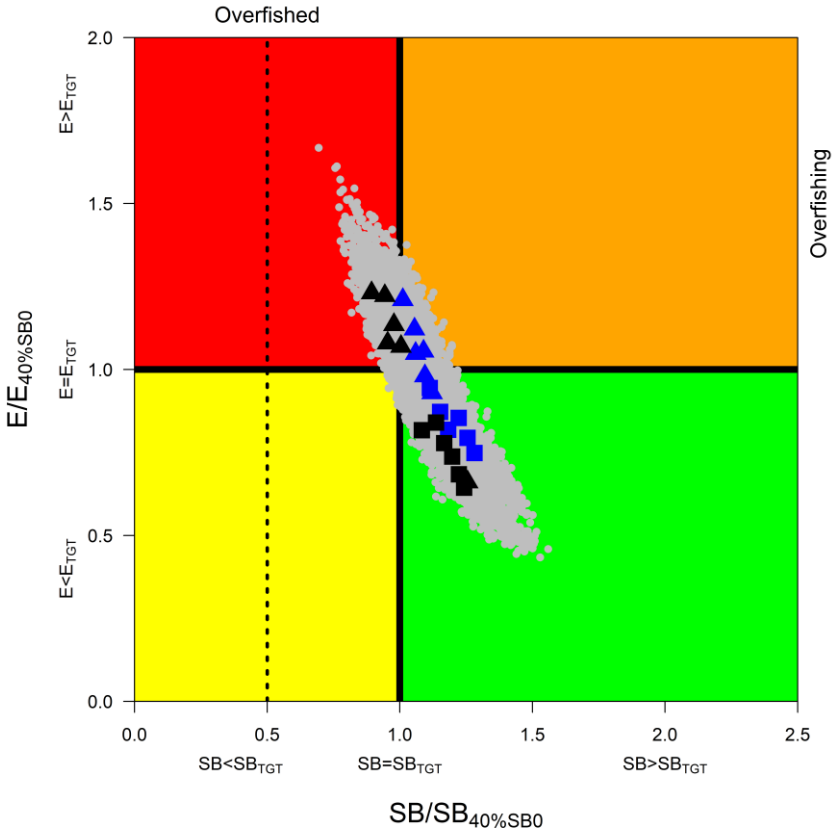


Fig. 3. Skipjack tuna: SS3 Aggregated Indian Ocean assessment Kobe plot of the 2020 uncertainty grid. Symbols represent Maximum posterior density (MPD) estimates of current stock status relative to $SB_{40\%SB0}$ (x-axis) and $E_{40\%SB0}$ (y-axis) for the individual models (blue, no effort creep; black, additional effort creep; triangle, full weighting of tagging data; square, tagging data downweighted). Grey dots represent uncertainty from individual models. The vertical dashed line represents the limit reference point for Indian Ocean skipjack tuna (SB_{lim} = 20%SB_0)

APPENDIX 11
EXECUTIVE SUMMARY: YELLOWFIN TUNA (2022)

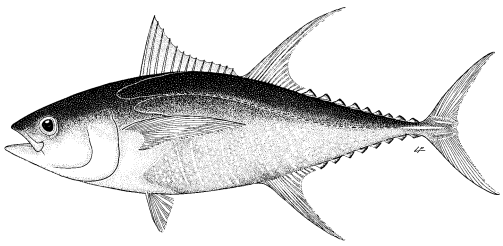


Table 1. Status of yellowfin tuna (*Thunnus albacares*) in the Indian Ocean

Area[1]	Indicator	Value	Status[4]
Indian Ocean	Catch in 2021 (t)[2]	416,235	68%*
	Average catch 2017-2021 (t)[3]	435,225	
	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 2021 catch fully or partially estimated by IOTC Secretariat: 18%
[3]Including re-estimations of EU PS species composition for 2018 (only requested for stock assessment purposes)
[4]The stock status refers to the most recent years' data used in the assessment conducted in 2021, i.e., 2020

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

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		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was carried out for yellowfin tuna in 2022 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.

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 60% of 2020 levels[25] there is >50% probability of being above SB_{MSY} levels by 2023.
- 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 2023 and also by 2030.
- The probability of breaching the biological limit reference point ($0.4SB_{MSY}$) with 2020 catches is 7% by 2023 and 64% by 2030. The probability of breaching the F limit reference point ($1.4\ F_{MSY}$) with 2020 catch is 52% by 2023 and 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.

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 2017-2021 average catches (435,225 t) were above the estimated MSY level.

[25] 2020 catch levels indicate the nominal catch available to the WPTT at its session in October 2021 (WPTT23).

Although catch in 2021 reduced by 3% 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 2017-2021)**: yellowfin tuna are caught using line (35.4%), followed by purse seine (33.6%) and gillnet (18.3%). The remaining catches taken with other gears contributed to 12.7% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2017-2021)**: the majority of yellowfin tuna catches are attributed to vessels flagged to I. R. Iran (12.2%) followed by EU (Spain) (11.3%) and Sultanate of Oman (10.4%). The 35 other fleets catching yellowfin tuna contributed to 66.1% 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

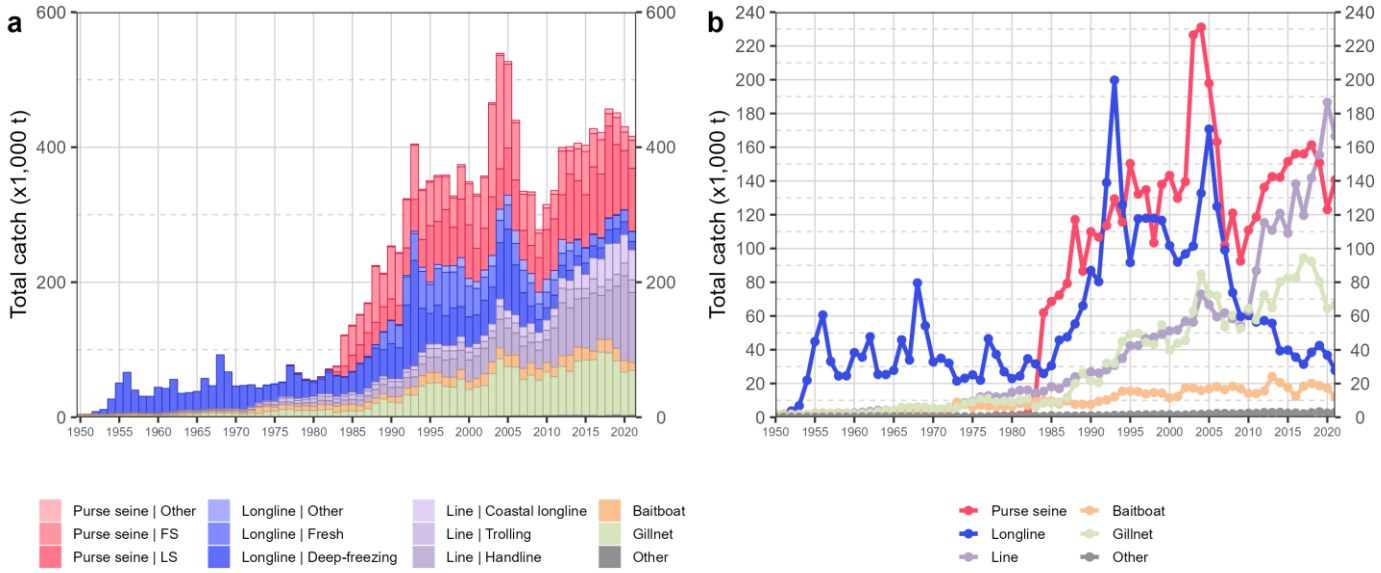


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tonnes; t) by fishery and (b) individual nominal catches (metric tonnes; t) by fishery group for yellowfin tuna during 1950–2021. FS = free-swimming school; LS = school associated with drifting floating objects. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

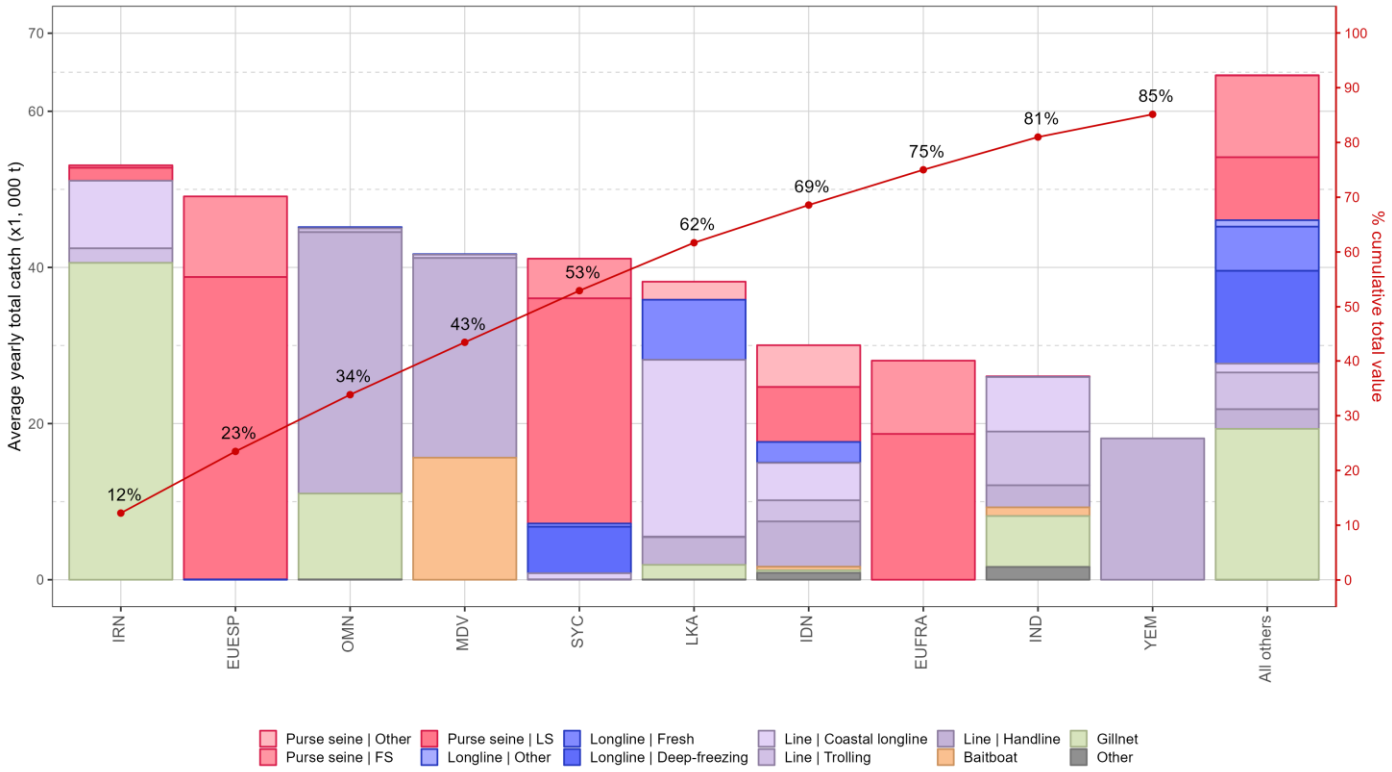


Fig. 2. Mean annual catches (metric tonnes; t) of yellowfin tuna by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet. FS = free-swimming school; LS = school associated with drifting floating objects. Purse seine | Other: coastal purse seine, purse seine of unknown association type, ring net; Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

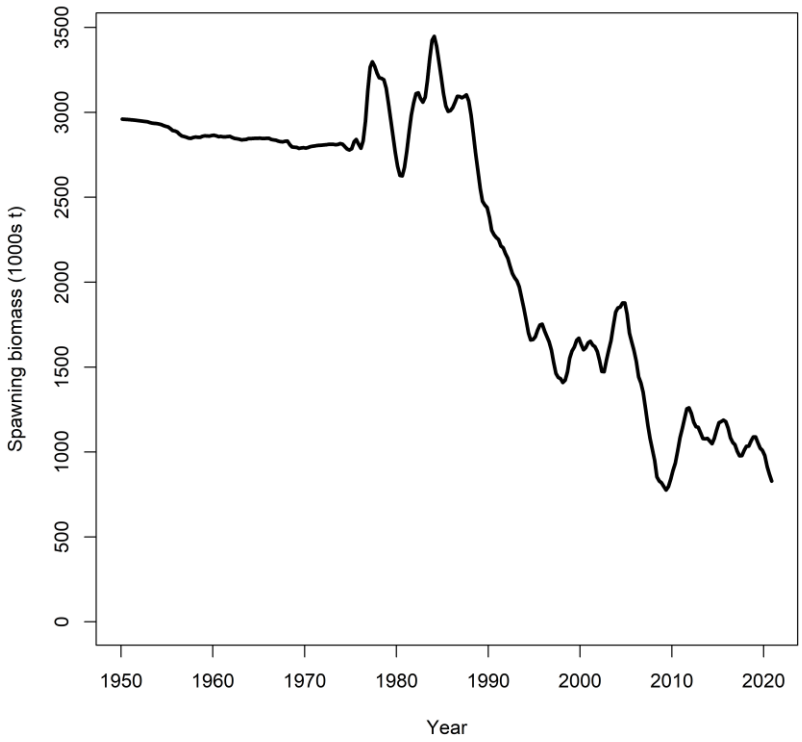


Fig 3. Estimated time series (1950-2020) of total spawning biomass of yellowfin tuna (left) from the reference model of the 2020 assessment.

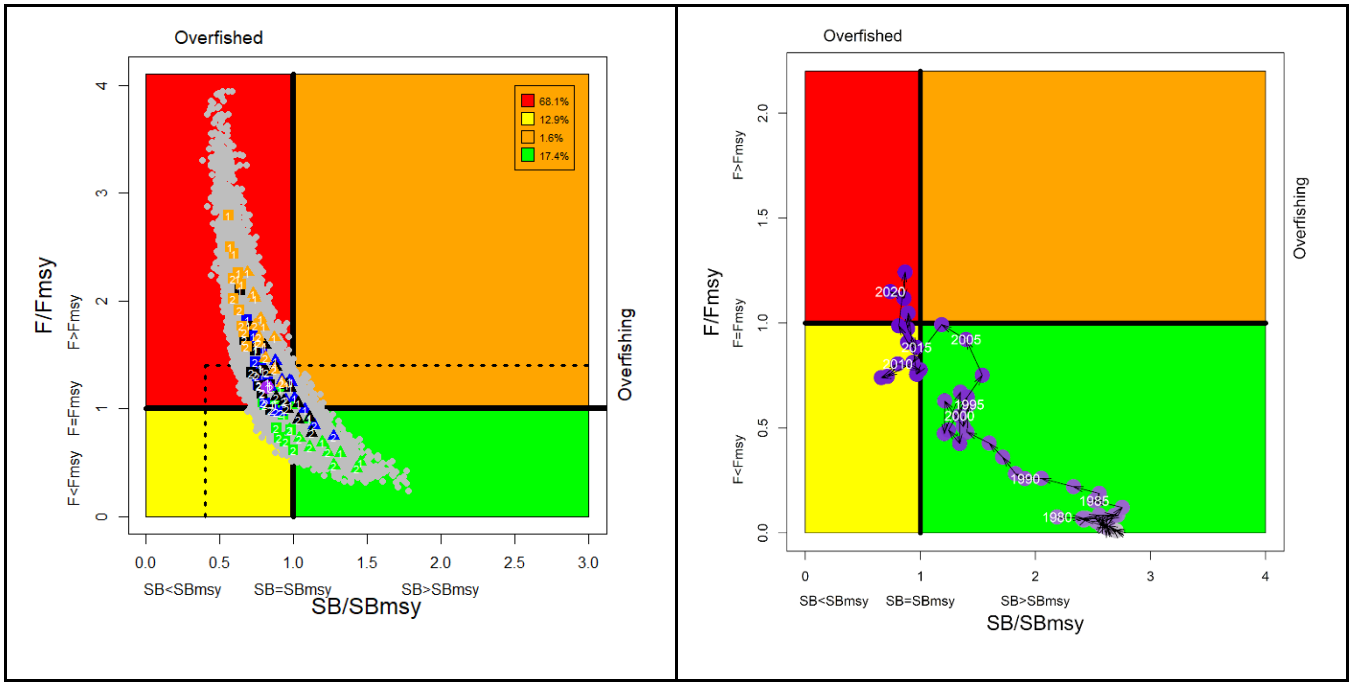


Fig. 4. Yellowfin tuna: SS3 Indian Ocean assessment Kobe plot: (left): current (2020) stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the final model options. Coloured symbols represent Maximum posterior density (MPD) estimates from individual models: square and 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

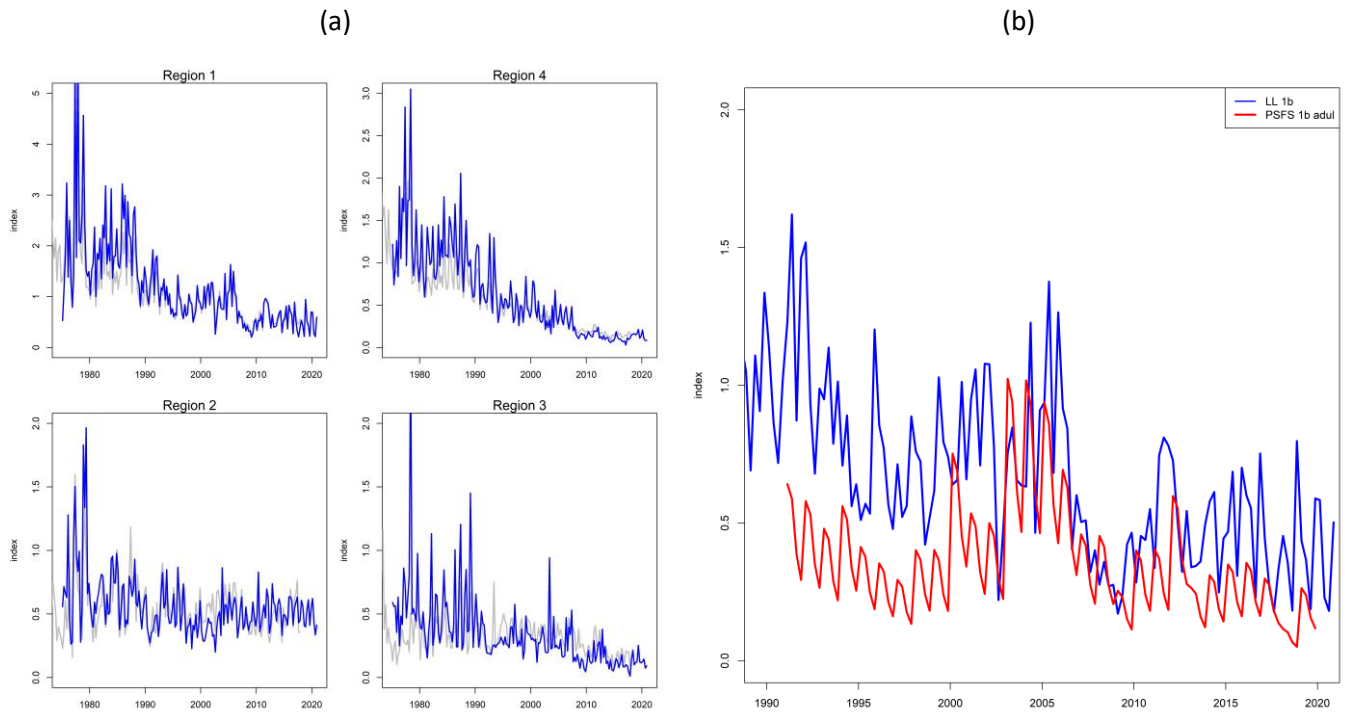


Fig 5. Standardised CPUE indices used in the final assessment models: (a) Joint longline CPUE indices by region 1975-2020 (The grey lines are indices used in 2018 assessment 1972 – 2017), and (b) EU Purse seine free school CPUE on adults (≥10 kg) (overlaid with the longline CPUE in region 1

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: SWORDFISH (2022)

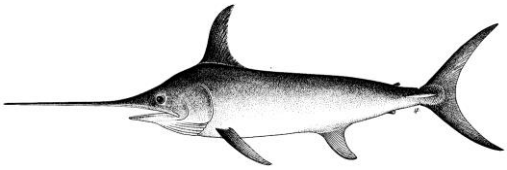


TABLE 1. Status of swordfish (*Xiphias gladius*) in the Indian Ocean

Area[1]	Indicators		2022 stock status determination
Indian Ocean	Catch 2021[2] (t) Average catch 2017-2021 (t)	23,917 31,157	**98%**
	MSY (1,000 t) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 t) (80% CI) F_{2018}/F_{MSY} (80% CI) SB_{2018}/SB_{MSY} (80% CI) SB_{2018}/SB_{1950} (80% CI)	33 (27–40) 0.23 (0.15–0.31) 59 (41–77) 0.60 (0.40–0.83) 1.75 (1.28–2.35) 0.42 (0.36–0.47)	

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence
[2] Proportion of 2020 catch estimated or partially estimated by IOTC Secretariat: 21.02%

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. An assessment was undertaken in 2020 using stock synthesis with fisheries data up to 2018. The assessment uses a spatially disaggregated, sex explicit and age structured model. The SS3 model, used for stock status advice, indicated that MSY-based reference points were not exceeded for the Indian Ocean population as a whole ($F_{2018}/F_{MSY}< 1$; $SB_{2018}/SB_{MSY}> 1$). The two alternative models (ASPIC and JABBA) applied to swordfish also indicated that the stock was above a biomass level that would produce MSY. Spawning biomass in 2018 was estimated to be 40-83% of the unfished levels. Most recent catches of 33,590 t in 2019 are approximately at the *MSY* level (33,000 t). On the weight-of-evidence available in 2020, the stock is determined to be ***not overfished*** and ***not subject to overfishing*** (**Table 1**, **Fig. 3**).

Outlook. The decrease in longline catch and effort from 2005 to 2011 lowered the pressure on the Indian Ocean stock as a whole, and despite the recent increase in total recorded catches, current fishing mortality is not expected to reduce the population to an overfished state over the next decade. There is a very low risk of exceeding MSY-based reference points by 2028 if catches are maintained at 2018 levels (<5% risk that $SB_{2028}< SB_{MSY}$, and <10% risk that $F_{2028}> F_{MSY}$) (**Table 1**). However, the Southern regions exhibit declining biomass trends which indicate higher depletion in these regions, compared to northern regions.

***Management advice*.** The 2019 catches (33,590 t at the time of the assessment) were close to the MSY level (33,000 t). Under those levels of catches, the spawning biomass was projected to remain relatively stable, with a high probability of maintaining at or above the SB_{MSY} for the longer term. It is noted that 2021 catches (23,917 t) are significantly lower than MSY. Nevertheless, the Commission should consider limiting the catches so as not to exceed the 2018 catch level (31,018 t) to ensure that the probability of exceeding the SB_{MSY} target reference points in the long term remains minimal (2%). Projections indicate that an increase of 40% or more from 2018 catch levels will likely result in the biomass dropping below the SB_{MSY} level for the longer term (>75% probability). Taking into account the updated information regarding swordfish stock structure (IOTC-2020-WPB18-09), as well as the

differential CPUE and biomass trends between regions, the WPB should continue to discuss the swordfish stock assessment model specifications and consider the feasibility of including a multi-stock assessment in 2023. Recognising that there is recurring evidence for localised depletion in the southern regions (particularly the South West) the WPB expresses concern and suggests this should be further monitored.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the Indian Ocean is 33,000 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 2017-2021)**: swordfish are caught using longline (53.9%), followed by line (30.2%) and gillnet (14.9%). The remaining catches taken with other gears contributed to 1% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2017-2021)**: the majority of swordfish catches are attributed to vessels flagged to Sri Lanka (29.2%) followed by Taiwan,China (17.9%) and EU (Spain) (6.5%). The 25 other fleets catching swordfish contributed to 46.4% of the total catch in recent years (**Fig. 2**).

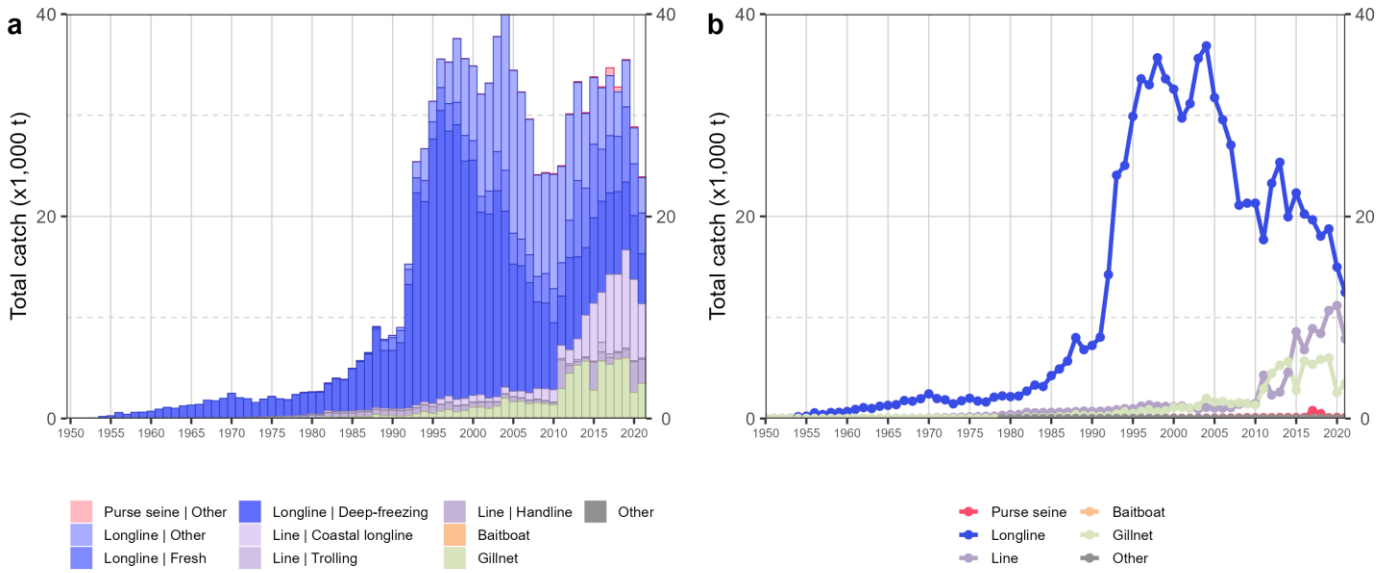


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tons; t) by fishery and (b) individual nominal catches (metric tons; t) by fishery group for swordfish during 1950–2021. Longline|Other: swordfish and sharks-targeting longlines; Other: all remaining fishing gears

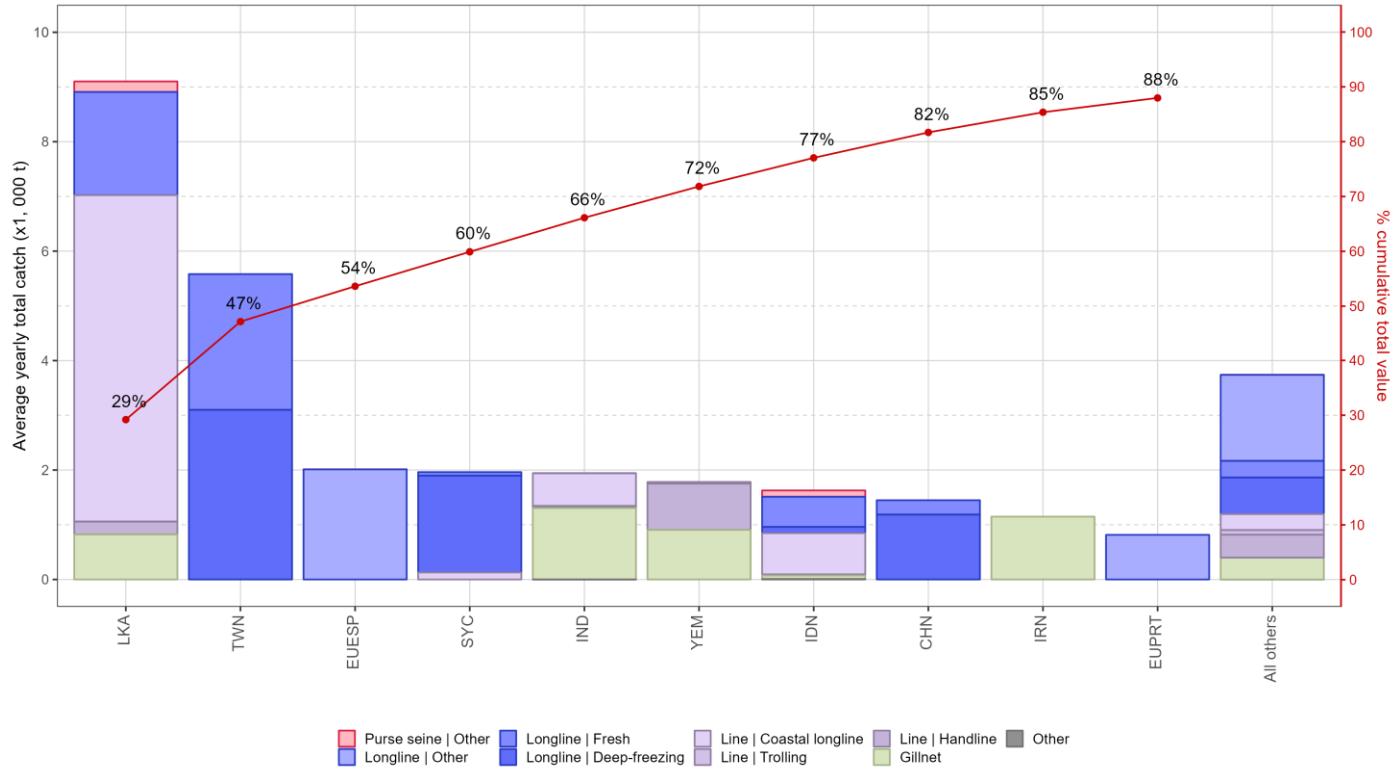


Fig. 2. Mean annual catches (metric tons; t) of swordfish by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

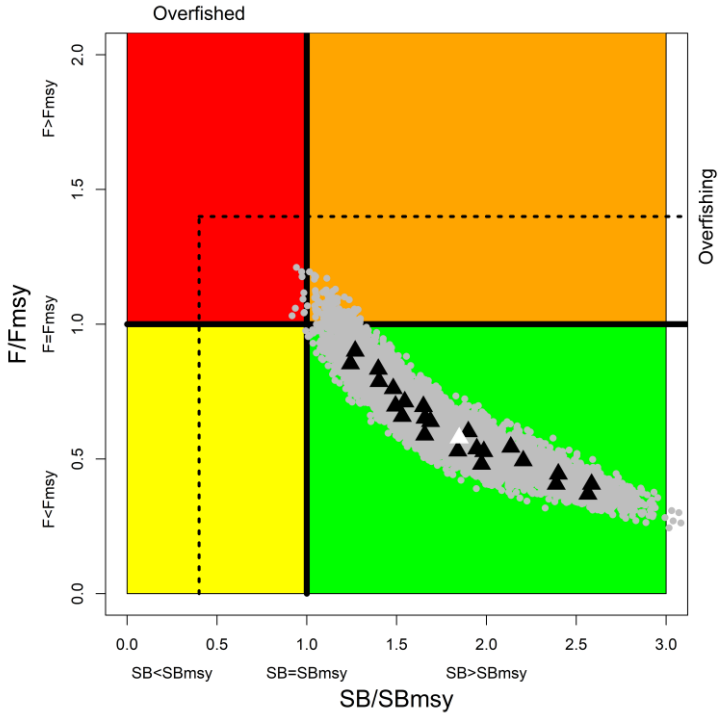


Fig. 3. Swordfish: 2018 stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points for the final model grid. Triangles represent MPD estimates from individual models (white triangle represent the estimate from the basic model). Grey dots represent uncertainty from individual models. The dashed lines represent limit reference points for Indian Ocean swordfish (SB_{lim} = 0.4 SB_{MSY} and F_{lim} = 1.4*FMSY)

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

Pr (SB<SB_{MSY})

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

Pr (F>F_{MSY})

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

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

APPENDIX 13
EXECUTIVE SUMMARY: BLACK MARLIN (2022)

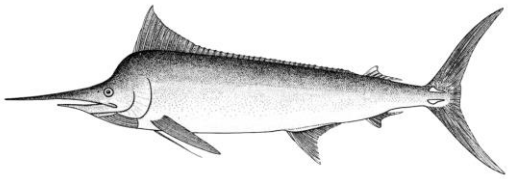


TABLE 1. Status of black marlin (*Istiompax indica*) in the Indian Ocean

Area[1]	Indicators		2022 stock status determination
Indian Ocean	Catch 2021 (t)[2]	14,115	
	Average catch 2017–2021 (t)	16,864	
	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 2021 catch fully or partially estimated by the IOTC Secretariat: 19.52%

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A stock assessment based on JABBA, a Bayesian state-space production model (age-aggregated), was conducted in 2021 for black marlin (using data up to 2019). The relative point estimates for this assessment are F/F_{MSY}=0.53 (0.22-1.05) and B/B_{MSY}=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 two 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 2017-2021): black marlin are caught using gillnet (59.7%), followed by line (28.3%) and longline (8%). The remaining catches taken with other gears contributed to 4% of the total catches in recent years (**Fig. 1**).
- **Main fleets** (mean annual catch 2017-2021): the majority of black marlin catches are attributed to vessels flagged to I. R. Iran (39.4%) followed by India (19.7%) and Sri Lanka (16.6%). The 24 other fleets catching black marlin contributed to 24% of the total catch in recent years (**Fig. 2**).

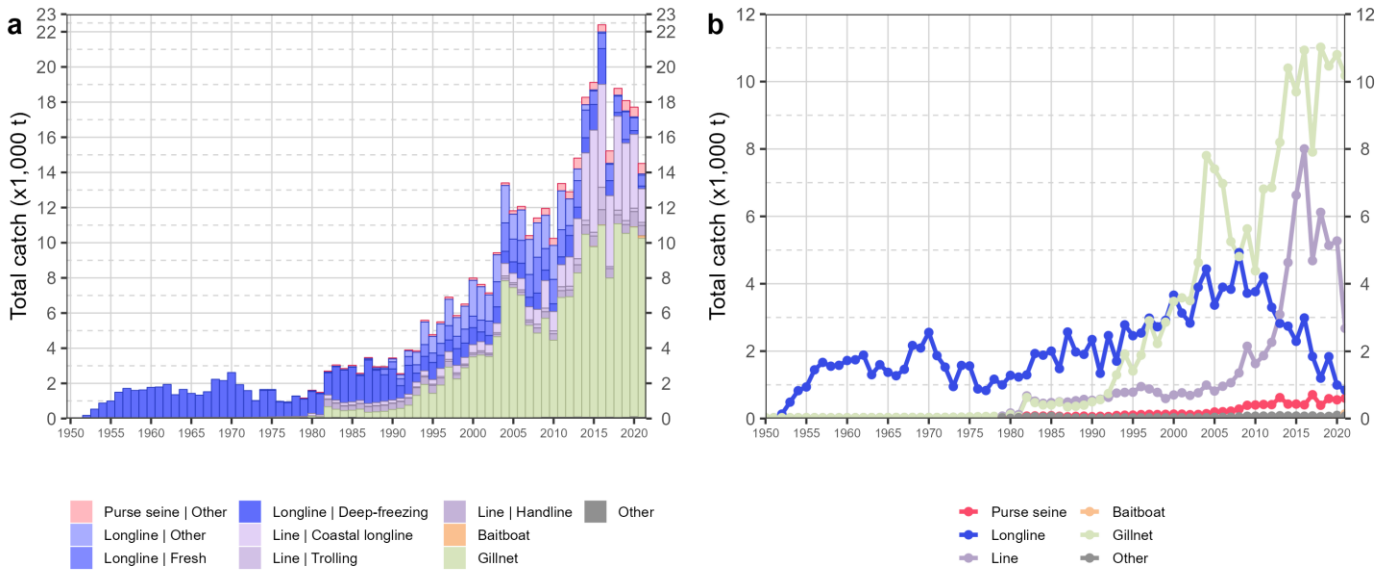


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tons; t) by fishery and (b) individual nominal catches (metric tons; t) by fishery group for black marlin during 1950-2021. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

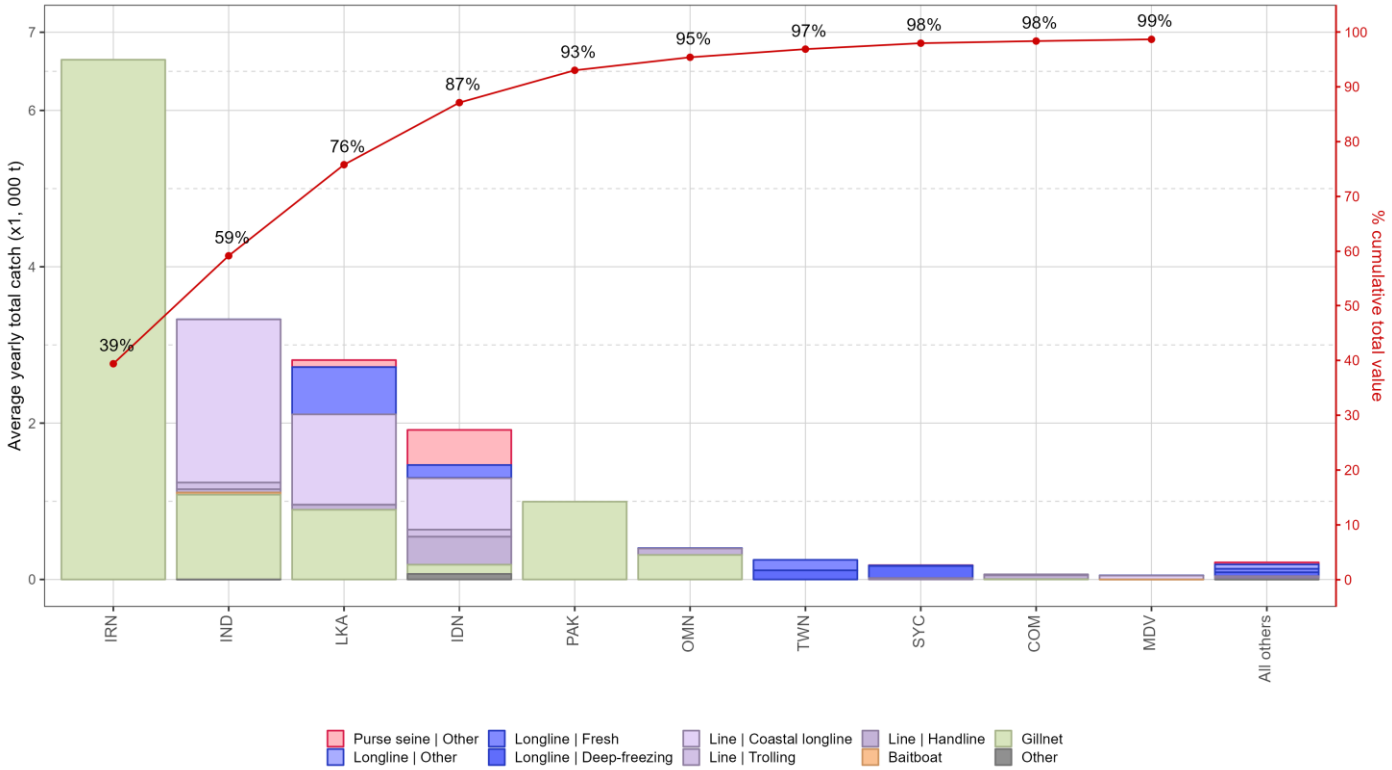


Fig. 2. Mean annual catches (metric tons; t) of black marlin by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

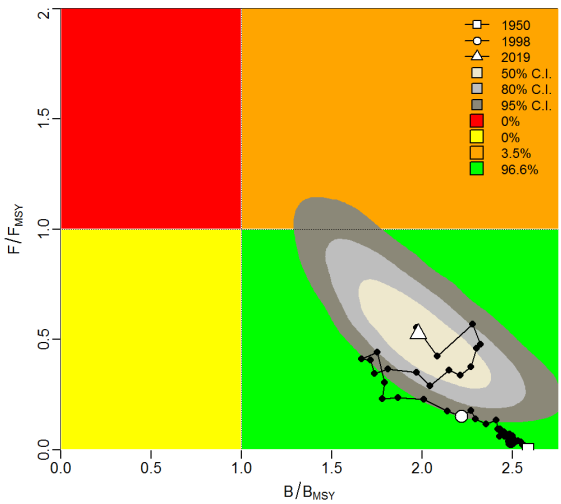


Fig. 2. JABBA Indian Ocean assessment Kobe plots for black marlin (contours are the 50, 80 and 95 percentiles of the 2019 estimate). Black line indicates the trajectory of the point estimates for the total biomass ratio (B/B_{MSY}) and fishing mortality ratio (F/F_{MSY}) for each year 1950–2019.

APPENDIX 14
EXECUTIVE SUMMARY: BLUE MARLIN (2022)

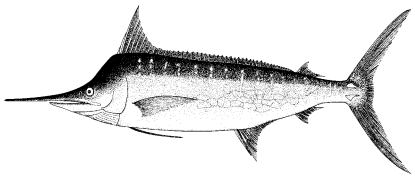


Table 1. Status of blue marlin (*Makaira nigricans*) in the Indian Ocean

Area[1]	Indicators		2022 stock status determination
Indian Ocean	Catch 2021[2] (t)	5,772	72%*
	Average catch 2017-2021 (t)	7,964	
	MSY (1,000 t) (80% CI)	8.74 (7.14 –10.72)	
	F_{MSY} (80% CI)	0.24 (0.14 – 0.39)	
	B_{MSY} (1,000 t) (80% CI)	35.8 (22.9 – 60.3)	
	F_{2020}/F_{MSY} (80% CI)	1.13 (0.75 – 1.69)	
	B_{2020}/B_{MSY} (80% CI)	0.73 (0.51 – 0.99)	
	B_{2020}/B_0 (80% CI)	0.36 (0.26 – 0.50)	

[1] Boundaries for the Indian Ocean are defined as the IOTC area of competence
[2] Proportion of 2021 catch estimated or partially estimated by IOTC Secretariat: 11.67%
* 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)	72%	0%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	26%	2%
Not assessed/Uncertain		

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. In 2022 a stock assessment was conducted 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 7,964 t in the last 5 years, 2017-2021) are lower than MSY (8,740 t). The stock is currently overfished and subject to overfishing. In order to achieve the Commission objectives of being in the green zone of the Kobe Plot by 2027 ($F_{2027} < F_{MSY}$ and $B_{2027} > B_{MSY}$) with at least a 60% chance, the catches of blue marlin would have to be reduced by 20% compared to 2020 catch (7,126 t), to a maximum value of approximately 5,700 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 2017-2021)**: blue marlin are caught using longline (53.4%), followed by line (22.9%) and gillnet (20.7%). The remaining catches taken with other gears contributed to 3.1% of the total catches in recent years (**Fig. 1**).
- **Main fleets (mean annual catch 2017-2021)**: the majority of blue marlin catches are attributed to vessels flagged to Taiwan,China (29%) followed by Sri Lanka (26.5%) and India (13.6%). The 21 other fleets catching blue marlin contributed to 30.9% of the total catch in recent years (**Fig. 2**).

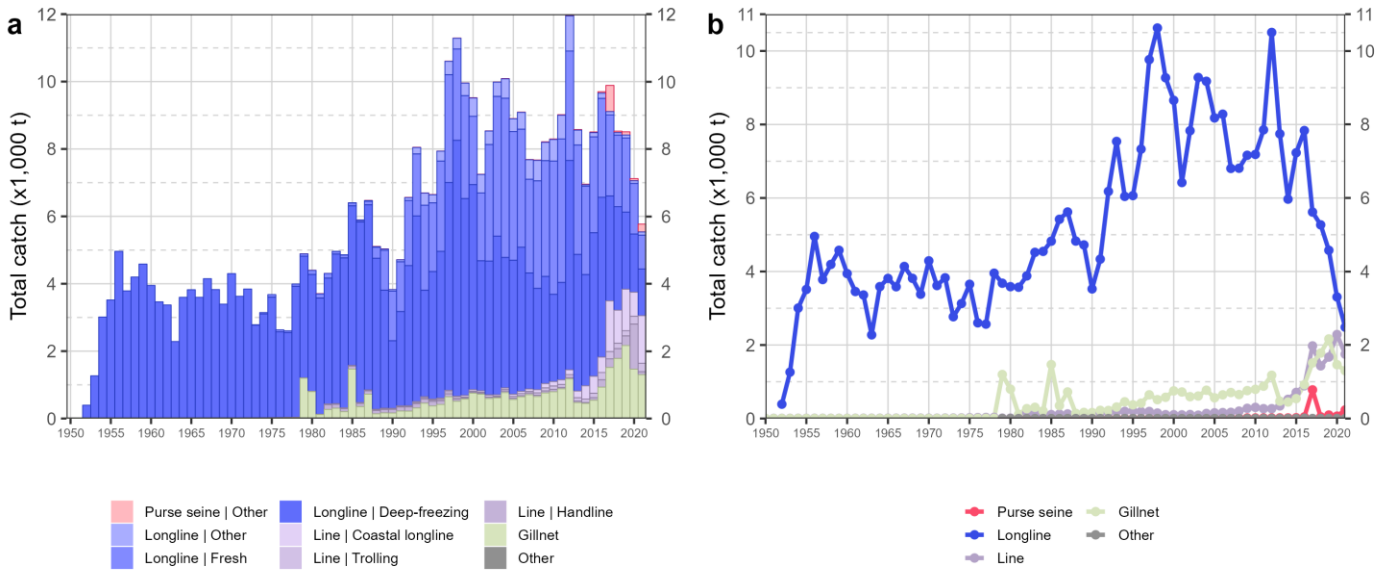


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tons; t) by fishery and (b) individual nominal catches (metric tons; t) by fishery group for blue marlin during 1950-2021. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

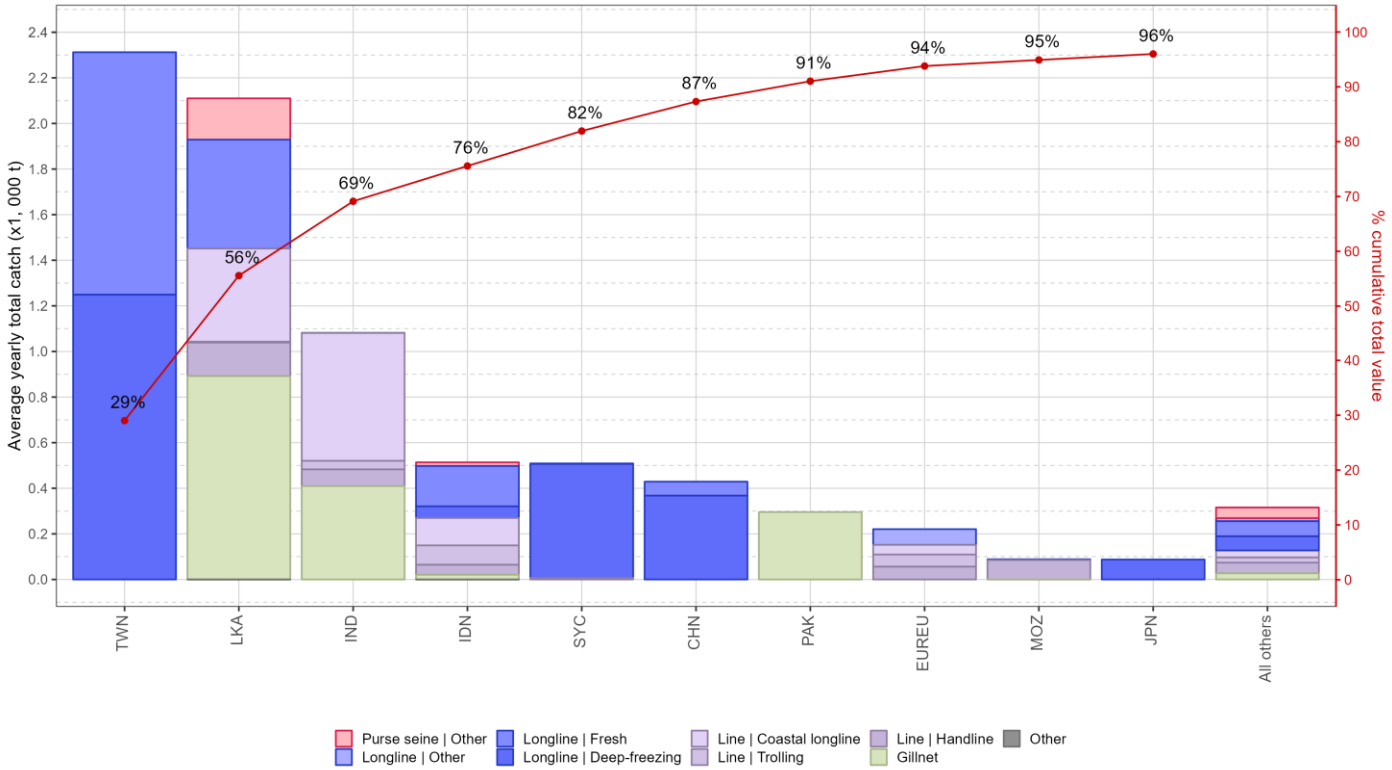


Fig. 2. Mean annual catches (metric tons; t) of blue marlin by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

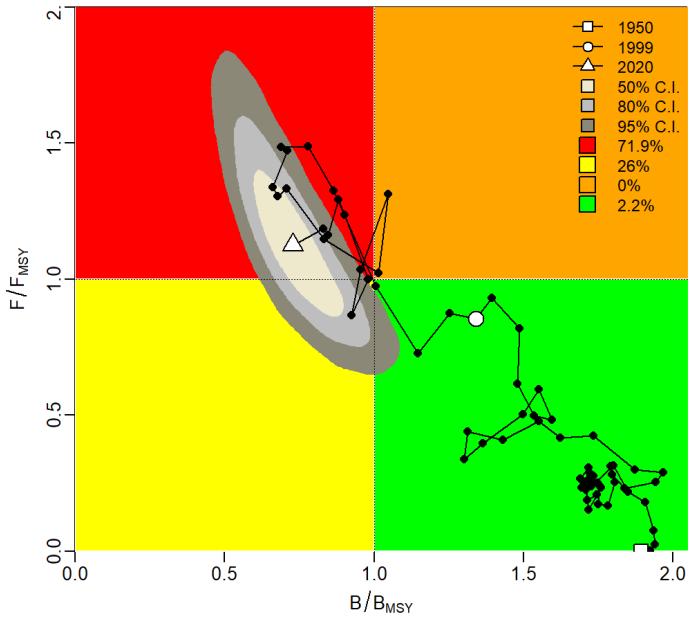


Fig. 3. Kobe stock status plot for the Indian Ocean stock of blue marlin, from the final JABBA base case (the black line traces the trajectory of the stock over time). Contours represent the smoothed probability distribution for 2020 (isopleths are probability relative to the maximum).

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)

Probability $F<=F_{MSY}$ and $B>=B_{MSY}$								
TAC (t)	2023	2024	2025	2026	2027	2028	2029	2030
2137 (30%)	65%	81%	90%	94%	96%	98%	99%	99%
2850 (40%)	59%	76%	85%	91%	94%	96%	97%	98%
3563 (50%)	54%	70%	80%	87%	90%	93%	95%	96%
4275 (60%)	48%	63%	73%	80%	86%	89%	91%	93%
4998 (70%)	42%	55%	65%	72%	78%	82%	85%	88%
5700 (80%)	36%	47%	56%	63%	69%	73%	77%	79%
6413 (90%)	30%	40%	46%	53%	57%	61%	65%	67%
7126 (100%)	25%	32%	37%	41%	45%	48%	51%	53%
7838 (110%)	21%	24%	28%	31%	33%	35%	37%	38%

APPENDIX 15
EXECUTIVE SUMMARY: STRIPED MARLIN (2022)

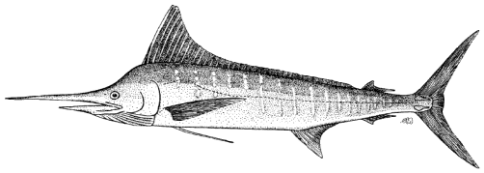


Table 1. Status of striped marlin (*Kajikia audax*) in the Indian Ocean

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

Area[1]	Indicators		2022 stock status determination
Indian Ocean	Catch 2021[2] (t)	2,696	100%*
	Average catch 2017-2021 (t)	2,946	
	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 2021 catch estimated or partially estimated by IOTC Secretariat: 49.44%
[3] JABBA estimates are the range of central values shown in Fig. 2
[4] SS3 is the only model that used SB/SB_{MSY}, all others used B/B_{MSY}
* Estimated probability that the stock is in the respective quadrant of the Kobe plot (shown below), derived from the confidence intervals associated with the current stock status

Colour key	Stock overfished (B_{year}/B_{MSY}< 1)	Stock not overfished (B_{year}/B_{MSY}≥ 1)
Stock subject to overfishing (F_{year}/F_{MSY}> 1)	100%	0.0%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	0.0%	0.0%
Not assessed/Uncertain		

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. In 2021 a stock assessment was conducted 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 2019 catches (3,001 t) available at the time of the stock assessment are lower than MSY (4,601 t) but 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 t – 5,080 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 2017-2021)**: striped marlin are caught using gillnet (59.5%), followed by longline (27%) and line (11.7%). 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 2017-2021)**: the majority of striped marlin catches are attributed to vessels flagged to I. R. Iran (30.1%) followed by Pakistan (25.5%) and Indonesia (17.1%). The 22 other fleets catching striped marlin contributed to 27.1% of the total catch in recent years (**Fig. 2**).

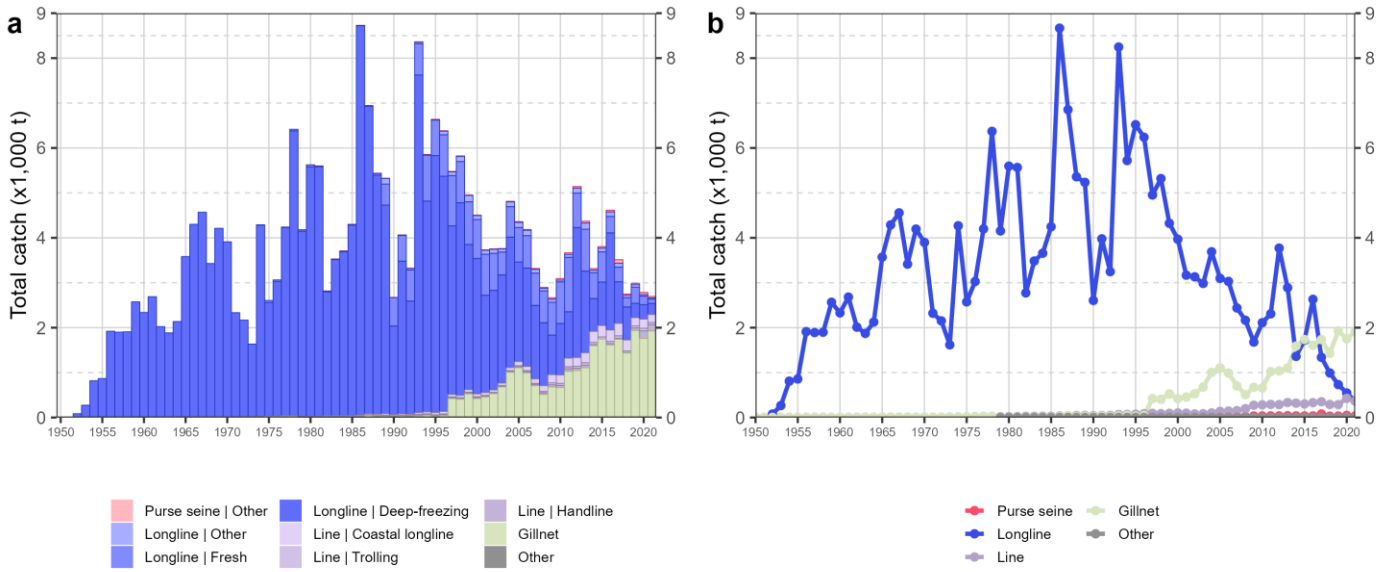


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tons; t) by fishery and (b) individual nominal catches (metric tons; t) by fishery group for striped marlin during 1950-2021. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

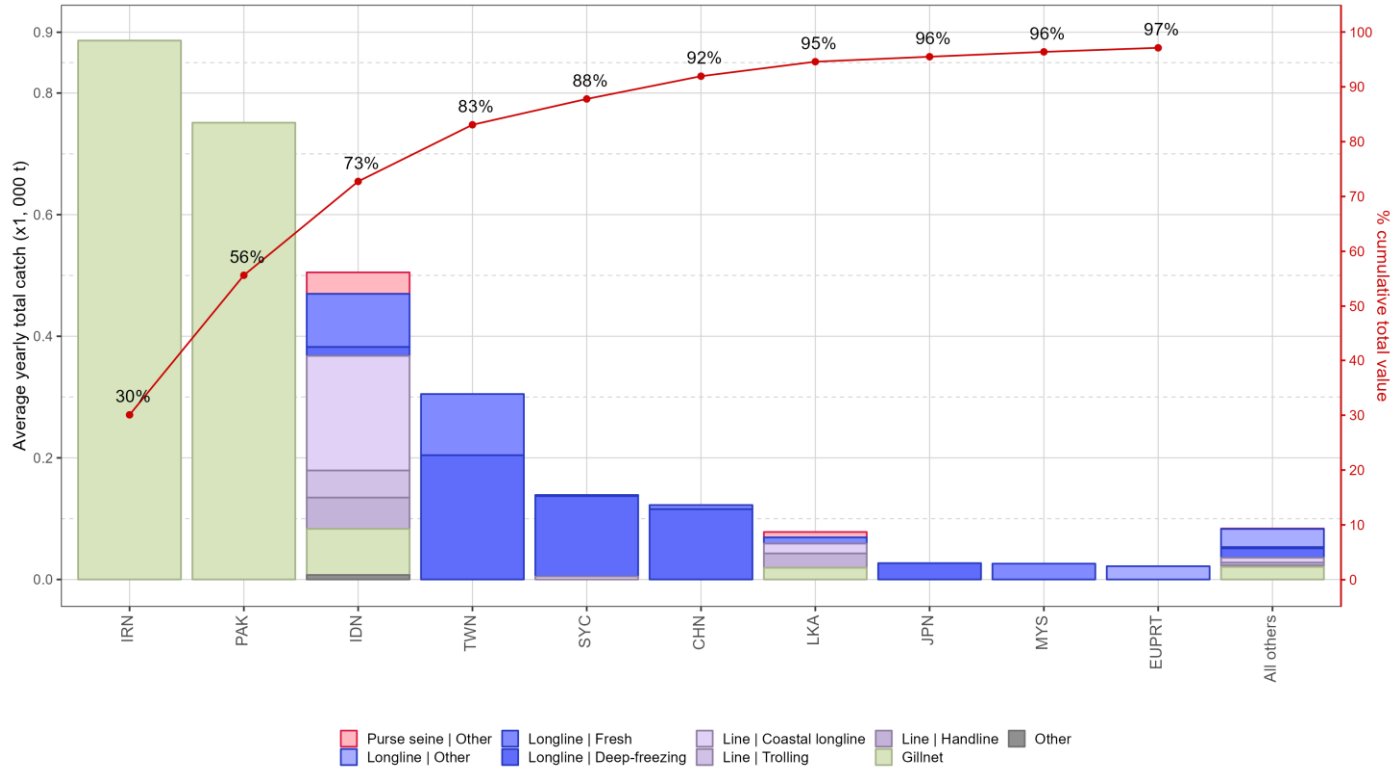


Fig. 2. Mean annual catches (metric tons; t) of striped marlin by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

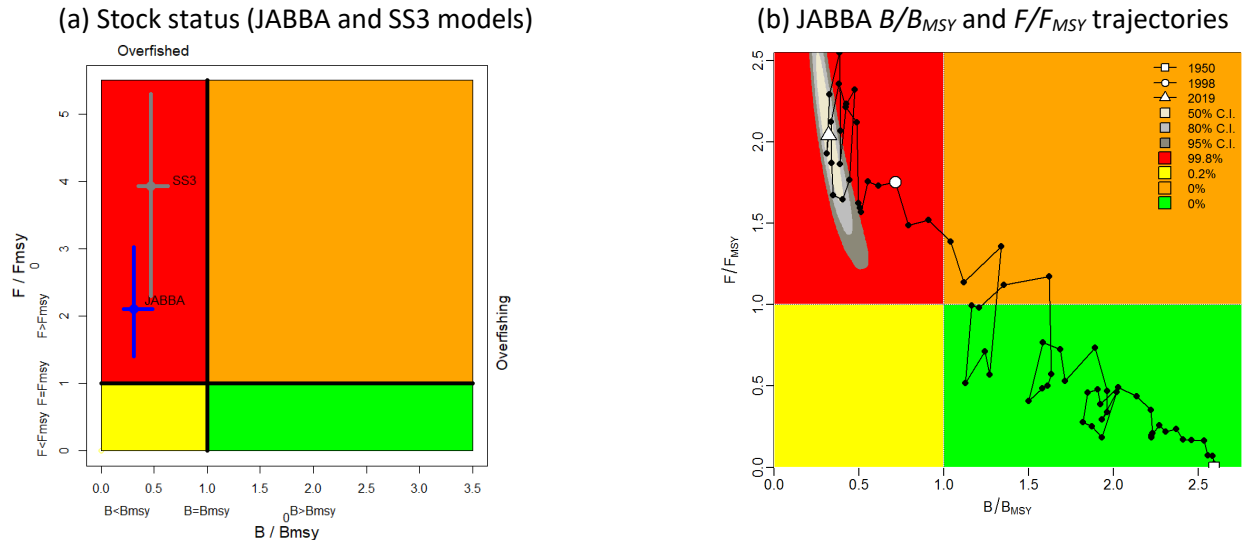


Fig. 3. (a) Striped marlin: Stock status from the Indian Ocean assessment JABBA (Bayesian State Space Surplus Production Model) and SS3 models with the confidence intervals (left); (b) Trajectories (1950-2019) of B/B_{MSY} *and* F/F_{MSY} from the JABBA model. NB: SS3 refers to SB/SB_{MSY} while the 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 | 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	32	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 16
EXECUTIVE SUMMARY: INDO-PACIFIC SAILFISH (2022)

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

Area[1]	Indicators		2022 stock status determination
Indian Ocean	Catch 2021[2] (t)	37,310	**54%**
	Average catch 2017-2021 (t)	32,178	
	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 2021 catch estimated or partially estimated by IOTC Secretariat: 33.24%

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		

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. In 2022 a new stock assessment was conducted based on JABBA, a Bayesian state-space production model (using data up to 2019). Data poor methods (C-MSY and SRA) applied to SFA 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 31,593 t in the last 3 years, 2019-2021) 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 both the 2020 and 2021 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 two 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 2017-2021):** Indo-Pacific sailfish are caught using gillnet (73.1%), followed by line (22.6%) and longline (3.4%). The remaining catches taken with other gears contributed to 1% of the total catches in recent years (**Fig. 1**)**.**
- **Main fleets (mean annual catch 2017-2021)**: the majority of Indo-Pacific sailfish catches are attributed to vessels flagged to I. R. Iran (38.6%) followed by India (23%) and United republic of Tanzania (8.3%). The 31 other fleets catching Indo-Pacific sailfish contributed to 29.8% of the total catch in recent years (**Fig. 2**).

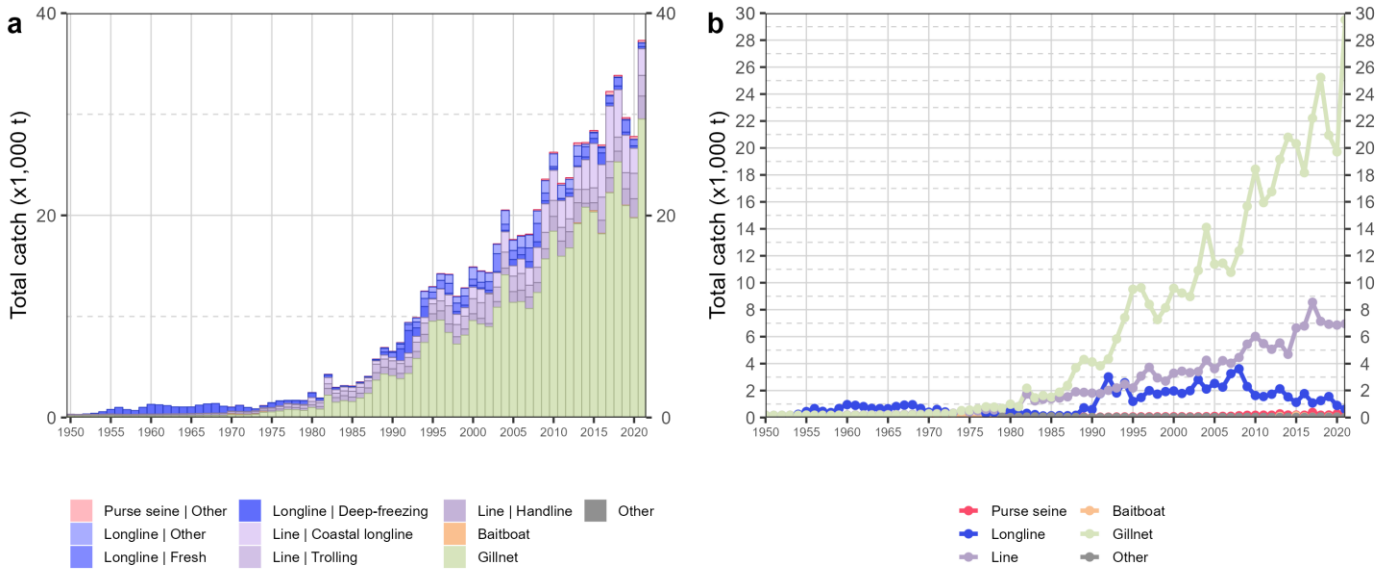


Fig. 1. Annual time series of (a) cumulative nominal catches (metric tons; t) by fishery and (b) individual nominal catches (metric tons; t) by fishery group for Indo-Pacific sailfish during 1950-2021. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

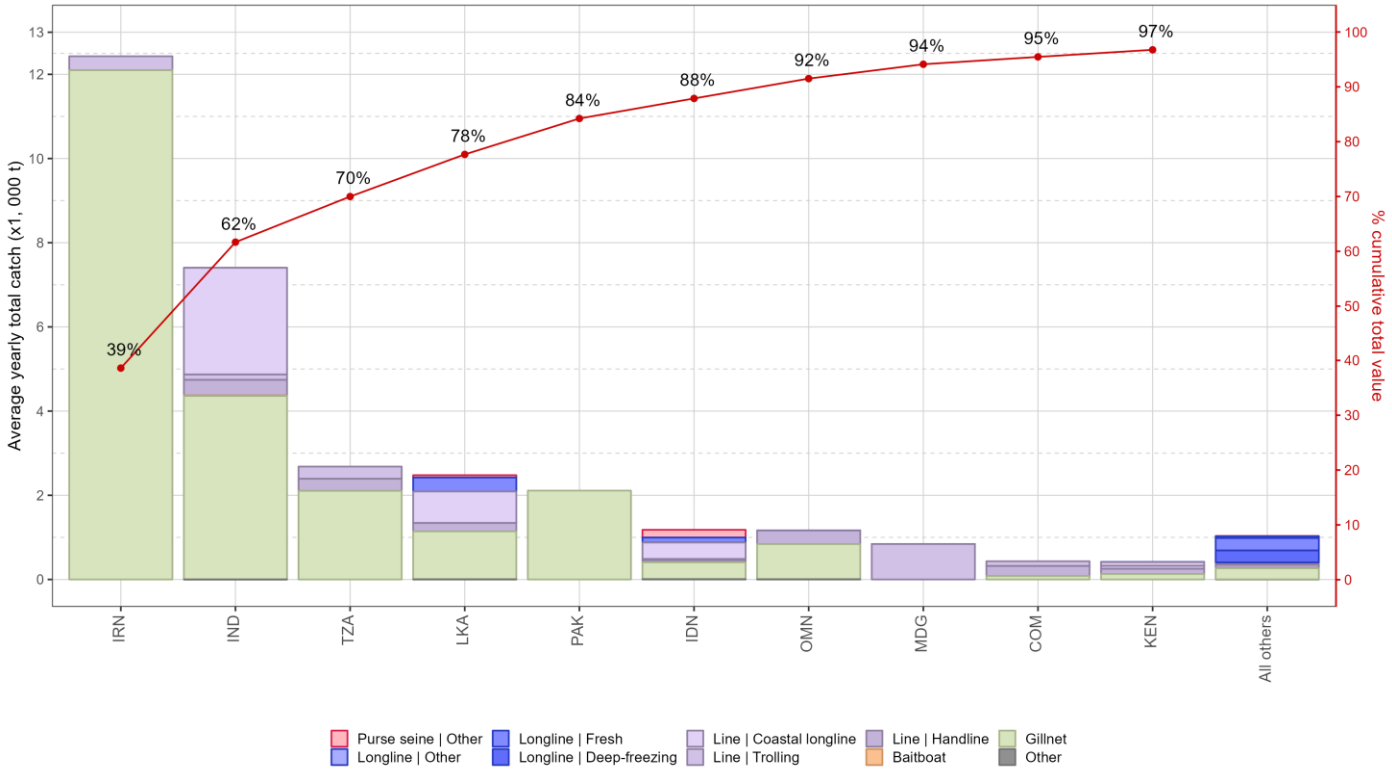


Fig. 2. Mean annual catches (metric tons; t) of Indo-Pacific sailfish by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet. Longline | Other: swordfish and sharks-targeted longlines; Other: all remaining fishing gears

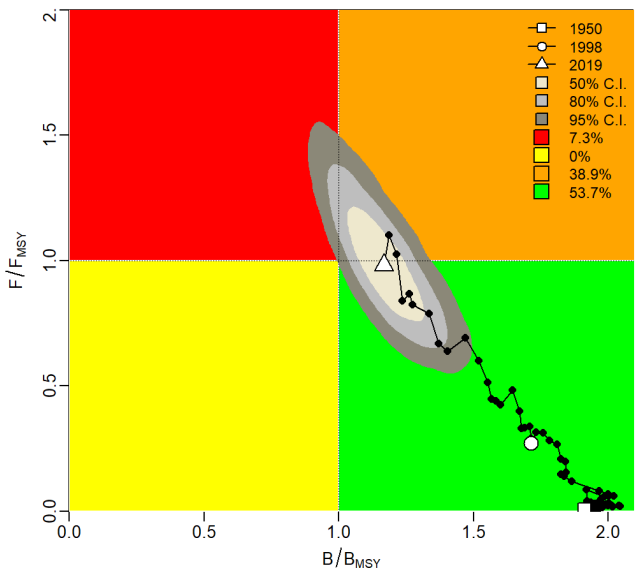


Fig. 3. Indo-Pacific sailfish: Kobe plot showing estimated trajectories (1950-2019) of B/B_{MSY} and F/F_{MSY}. Different grey shaded areas denote the 50%, 80%, and 95% credibility interval for the terminal assessment year. The probability of terminal year points falling within each quadrant is indicated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

Table 2. Summary of posterior quantiles presented in the form of marginal posterior medians and associated the 95% credibility intervals of parameters for the JABBA assessment of Indian Ocean Indo-Pacific sailfish.

Estimates	***Median***	***2.5%***	***97.5%***
K	276,803	215,921	371,953
r	0.375	0.293	0.476
ψ (*psi*)	0.964	0.827	0.999
σ_{proc}	0.052	0.034	0.088
F_{MSY}	0.188	0.146	0.238
B_{MSY}	138,402	107,961	185,977
MSY	25,906	20,789	34,168
B_{1959}/K	0.956	0.801	1.084
B_{2019}/K	0.584	0.472	0.709
B_{2019}/B_{MSY}	1.167	0.944	1.417
F_{2019}/F_{MSY}	0.982	0.65	1.421

APPENDIX 17
EXECUTIVE SUMMARY: BULLET TUNA (2022)

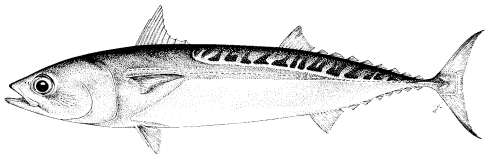


Table 1. Status of bullet tuna (*Auxis rochei*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch 2021[2] (t)	14,072	
	Mean annual catch (2017-2021) (t)	22,562	
	MSY (1,000 t) (80% CI)	unknown	
	F_{MSY} (80% CI)	unknown	
	B_{MSY} (1,000 t) (80% CI)	unknown	
	$F_{current}/F_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_0$ (80% CI)	unknown	

[1]Stock boundaries defined as the IOTC area of competence; [2]Proportion of catch fully or partially estimated for 2021: 49%; [3]Status relates to the final year data are available for 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		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was conducted in 2022 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 (8,547 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), 49% 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 2017-2021)**: bullet tuna is caught using purse seine (59.1%), followed by line (19.3%) and gillnet (14.4%). The remaining catches taken with other gears contributed to 7.2% of the total catches in recent years (**Fig. 1**);
- **Main fleets (mean annual catch 2017-2021)**: most bullet tuna catches are attributed to vessels flagged to India (34.1%) followed by Indonesia (31%) and Thailand (27.3%). The 14 other fleets catching bullet tuna contributed to 7.7% of the total catch in recent years (**Fig. 2**).

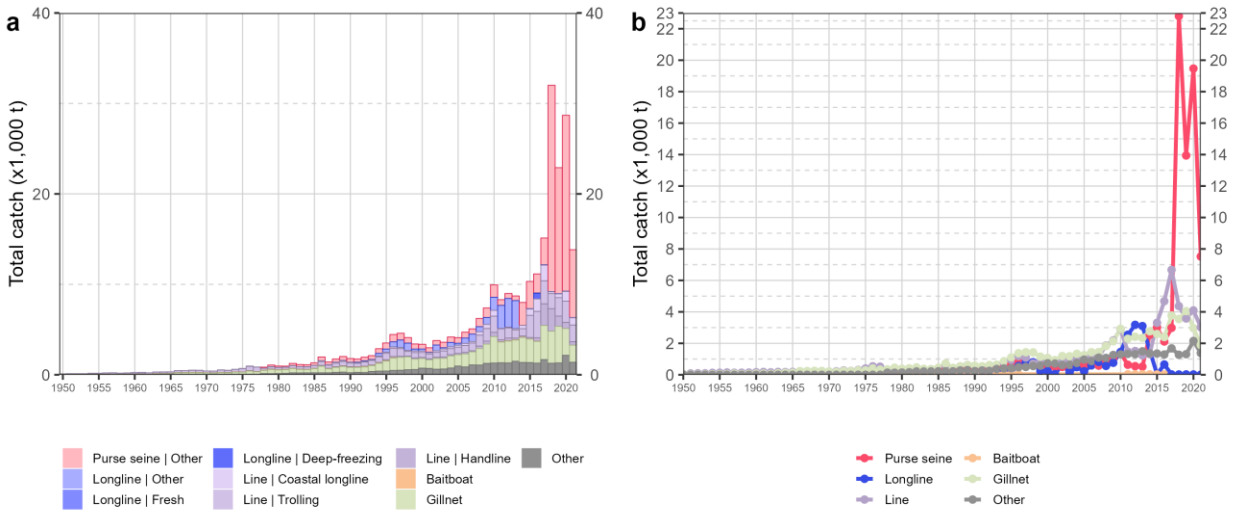


Fig. 1. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for bullet tuna during 1950-2021

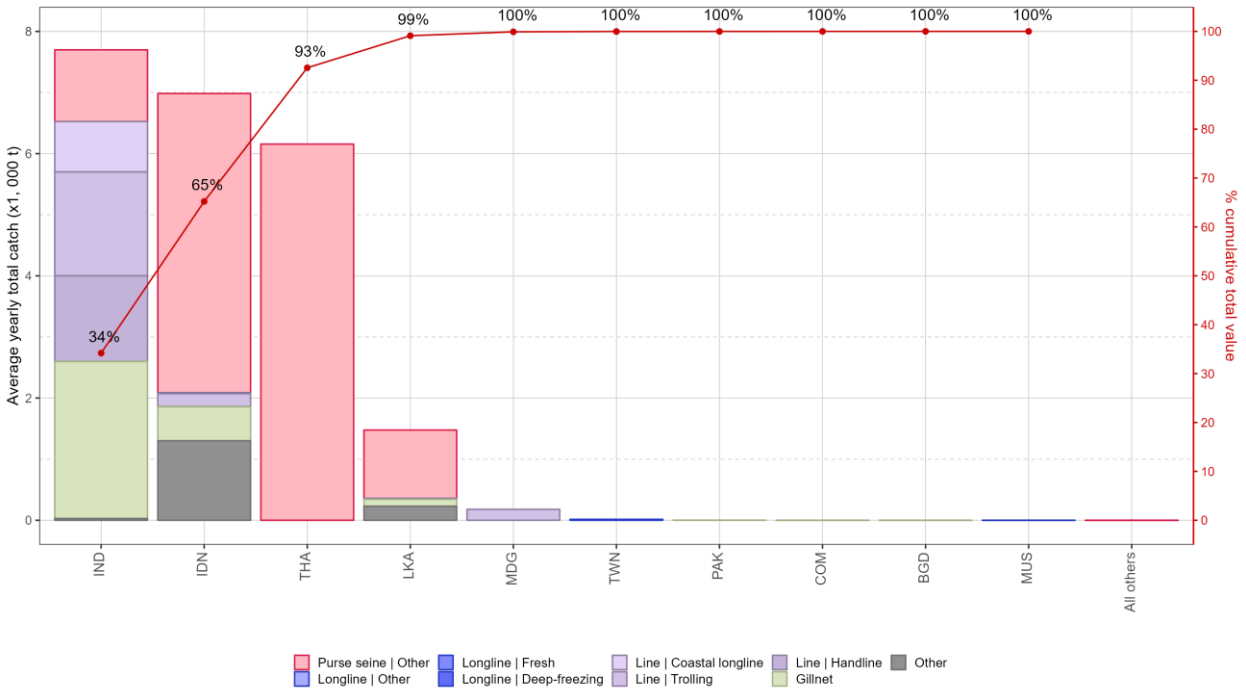


Fig. 2. Mean annual catches (t) of bullet tuna by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX 18
EXECUTIVE SUMMARY: FRIGATE TUNA (2022)

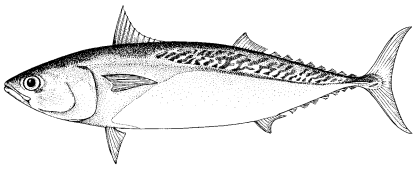


TABLE 1. Status of frigate tuna (*Auxis thazard*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch (2021) (t)[2]	107,065	
	Mean annual catch (2017-2021) (t)	104,697	
	MSY (1,000 t) (80% CI)	unknown	
	F_{MSY} (80% CI)	unknown	
	B_{MSY} (1,000 t) (80% CI)	unknown	
	$F_{current}/F_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_0$ (80% CI)	unknown	

[1]Stock boundaries defined as the IOTC area of competence; [2]Proportion of catch fully or partially estimated for 2021: 79.8%; [3]Status relates to the final year data are available for 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		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new assessment was conducted in 2022 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 2017-2021)**: frigate tuna is caught using gillnet (37.4%), followed by line (32.8%) and purse seine (15.3%). The remaining catches taken with other gears contributed to 14.5% of the total catches in recent years (**Fig. 1**);
- **Main fleets (mean annual catch 2017-2021)**: most frigate tuna catches are attributed to vessels flagged to Indonesia (60.4%) followed by Pakistan (10.8%) and I. R. Iran (9.1%). The 27 other fleets catching frigate tuna contributed to 19.8% of the total catch in recent years (**Fig. 2**).

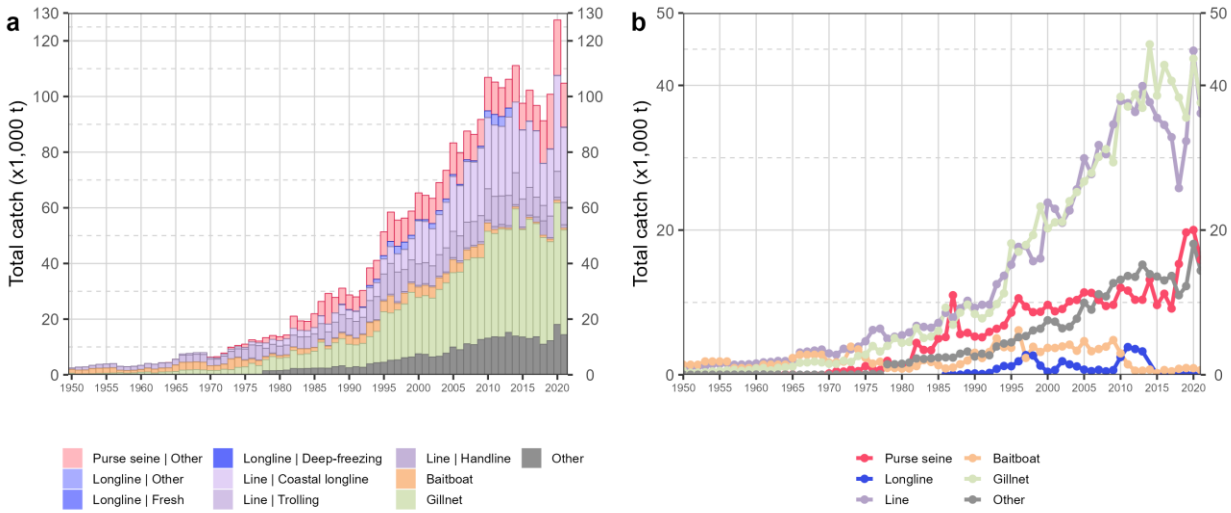


Fig. 1. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for frigate tuna during 1950-2021

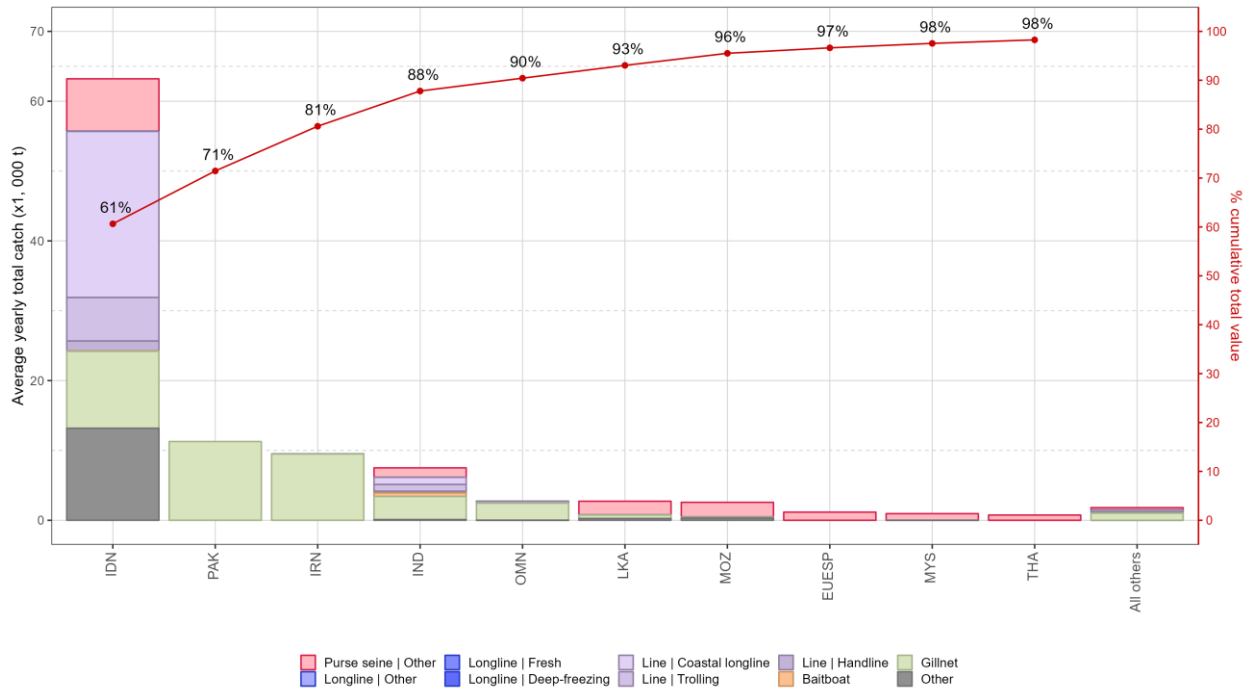


Fig. 2. Mean annual catches (t) of frigate tuna by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX 19
EXECUTIVE SUMMARY: KAWAKAWA (2022)

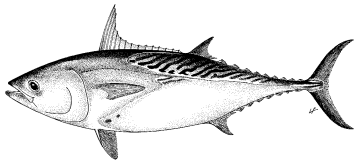


Table 1. Status of kawakawa (*Euthynnus affinis*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch 2021[2] (t) Mean annual catch 2017-2021 (t)	147,228 153,645	**50%**
	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)	148,825 (124,114 – 222,505) 0.44 (0.21–0.82) 355,670 (192,080 – 764,530) 0.98 (0.85–1.11) 1.13 (0.75–1.58)	

[1]Stock boundaries defined as the IOTC area of competence; [2]Proportion of catch fully or partially estimated for 2021: 57%; [3]Status relates to the final year data are available for 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%	15%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	0%	50%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was conducted for kawakawa in 2022 and so the results are based on the assessment carried out in 2020 using data-limited assessment techniques (based on data up to 2018). The OCOM model indicated that the fishing mortality F was very close to F_{MSY} (F/F_{MSY}=0.98) and the B above B_{MSY} (B/B_{MSY}=1.13). The estimated probability of the stock currently being in green quadrant of the Kobe plot is about 50%. Due to the quality of the data being used, the simple modelling approach employed in 2020, and the large increase in kawakawa catches over the last decade (**Fig. 1**), measures need to be taken in order to reduce the level of catches which have surpassed the estimated MSY levels for most years since 2011. Based on the weight-of-evidence available, the kawakawa stock for the Indian Ocean is classified as **not overfished** and **not subject to overfishing** (**Table 1**, **Fig. 1**).

Outlook. There is considerable uncertainty about stock structure and the estimate of total catches. Due to the uncertainty associated with catch data (e.g., 53% of catches partially or fully estimated by the IOTC Secretariat in 2019) 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 2021 was just below the estimated MSY. The available gillnet CPUE of kawakawa showed a somewhat increasing trend although the reliability of the index as abundance indices remains unknown. Despite the substantial

uncertainties, the stock is probably very close to being fished at MSY levels and that higher catches may not be sustained in the longer term. A precautionary approach to management is recommended.

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean is estimated to be 148,825 t with a range between 124,114 and 222,505 t and so catch levels should be reduced in future to prevent the stock becoming overfished;
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, 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 53% of the catches (in 2020, with reference year 2019), 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.

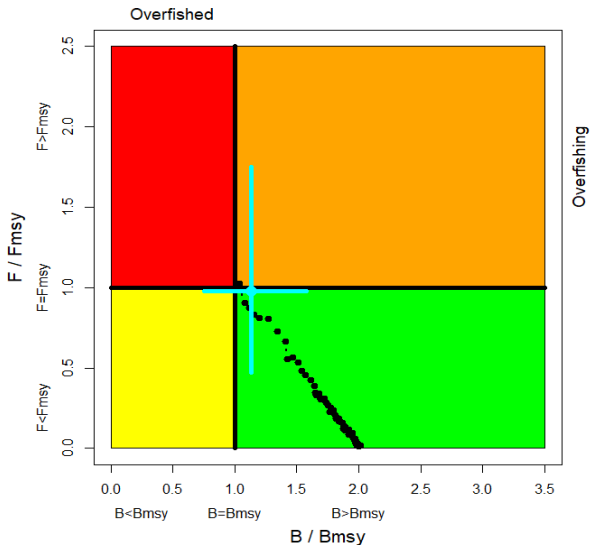


Fig. 1. COM Indian Ocean assessment Kobe plot for kawakawa. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018 (median and 80% confidence interval)

Fisheries overview.

- **Main fisheries (mean annual catch 2017-2021)**: kawakawa are caught using gillnet (49.3%), followed by purse seine (29.9%) and line (15.9%). The remaining catches taken with other gears contributed to 4.9% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2017-2021)**: the majority of kawakawa catches are attributed to vessels flagged to Indonesia (30.6%) followed by I. R. Iran (24%) and India (20%). The 30 other fleets catching kawakawa contributed to 25.4% of the total catch in recent years (**Fig. 3**).

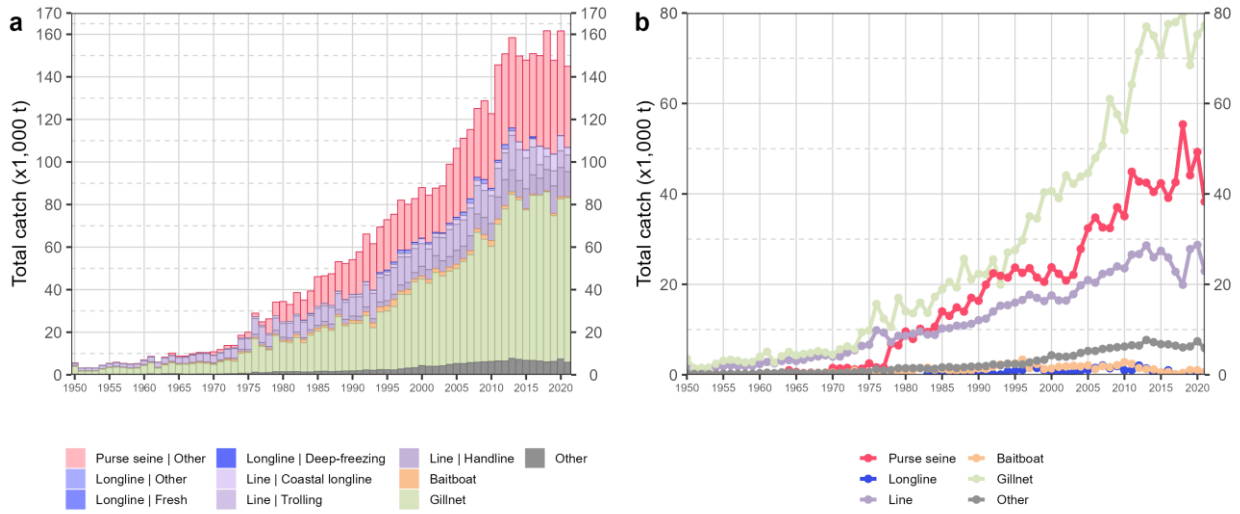


Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for kawakawa during 1950-2021

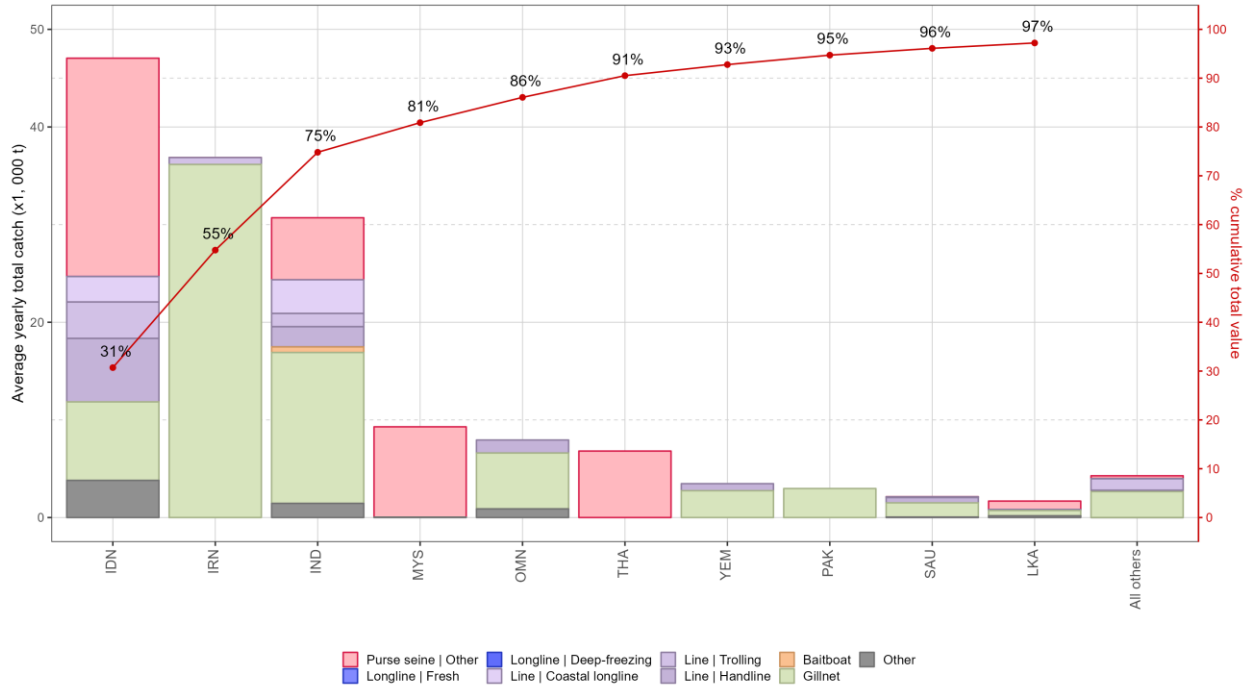


Fig 3. Mean annual catches (t) of kawakawa by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX 20
EXECUTIVE SUMMARY: LONGTAIL TUNA (2022)

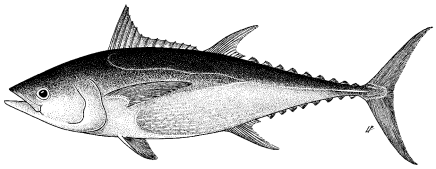


Table 1. Status of longtail tuna (*Thunnus tonggol*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination[3]
Indian Ocean	Catch 2021[2] (t)	135,962	76%
	Mean annual catch (2017-2021) (t)	133,499	
	MSY (t) (80% CI)	128,750 (99,902 – 151,357)	
	F_{MSY} (80% CI)	0.32 (0.15 – 0.66)	
	B_{MSY} (t) (80% CI)	395,460 (129,240 – 751,316)	
	$F_{current}/F_{MSY}$ (80% CI)	1.52 (0.751 – 2.87)	
	$B_{current}/B_{MSY}$ (80% CI)	0.69 (0.45 – 1.21)	

[1]Stock boundaries defined as the IOTC area of competence; [2]Proportion of catch fully or partially estimated for 2021: 30.6%; [3]Status relates to the final year data are available for 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)	76%	2%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	2%	20%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new assessment was conducted for longtail tuna in 2022 and so the results are based on the assessment carried out in 2020 using the Optimised Catch-Only Method (OCOM) (based on data up to 2018). Analysis using the OCOM indicates that the stock is being exploited at a rate that exceeded F_{MSY} in recent years and that the stock appears to be below B_{MSY} and above F_{MSY} (76% of plausible models runs) (**Fig. 2**). Catches were above MSY between 2010 and 2018 but steadily declined from 2012 to less than 113,000 t in 2019, below the estimated MSY (**Fig. 1**). The F_{2018}/F_{MSY} ratio is slightly higher than previous estimates. The estimate of the B_{2018}/B_{MSY} ratio (0.69) was lower than in previous years, reflecting declining abundance. An assessment using a biomass dynamic model incorporating gillnet CPUE indices was also undertaken in 2020 and results were consistent with OCOM in terms of status. 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 weight-of-evidence currently available, the stock is considered to be both **overfished** and **subject to overfishing** (**Table 1**; **Fig. 1**).

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 2021 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 estimate of around 128,750 t was exceeded between 2011 and 2018. Limits to catches are warranted to recover the stock to the B_{MSY} level;
- Limit reference points: the Commission has not adopted limit reference points for any of the neritic tunas under its mandate;
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods;
- Improvements in data collection and reporting are required if the stock is to be assessed using integrated stock assessment models;
- Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets (I.R. Iran, Indonesia, Pakistan, 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 (reference year 2021) 31% 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.

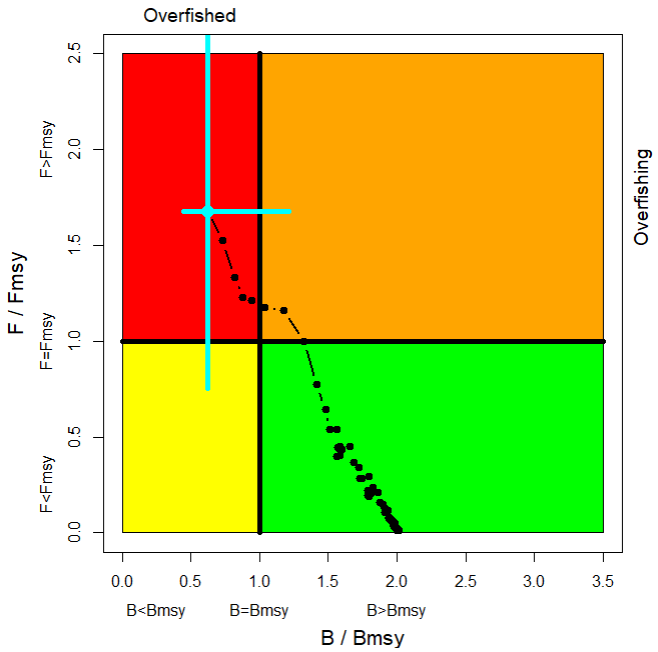


Fig. 1. Longtail tuna OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018 (median and 80% confidence interval)

Fisheries overview.

- **Main fisheries (mean annual catch 2017-2021)**: longtail tuna are caught using gillnet (68.4%), followed by line (15%) and purse seine (7.6%). The remaining catches taken with other gears contributed to 9% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2017-2021)**: the majority of longtail tuna catches are attributed to vessels flagged to I. R. Iran (41.7%) followed by Indonesia (20.2%) and Sultanate of Oman (16.5%). The 23 other fleets catching longtail tuna contributed to 21.6% of the total catch in recent years (**Fig. 3**).

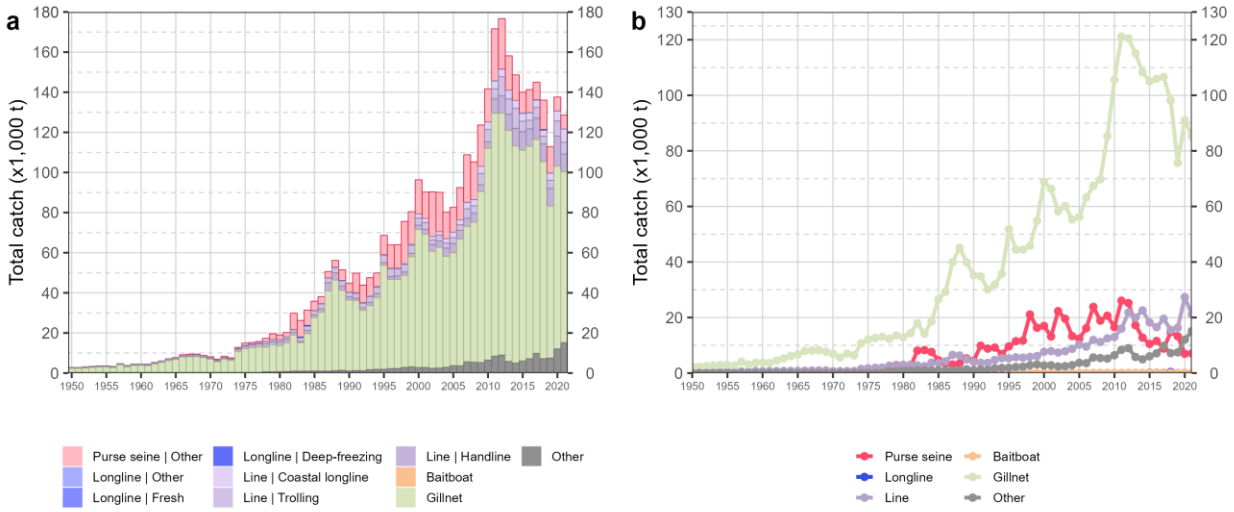


Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for longtail tuna during 1950-2021

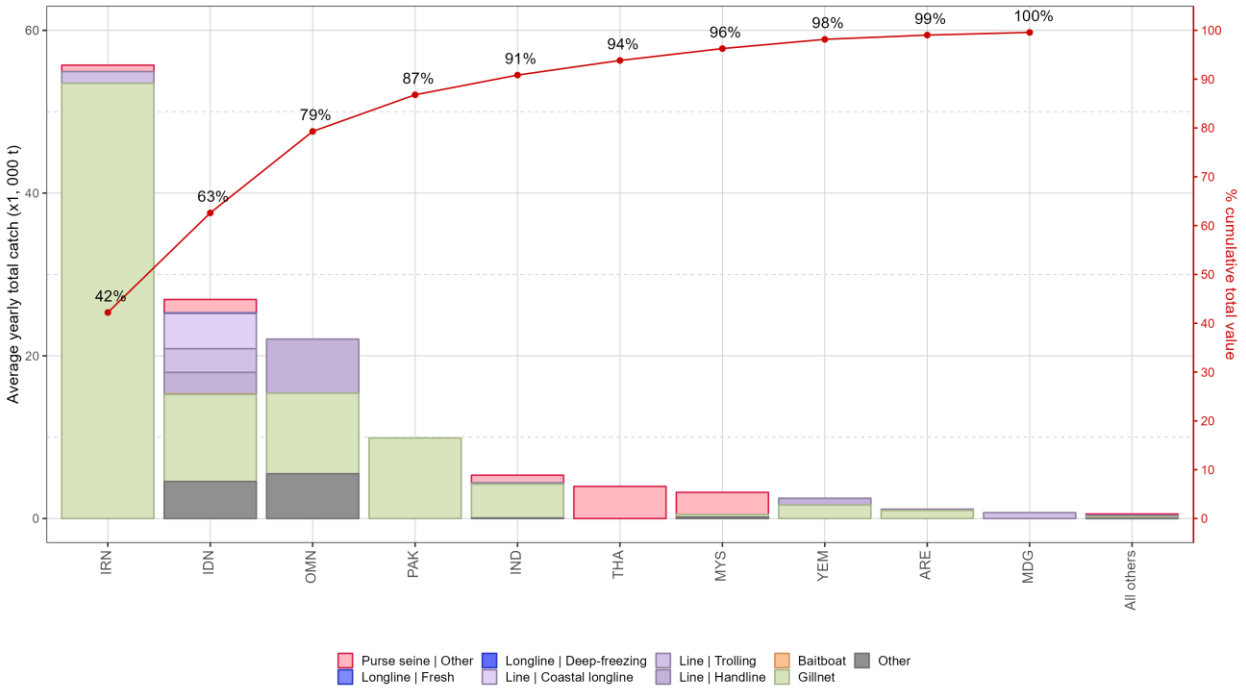


Fig. 3. Mean annual catches (t) of longtail tuna by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX 21
EXECUTIVE SUMMARY: INDO-PACIFIC KING MACKEREL (2022)

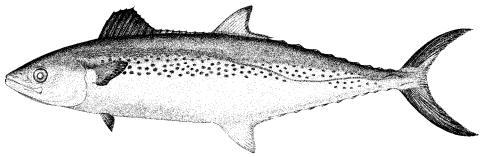


Table 1. Status of Indo-Pacific king mackerel (*Scomberomorus guttatus*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch (2021) (t)[2]	33,491	**35%**
	Mean annual catch (2017-2021) (t)	43,764	
	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 2021: 69.1%; [3]Status relates to the final year data are available for assessment.

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new assessment was conducted in 2022 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:

- 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 (reference year 2021), 69% 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.

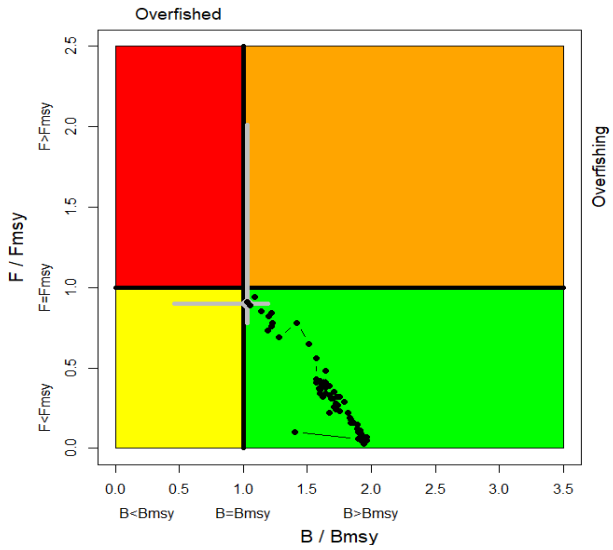


Fig. 1 Kobe plot of the CMSY assessment for the Indian Ocean spotted kingfish. The Kobe plot shows the trajectories (geometric mean) of the range of plausible model options included in the formulation of the final management advice. The grey cross represents the estimated stock status in 2021 (median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

Fisheries overview.

- **Main fisheries (mean annual catch 2017-2021)**: Indo-Pacific king mackerel are caught using gillnet (66.5%), followed by other (21.8%) and line (9%). The remaining catches taken with other gears contributed to 2.7% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2017-2021)**: the majority of Indo-Pacific king mackerel catches are attributed to vessels flagged to Indonesia (31.3%) followed by India (29.9%) and I. R. Iran (23.1%). The 12 other fleets catching Indo-Pacific king mackerel contributed to 15.7% of the total catch in recent years (**Fig. 3**).

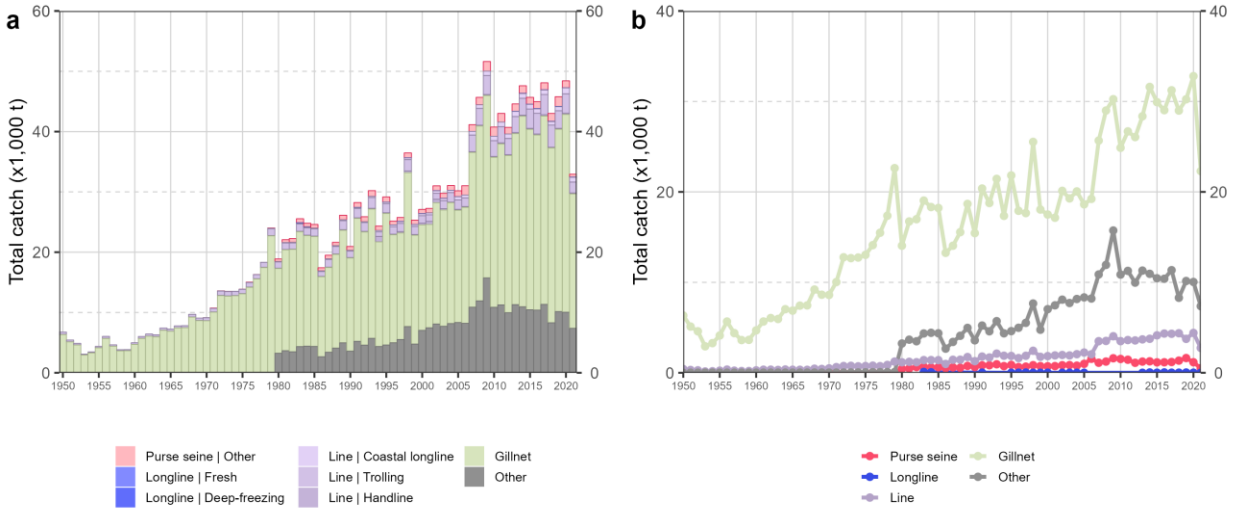


Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for Indo-Pacific king mackerel during 1950-2021

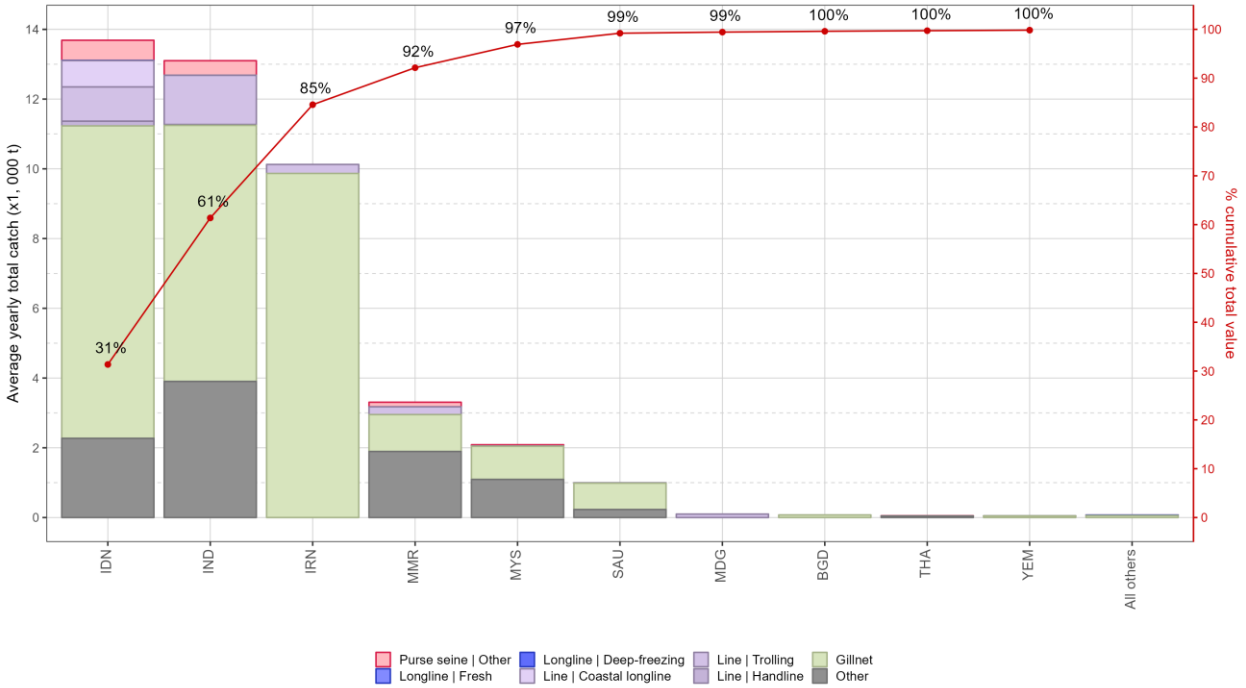


Fig. 3. Mean annual catches (t) of Indo-Pacific king mackerel by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX 22
EXECUTIVE SUMMARY: NARROW-BARRED SPANISH MACKEREL (2022)

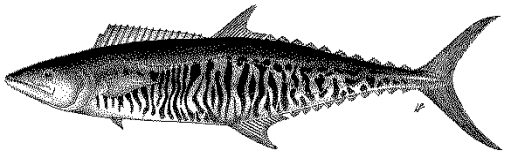


Table 1. Status of narrow-barred Spanish mackerel (*Scomberomorus commerson*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch (2021)[2] (t)	172,887	73%
	Mean annual catch (2017-2021) (t)	160,966	
	MSY (t) (80% CI)	157,760 (132,140–187,190)	
	F_{MSY} (80% CI)	0.49 (0.25–0.87)	
	B_{MSY} (t) (80% CI)	323,500 (196,260–592,530)	
	$F_{current}/F_{MSY}$ (80% CI)	1.24 (0.65–2.13)	
	$B_{current}/B_{MSY}$ (80% CI)	0.80 (0.54–1.27)	

[1]Stock boundaries defined as the IOTC area of competence; [2]Proportion of catch fully or partially estimated for 2021: 79%; [3]Status relates to the final year data are available for 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)	73%	3%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	3%	22%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new assessment was conducted for narrow-barred Spanish mackerel in 2022 and so the results are based on the assessment carried out in 2020 using the Optimised Catch-Only Method (OCOM) (based on data up to 2018). The OCOM model indicates that the stock is being exploited at a rate exceeding F_{MSY} in recent years, and the stock appears to be below B_{MSY}. An analysis undertaken in 2013 in the Northwest Indian Ocean (Gulf of Oman) indicated that overfishing is occurring in this area and that localised depletion may also be occurring[26]. 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 weight-of-evidence available, the stock appears to be **overfished** and **subject to overfishing** (**Table 1**, **Fig. 1**). Catches since 2012 and also recent average catches for 2015-2019 have been above or close to the current MSY estimate of 157,76 0 t in recent years (**Fig. 1**).

Outlook. There is considerable uncertainty about the estimate of total catches. The continued increase in annual catches in recent years has further increased the pressure on the Indian Ocean narrow-barred Spanish mackerel stock. The apparent fidelity of narrow-barred Spanish mackerel to particular areas/regions is a matter for concern as overfishing in these areas can lead to localised depletion.

Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).

[26] IOTC-2013-WPNT03-27

Management advice. The catch in 2021 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 157,760 t, with catches for 2019 (159,457 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 (reference year 2021) 79% 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.

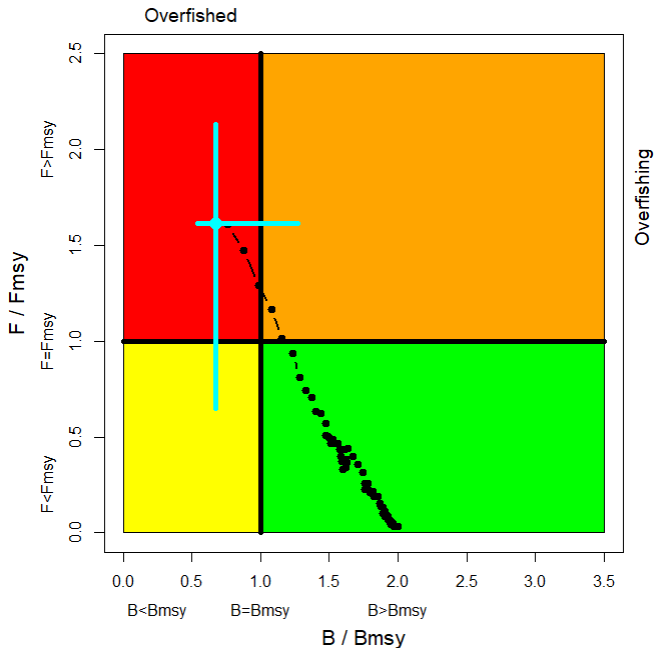


Fig. 1. Narrow-barred Spanish Mackerel OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018 (median and 80% confidence interval)

Fisheries overview.

- **Main fisheries (mean annual catch 2017-2021)**: narrow-barred Spanish mackerel are caught using gillnet (59.7%), followed by line (18.3%) and other (15.8%). The remaining catches taken with other gears contributed to 6.2% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2017-2021)**: the majority of narrow-barred Spanish mackerel catches are attributed to vessels flagged to Indonesia (27.3%) followed by India (18.7%) and I. R. Iran (15.7%). The 28 other fleets catching narrow-barred Spanish mackerel contributed to 38.3% of the total catch in recent years (**Fig. 3**).

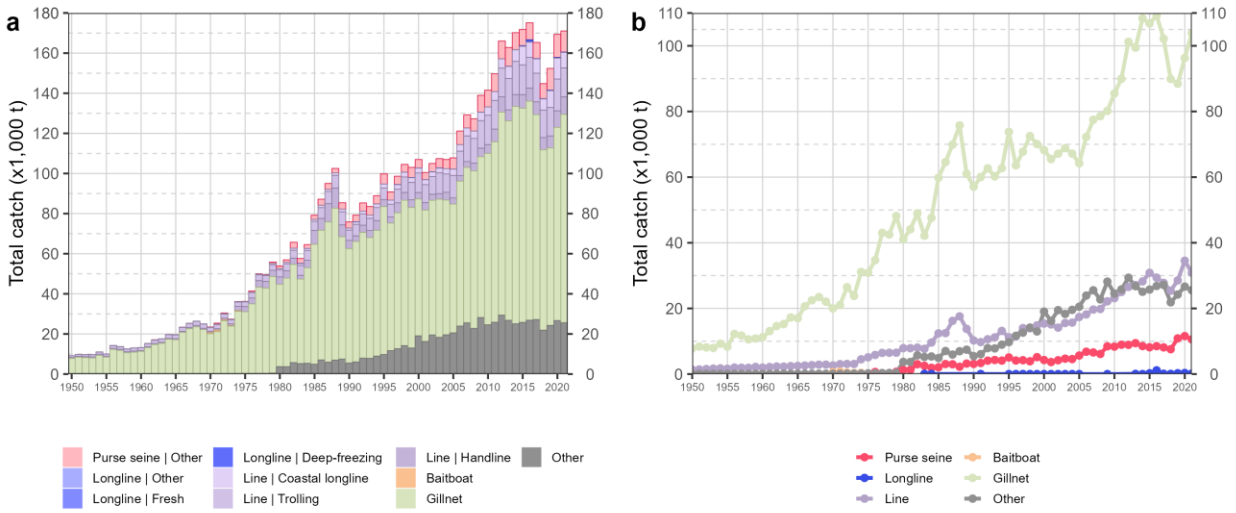


Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for narrow-barred Spanish mackerel during 1950-2021

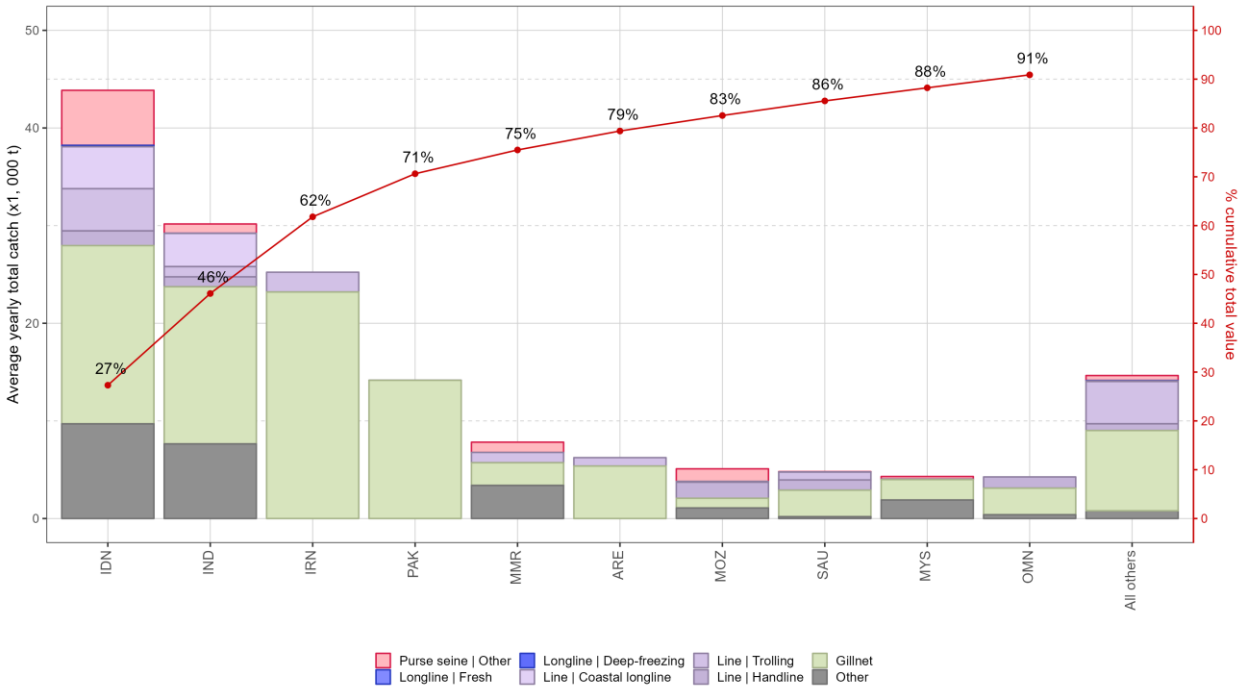


Fig. 3. Mean annual catches (t) of narrow-barred Spanish mackerel by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX 23
EXECUTIVE SUMMARY: BLUE SHARK (2022)

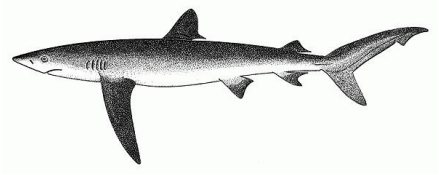


Table 1. Status of blue shark (*Prionace glauca*) in the Indian Ocean

Area	Indicators		2021 stock status determination
Indian Ocean	Reported catch 2021 (t)	24,418	99.9%
	Estimated catch 2019 (t)[4]	43,240	
	Not elsewhere included (nei) sharks[1] 2021 (t)	29,845	
	Average reported catch 2017-21 (t)	26,694	
	Average estimated catch 2015-19 (t)[4]	48,781	
	Avg. not elsewhere included (nei) sharks[1] 2017-21 (t)	32,523	
	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)

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		

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, Stevens 2009

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new stock assessment was carried out for blue sharks in 2022 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** (2017–21): coastal longline; longline (deep-freezing); longline targeting swordfish.
- **Main fleets** (2017–21): Indonesia; Taiwan,China; EU-Spain, EU-Portugal; Yemen; .

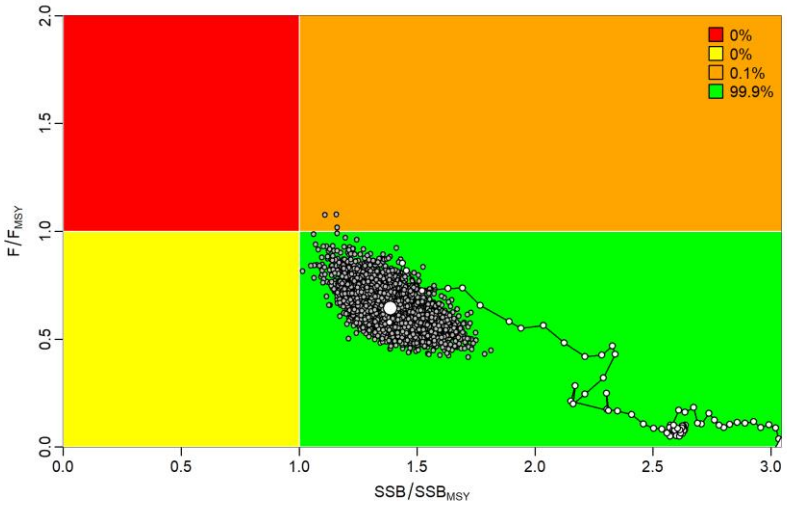


Fig. 1. Blue shark: Aggregated Indian Ocean stock assessment Kobe plot for the 2021 assessment base case model (base case model with trajectory and uncertainty in the terminal year.

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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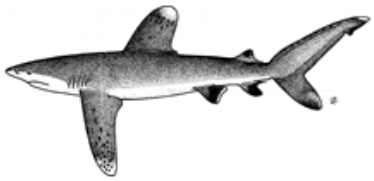
APPENDIX 24
EXECUTIVE SUMMARY: OCEANIC WHITETIP SHARK (2022)



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 2021	32 t	
	Not elsewhere included (nei) sharks[2] 2021	29,845 t	
	Average reported catch 2017-21	35 t	
	Av. not elsewhere included 2017-2021 (nei) sharks[2]	32,523 t	
	MSY (1,000 t) (80% CI)	unknown	
	F_{MSY} (80% CI)		
	SB_{MSY} (1,000 t) (80% CI)		
	$F_{current}/F_{MSY}$ (80% CI)		
	$SB_{current}/SB_{MSY}$ (80% CI)		
	$SB_{current}/SB_0$ (80% CI)		

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

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

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

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

Common name	**Scientific name**	**IUCN threat status[3]**		
		Global status	**WIO**	**EIO**
Oceanic whitetip shark	*Carcharhinus longimanus*	Critically Endangered	–	–

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

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

Sources: IUCN Red List 2020, Baum et al. 2006

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty about the relationship between abundance, standardised CPUE series and total catches over the past decade (**Table 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. 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:

1. **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
2. **Reference points**: Not applicable.
3. **Main fishing gear** (2017-21): Offshore gillnet Troll line; Longline-fresh.
4. **Main fleets** (2017-21): I.R. Iran; Comoros; China, Seychelles, (Reported as discarded/released alive by China, EU-France, Sri Lanka, EU-Spain).

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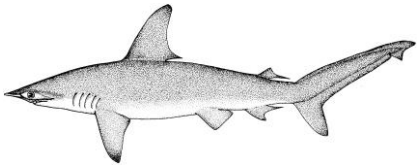
APPENDIX 25
EXECUTIVE SUMMARY: SCALLOPED HAMMERHEAD SHARK (2022)



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 2021 (t)	232	
	Not elsewhere included (nei) sharks[2] 2021 (t)	28,770	
	Average reported catch 2017-21 (t)	97	
	Av. not elsewhere included 2017-2021 (nei) sharks[2] (t)	31,281	
	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; SPN: Hammerhead sharks nei).

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

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

Common name	Scientific name	IUCN threat status[3]		
		Global status	WIO	EIO
Scalloped hammerhead 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, Baum 2007

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. The current IUCN threat status of 'Critically Endangered' applies to scalloped hammerhead sharks globally but specifically for the western Indian Ocean the status is '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 (Table 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:

5. **Maximum Sustainable Yield (MSY)**: Unknown.
6. **Reference points**: Not applicable.
7. **Main fishing gear** (2017-2021): Handline, Ringnet; Gillnet; longline-coastal; and offshore gillnet.
8. **Main fleets** (2017-21): Sri Lanka; Kenya; Malaysia (report as released alive/discarded by United Kingdom, EU-France, South Africa,).

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APPENDIX 26
EXECUTIVE SUMMARY: SHORTFIN MAKO SHARK (2022)

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 2021 (t)	792	
	Not elsewhere included (nei) sharks[2] 2021 (t)	31,499	
	Average reported catch 2017-21 (t)	1,326	
	Av. Not elsewhere included (nei) sharks[2] 2017-21 (t)	34,369	
	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;; MSK: Mackerel sharks,porbeagles nei; MAK: Mako sharks; AG38: Blue shark, shortfin mako, oceanic whitetip shark).

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

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

Common name	Scientific name	IUCN threat status[3]		
		Global status	WIO	EIO
Shortfin mako shark	*Isurus oxyrinchus*	Endangered	–	–

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

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

Sources: IUCN Red List 2020, Cailliet 2009

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty about the relationship between abundance, the standardised CPUE series, and total catches over the past decade (**Table 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 years) - the shortfin mako shark is vulnerable to overfishing. Although an attempt was made to assess the shortfin mako stock in 2020, there is no quantitative stock assessment currently available for shortfin mako shark in the Indian Ocean. Therefore, the stock status is **unknown**. This highlights the need for further work on data improvement and provision of abundance indices as well as utilizing complimentary approaches (e.g., genetic tools) to inform the trends in abundance of the stock.

Outlook. 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:

9. **Maximum Sustainable Yield (MSY)**: Unknown.
10. **Reference points**: Not applicable.
11. **Main fishing gear** (2017-21): Longline targeting swordfish; gillnet, longline ,); gillnet offshore.
12. **Main fleets** (2017-21): 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 (2022)

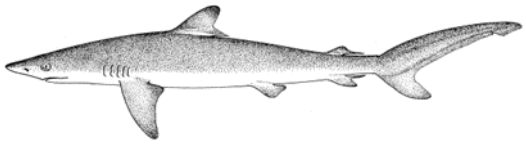

Table 1. Status of silky shark (*Carcharhinus falciformis*) in the Indian Ocean

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2021 (t) Not elsewhere included (nei) sharks[2] 2021 (t) Average reported catch 2017-21 (t) Av. Not elsewhere included (nei) sharks[2] 2017-21 (t)	1,423 21,879 1,702 25,732	
	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).

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

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

Common name	Scientific name	IUCN threat status[3]		
		Global status	WIO	EIO
Silky shark	*Carcharhinus falciformis*	Vulnerable	Near Threatened	Near Threatened

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

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

Sources IUCN Red List 2020

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty about the relationship between abundance and the nominal CPUE series from the main longline fleets, and about the total catches over the past decade (**Table 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 'Near Threatened' applies to silky shark in the western and eastern Indian Ocean but globally the status 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.

The following key points should also be noted:

13. **Maximum Sustainable Yield (MSY)**: Unknown.
14. **Reference points**: Not applicable.
15. **Main fishing gear** (2017-21): Gillnet; offshore gillnet; longline; longline (fresh), trolling
16. **Main fleets** (2017-21): Sri Lanka, I.R. Iran; Pakistan, Taiwan,China; (reported as discarded/released alive by: China, EU-France, Mauritius, EU-Spain, Korea).

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APPENDIX 28
EXECUTIVE SUMMARY: BIGEYE THRESHER SHARK (2022)

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

Area[1]	Indicators		2018 Stock status determination
Indian Ocean	Reported catch 2021 (t)	< 1	
	Not elsewhere included (nei) sharks[2] 2021 (t)	26,965	
	Average reported catch 2017-21 (t)	< 1	
	Av. Not elsewhere included (nei) sharks[2] 2017-21 (t)	30,323	
	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		

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, Amorim et al. 2009

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty in the stock status due to lack of information necessary for assessment or for the development of other indicators of the stock (**Table 1**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 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*[27].

The following key points should also be noted:

17. **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
18. **Reference points**: Not applicable.
19. **Main fishing gear** (2017–21): No report after 2012. (reported previously as discard from gillnet and longline).
20. **Main reporting fleets** (2017–21): India; (reported as discarded/released alive by United Kingdom, South Africa, Indonesia, Korea, EU,France,).

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[27] 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 (2022)

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

Area[1]	Indicators		Stock status determination
Indian Ocean	Reported catch 2021 (t)	176	
	Not elsewhere included (nei) sharks[2] 2021 (t)	26,965	
	Average reported catch 2017-21 (t)	270	
	Av. Not elsewhere included (nei) sharks[2] 2017-21 (t)	30,323	
	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 ($SB_{year}/SB_{MSY}\geq 1$)
Stock subject to overfishing ($F_{year}/F_{MSY}> 1$)		
Stock not subject to overfishing ($F_{year}/F_{MSY}\leq 1$)		
Not assessed/Uncertain		

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

Common name	**Scientific name**	**IUCN threat status[3]**		
		Global status	**WIO**	**EIO**
Pelagic thresher shark	*Alopias pelagicus*	Endangered	–	–

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

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

Sources: IUCN Red List 2020, Reardon et al. 2009

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty in the stock status due to lack of information necessary for assessment or for the development of other indicators (**Table 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*[28].

The following key points should also be noted:

21. **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
22. **Reference points**: Not applicable.
23. **Main fishing gear** (2017-21): Gillnet, exploratory longline (reported as discard/ released from gillnet and longline).
24. **Main fleets** (2017-21): Pakistan; (reported as discarded/released alive by Korea, South Africa, Indonesia).

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[28]Scientific observers shall be allowed to collect biological samples from thresher sharks that are dead at haulback, provided that the samples are part of the research project approved by the Scientific Committee (or the Working Party on Ecosystems and Bycatch).

APPENDIX 30
EXECUTIVE SUMMARY: MARINE TURTLES

Table 1. 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[29]
Flatback turtle	*Natator depressus*	Data deficient
Green turtle	*Chelonia mydas*	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Critically Endangered
Leatherback turtle	*Dermochelys coriacea*	
	(N. East Indian Ocean subpopulation)	Data deficient
	(S. West Indian Ocean subpopulation)	Critically Endangered
Loggerhead turtle	*Caretta caretta*	
	(N. West Indian Ocean subpopulation)	Critically Endangered
	(S. East Indian Ocean subpopulation)	Near Threatened
Olive Ridley turtle	*Lepidochelys olivacea*	Vulnerable

Sources: Marine Turtle Specialist Group 1996, Red List Standards & Petitions Subcommittee 1996, Sarti Martinez (Marine Turtle Specialist Group) 2000, Seminoff 2004, Abreu-Grobois & Plotkin 2008, Mortimer et al. 2008, IUCN 2020, The IUCN Red List of Threatened species. <www.iucnredlist.org>. Downloaded on 16 September 2020

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No assessment has been undertaken by the IOTC WPEB for marine turtles due to the lack of data being submitted by CPCs. However, the current International Union for Conservation of Nature (IUCN) threat status for each of the marine turtle species reported as caught in IOTC fisheries to date is provided in **Table 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

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

http://iotc.org/science/species-identification-cards. Notwithstanding this, it is acknowledged that the impact on marine turtle populations from fishing for tuna and tuna-like species will increase as fishing pressure increases, and that the status of the marine turtle populations will continue to worsen due to other factors such as an increase in fishing pressure from other fisheries or anthropological or climatic impacts.

The following should also be noted:

(a) The available evidence indicates considerable risk to marine turtles in the Indian Ocean.
(b) 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.
(c) 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.
(d) Current reported interactions are known to be a severe underestimate.
(e) 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.
(f) 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.
(g) Efforts should be undertaken to encourage CPCs to investigate means to reduce marine turtle bycatch 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[30]
Albatross		
Atlantic Yellow-nosed Albatross	*Thalassarche chlororhynchos*	Endangered
Black-browed albatross	*Thalassarche melanophris*	Least Concern
Indian yellow-nosed albatross	*Thalassarche carteri*	Endangered
Shy albatross	*Thalassarche cauta*	Near Threatened
Sooty albatross	*Phoebetria fusca*	Endangered
Light-mantled albatross	*Phoebetria palpebrata*	Near Threatened
Amsterdam albatross	*Diomedea amsterdamensis*	Endangered
Tristan albatross	*Diomedea dabbenena*	Critically Endangered
Wandering albatross	*Diomedea exulans*	Vulnerable
White-capped albatross	*Thalassarche steadi*	Near Threatened
Grey-headed albatross	*Thalassarche chrysostoma*	Endangered
Petrels		
Cape/Pintado petrel	*Daption capense*	Least Concern
Great-winged petrel	*Pterodroma macroptera*	Least Concern
Grey petrel	*Procellaria cinerea*	Near Threatened
Southern giant petrel	*Macronectes giganteus*	Least Concern
Northern giant-petrel	*Macronectes halli*	Least Concern
White-chinned petrel	*Procellaria aequinoctialis*	Vulnerable
Others		
Cape gannet	*Morus capensis*	Endangered
Flesh-footed shearwater	*Puffinus carneipes*	Near Threatened

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. Following a data call in 2016, the IOTC Secretariat received seabird bycatch data from 6 CPCs, out of the 15 with reported or expected longline effort South of 25ºS (IOTC-2016-SC19-INF02). Due to the lack of data submissions from other CPCs, and the limited information provided on the use of seabird bycatch mitigations, it has not yet been possible to undertake an assessment for seabirds. The current International Union for Conservation of Nature (IUCN) threat status for each of the seabird species reported as caught in IOTC fisheries to date is provided in **Table 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.

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

Outlook. The level of compliance with Resolution 12/06 (*On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries*) and the frequency of use of each of the 3 measures (because vessels can choose two out of three possible options) are still poorly known. Observer reports and logbook data should be analysed to support assessments of the effectiveness of mitigation measures used and relative impacts on seabird mortality rates. Information regarding seabird interactions reported in National Reports should be stratified by season, broad area, and in the form of catch per unit effort. Following the data call in 2016 it was possible to carry out a preliminary and qualitative analysis. The information provided suggests higher sea bird catch rates at higher latitudes, even within the area south of 25°S, and higher catch rates in the coastal areas in the eastern and western parts of the southern Indian Ocean. In terms of mitigation measures, the preliminary information available suggests that those currently in use (Resolution 12/06) may be proving effective in some cases, but there are also some conflicting aspects that need to be explored further. Unless IOTC CPCs become compliant with the data collection, Regional Observer Scheme and reporting requirements for seabirds, the WPEB will continue to be unable to fully address this issue.

The following should also be noted:

25. The available evidence indicates considerable risk from longline fishing to the status of seabirds in the Indian Ocean, where the best practice seabird incidental catches mitigation measures outlined in Resolution 12/06 are not implemented.
26. CPCs that have not fully implemented the provisions of the IOTC Regional Observer Scheme outlined in paragraph 2 of Resolution 11/04 shall report seabird incidental catches through logbooks, including details of species, if possible.
27. Appropriate mechanisms should be developed by the Compliance Committee to assess levels of compliance by CPCs with the Regional Observer Scheme requirements and the mandatory measures described in Res 12/06.

APPENDIX 32
EXECUTIVE SUMMARY: CETACEANS

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

Family	Common name	Species	IUCN Red List status*	Interactions by Gear Type**
Balaenidae	Southern right whale	*Eubalaena australis*	LC	GN
Neobalaenidae	Pygmy right whale	*Caperea marginata*	LC	-
Balaenopteridae	Common minke whale	*Balaenoptera acutorostrata*	LC	-
	Antarctic minke whale	*Balaenoptera bonaerensis*	NT	-
	Sei whale	*Balaenoptera borealis*	EN	PS
	Bryde's whale	*Balaenoptera edeni/brydei*	LC	-
	Blue whale	*Balaenoptera musculus*	EN	-
	Fin whale	*Balaenoptera physalus*	VU	-
	Omura's whale	*Balaenoptera omurai*	DD	-
	Humpback whale	*Megaptera novaeangliae*	LC***	GN
Physeteridae	Sperm whale	*Physeter macrocephalus*	VU	GN
Kogiidae	Pygmy sperm whale	*Kogia breviceps*	LC	GN
	Dwarf sperm whale	*Kogia sima*	LC	GN
Ziphiidae	Arnoux's beaked whale	*Berardius arnuxii*	DD	-
	Southern bottlenose whale	*Hyperoodon planifrons*	LC	-
	Longman's beaked whale	*Indopacetus pacificus*	DD	GN
	Andrew's beaked whale	*Mesoplodon bowdoini*	DD	-
	Blainville's beaked whale	*Mesoplodon densirostris*	DD	-
	Gray's beaked whale	*Mesoplodon grayi*	DD	-
	Hector's beaked whale	*Mesoplodon hectori*	DD	-
	Deraniyagala's beaked whale	*Mesoplodon hotaula*	DD	-
	Strap-toothed whale	*Mesoplodon layardii*	DD	-
	True's beaked whale	*Mesoplodon mirus*	DD	-
	Spade-toothed whale	*Mesoplodon traversii*	DD	-
	Shepherd's beaked Whale	*Tasmacetus shepherdi*	DD	-
	Cuvier's beaked whale	*Ziphius cavirostris*	LC	GN
Delphinidae	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
	Indo-Pacific humpback dolphin	*Sousa chinensis*	VU	GN
Delphinidae	Indian Ocean humpback dolphin	*Sousa plumbea*	EN	GN
	Australian humpback dolphin	*Sousa sahulensis*	VU	GN
	Pantropical spotted dolphin	*Stenella attenuata*	LC	PS, GN, LL
	Striped dolphin	*Stenella coeruleoalba*	LC	-
	Spinner dolphin	*Stenella longirostris*	LC	GN
	Rough-toothed dolphin	*Steno bredanensis*	LC	GN
	Indo-Pacific bottlenose dolphin	*Tursiops aduncus*	NT	GN
	Bottlenose dolphin	*Tursiops truncatus*	LC	LL, GN
Phocoenidae	Indo-Pacific finless porpoise	*Neophocaena phocaenoides*	VU	GN

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. The current[31] 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, 2014). Many reports (e.g., Sabarros et al., 2013) also suggest some level of cetacean mortality for species involved in depredation of pelagic longlines, and these interactions need to be further documented throughout the IOTC Area of Competence. Recently published information suggests that the incidental capture of cetaceans in purse seines is low (e.g., Escalle et al., 2015), but should be further monitored.

Outlook. Resolution 13/04 *On the conservation of cetaceans* highlights the concerns of the IOTC regarding the lack of accurate and complete data collection and reporting to the IOTC Secretariat of interactions and mortalities of cetaceans in association with tuna fisheries in the IOTC Area of Competence. In this resolution, the IOTC have agreed that CPCs shall prohibit their flagged vessels from intentionally setting a purse seine net around a cetacean if the animal is sighted prior to the commencement of the set. The IOTC also agreed that CPCs using other gear types targeting tuna and tuna-like species found in association with cetaceans shall report all interactions with cetaceans to the relevant authority of the flag State and that these will be reported to the IOTC Secretariat by 30 June of the following year. It is acknowledged that the impact on cetacean populations from fishing for tuna and tuna-like species may increase if fishing pressure increases (which is already clear for tuna gillnet fisheries from IOTC data) or if the status of cetacean populations worsens due to other factors such as an increase in external fishing pressure or other anthropogenic or climatic impacts.

[31] September 2020

The following should be noted:

28. 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.
29. Available evidence indicates considerable risk to cetaceans in the Indian Ocean, particularly from tuna drift gillnets (Anderson, 2020).
30. Current reported interactions and mortalities are scattered but are most likely severely underestimated (Anderson et al., 2020, Kiszka et al., 2021)
31. 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.
32. 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.

RELEVANT LITERATURE

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APPENDIX 33
STATUS OF YELLOWFIN TUNA CATCH LIMITS FOR 2022 AND 2023 PURSUANT TO RESOLUTIONS 19/01 AND 21/01

Table 1: calculated / estimated total catch limits for 2022 and 2023 for all CPCs bound to Resolution 21/01

YFT annual catch limits (t) for 2022 (calculated) and 2023 (estimated) as per Res. 21/01			
CPC	Base annual limit	Catch limits	
		2022	*2023*
AUS – Australia	2,000	2,000	*2,000*
BGD – Bangladesh	2,000	2,000	*2,000*
CHN – China	10,557	7,658	*7,658*
COM – Comoros	5,279	5,279	*5,279*
ERI – Eritrea	2,000	2,000	*2,000*
EU – European Union	73,078	*72,515	*72,447*
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	*36,587*
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	291,948	*291,948*

* Calculated using a base annual limit of 73,146 t (instead of 73,078 t) that includes 68 t of catches reported by EU,GBR for 2014

Table 2: Calculated / estimated catch limits for 2020-2022 and 2023 for industrial fisheries of all CPCs bound to Resolution 19/01

YFT annual catch limits (t) for 2020, 2021, 2022 (calculated) and 2023 (estimated) as per Res. 19/01						
CPC	**Fishery**	**Base annual limit**	**Catch limits**			
			2020	**2021**	**2022**	***2023***
IDN – Indonesia	**LL**	**11,381**	**11,381**	**11,381**	**11,381**	***11,381***
	PS	**12,395**	**12,395**	**7,515**	**1,666**	***3,402***
	ART	**-**	**-**	**-**	**-**	**-**
IND - India	**LL**	**-**	**-**	**-**	**-**	**-**
	ART	**-**	**-**	**-**	**-**	**-**
IRN – I.R. Iran	**GN**	**21,961**	**21,961**	**-28,907**	**-1,866**	***-8,989***
	PS	**-**	**-**	**-**	**-**	**-**
	ART	**-**	**-**	**-**	**-**	**-**
MDG – Madagascar	**LL**	**-**	**-**	**-**	**-**	**-**
	ART	**-**	**-**	**-**	**-**	**-**
OMN – Oman	**LL**	**-**	**-**	**-**	**-**	**-**
	ART	**-**	**-**	**-**	**-**	**-**
SOM – Somalia	**IND**	**-**	**-**	**-**	**-**	**-**
	ART	**-**	**-**	**-**	**-**	**-**

APPENDIX 34
PROGRESS MADE ON THE RECOMMENDATIONS OF SC24

SC24 Report	SC recommendations	Update/Progress
	National Reports from CPCs	
SC24.08 Para. 26	**NOTING** that the Commission, at its 25th Session (in 2021), noted that there was an improvement in submission of National reports in 2020 over the previous year, it also reiterated its concerns about the lack and poor quality of data, and again, strongly encouraged CPCs to take immediate steps to review, and where necessary, improve their performance with respect to the provision of data through improved compliance with Resolutions 15/01 and 15/02. The SC **RECOMMENDED** that the Commission note that there was a decrease in the Submission of National reports in 2021, as only 21 reports were provided by CPCs (25 in 2020, 23 in 2019, 26 in 2018, 23 in 2017 and 23 in 2016 (Table 2).	**Update:** Ongoing. "(Para 26) The Commission NOTED that 21 National Reports were submitted to the IOTC Secretariat in 2021 by CPCs. Of the 21 National Reports submitted, 6 were submitted after the deadline." CPCs are encouraged to provide national reports whether or not they are attending the SC meeting and that the provision of national reports is a mandatory requirement for all CPCs
SC24.09 Para. 27	The SC **RECOMMENDED** that the Compliance Committee and Commission note the lack of compliance by 9 Contracting Parties (Members) and 1 Cooperating Non-Contracting Party (CNCPs) that did not submit a National Report to the Scientific Committee in 2021, noting that the Commission agreed that the submission of the annual reports to the Scientific Committee is mandatory	**Update:** The SC chair presented the report of the S24 to the Commission in May 2022. The Commission noted this issue.
	Report of the 19th Session of the Working Party on Billfish (WPB19)	
SC24.10 Para. 42	**RECALLING** that one of the Indian Ocean billfish species (shortbill spearfish, *Tetrapturus angustirostris*) is currently not listed among the species managed by IOTC and considering the ocean-wide distribution of this species, its highly-migratory nature, and that it is a common bycatch in IOTC managed fisheries, the SC reiterated its previous **RECOMMENDATION** that shortbill spearfish be included as an IOTC species.	**Update:** Ongoing (Para 4 of IOTC-2022-WPB19-R) - The WPB **NOTED** that a recommendation to include shortbill spearfish in the IOTC list of species had been made for several consecutive years with no progress to date. As such the WPB **AGREED** that it would be more productive to provide some additional justification for this request before making it again, including feedback on catches and the necessity for this inclusion. The WPB also **NOTED** that there may be a need to revise the IOTC agreement to accommodate this request.)
	Revision of catch levels of Marlins under Resolution 18/05	
SC24.11 Para. 56	The SC **NOTED** that catches in recent years for black marlin and Indo-Pacific sailfish have exceeded all recent MSY estimates and catch limits set by Resolution 18/05 (para 3), and that the current catch trends for the two species show no signs of decline - these catch limits will likely be exceeded again in 2021. Furthermore, results from the 2021 assessment of striped marlin provided certainty that the stock is overfished and subject to overfishing (100% probability) and that biomass has been below that which would produce MSY for over a decade. The biomass of striped marlin is considered severely depleted. As such, the SC **NOTED** the inadequacy of Resolution 18/05 in limiting the catches of billfishes and **RECOMMENDED** the Commission to review the Resolution to update catch limits and provide mechanisms to ensure these limits are adhered to.	**Update:** Ongoing. To date no new CMMs have been adopted by the Commission for Billfish.

	Report of the 17th Session of the Working Party on Ecosystems and Bycatch (WPEB17)	
SC24.12 Para. 60	***Status of development and implementation of national plans of action for seabirds and sharks, and implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations*** The SC **RECOMMENDED** that the Commission note the current status of development and implementation of National Plans of Action (NPOAs) for sharks and seabirds, and the implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations, by each CPC as provided in Appendix 5, recalling that the IPOA-Seabirds and IPOA-Sharks were adopted by the FAO in 1999 and 2000, respectively, and recommended the development of NPOAs.	**Update:** Ongoing. 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 2022.
SC24.13 Para. 74	***Other matters*** The SC **ACKNOWLEDGED** the proposed Letter of Intent between the IWC and IOTC and **NOTED** that this letter is based on the language used in the Letter of Intent between IOTC and ACAP which has been accepted by the Commission. The SC **RECOMMENDED** that the letter is presented at the Commission for further consideration.	**Update:** Completed. The Commission approved an agreement to increase cooperation between the IOTC and IWC.
SC24.14 Para. 77	The SC **NOTED** the use of subsurface gillnetting in the Indian Ocean may be an effective mitigation measure to reduce bycatch of cetaceans, sharks and sea turtles and that Resolution 19/01 already requests the utilization of subsurface gillnets by 2023 to mitigate ecological impacts of this gear. The SC **RECOMMENDED** that it be kept informed by the Commission on the current status of implementation of the relevant clause of Resolution 19/01.	**Update:** Ongoing. The SC will continue to liaise with the Commission to receive this information
	Report of the 23rd Session of the Working Party on Tropical Tunas (WPTT23)	
SC24.15 Para. 103	***Yellowfin tuna Stock Assessment*** The SC **NOTED** the importance of the peer review process and its role in providing improved scientific advice for management. The SC therefore **RECOMMENDED** that the Commission endorse the process for a YFT stock assessment review as well as the BET MSE review and provide the financial resources to conduct the work planned.	**Update**: Approved. The Commission endorsed the process, and a yellowfin tuna stock assessment peer review meeting will be held in February 2023. The BET MSE expert will also be contracted in 2023.
SC24.16 Para. 107	***Update on the WGFAD02*** The SC **RECOMMENDED** the Committee endorse the process to improve current definitions of FAD and FAD activities used by the IOTC, to be conducted by the WPTT and WGFAD	**Update**: Ongoing. The issues was once again discussed during the WGFAD03 meeting in 2022 and progress is being made in a small WG to advance the adoption of standardised definitions.

	Report of the 12th Session of the Working Party on Methods (WPM12)	
	Management Strategy Evaluation Progress	
SC24.17 (para. 114)	The SC **NOTED** the guidelines included as Appendix 6a to this report to deal with exceptional circumstances in the MSE process. The SC further **NOTED** that these guidelines are a living document and revisions may still be required in the future. The SC **RECOMMENDED** that the Commission consider and endorse the guidelines.	**Update**: Endorsed. The Commission endorsed the document, and it is included/referenced in Res 22/03.
SC24.18 (para. 115)	The SC **NOTED** the revised schedule of MSE work included as Appendix 6b to this report to provide the timeframe for the development of management procedures for key IOTC species. The SC **NOTED** that the revised MSE schedule is still ambitious but that the technical work could, in principle, be completed within the proposed timeframes with minor adjustments. The SC **RECOMMENDED** that the Commission consider and endorse the revised timetable.	**Update**: Completed. The Commission endorsed the revised timetable.
	Report of the 17th Session of the Working Party on Data Collection and Statistics (WPDCS17)	
SC24.19 (para. 136)	**NOTING** that the WPDCS identified aspects of several data-related resolutions that are either unclear or inconsistent (15/01, 15/02 and 19/02) the SC **RECOMMENDED** that the Commission consider how to best address these issues at the next revision of each resolution. **ACKNOWLEDGING** that the workload of the Secretariat data team has increased markedly in recent years to manage an increasing number of datasets, provide more data outputs, and improve data access, the SC **RECOMMENDED** that the Commission consider strengthening the capacity of the Secretariat's Data Group with the addition of an extra staff member**.**	**Update**: Ongoing. No revision to the relevant Resolutions were undertaken in 2021/22
SC24.20 (para. 139)	The SC **ACKNOWLEDGED** the long-term relationship between the OFCF and the IOTC to improve the collection, management and reporting of fisheries statistics and **RECOMMENDED** the Commission consider the continuation of this collaboration through an appropriate arrangement.	**Update**: Ongoing. The Commission endorsed the new position, but it has yet to be filled
SC24.21 (para. 140)	***Update on WGEMS01*** The SC **NOTED** the outcomes of the 1st ad-hoc IOTC WGEMS and **RECOMMENDED** the Commission endorse its continuation in the future and for the Commission to discuss if the WGEMS should remain under the WPDCS or report directly to the SC or CoC. The SC **ENDORSED** the Terms of Reference and Plan of Work for the WGEMS.	**Update**: Completed. The Commission endorsed and agreed to a Collaborative agreement with OFCF.
SC24.22 (para. 143)		**Update**: Completed. The WGEMS was endorsed by the Commission and held its second meeting in 2022.
SC24.23 Para. 145	***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 2023.
SC24.24 Para. 147	***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	**Update**: All meetings have been held online since 2019, apart from the 2022 SC and as such the MPF has not been significantly utilized recently. It is envisioned that hybrid meetings will be held in 2023 and as such the MPF will once again be utilised.

	later than 60 days, and that the full Draft paper be submitted no later than 45 days before the start of the relevant meeting. The aim is to allow the Selection Panel to review the full paper rather than just the abstract, and provide guidance on areas for improvement, as well as the suitability of the application to receive funding using the IOTC MPF. The earlier submission dates would also assist with visa application procedures for candidates.	
SC24.25 Para. 148	***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 2022 and will do again in 2023.
SC24.26 Para. 150	***General - Chairpersons and Vice-Chairpersons of the SC and its subsidiary bodies*** The SC **RECOMMENDED** that the Commission note and endorse the Chairpersons and Vice-Chairpersons for the SC and its subsidiary bodies for the coming years, as provided in Appendix 7.	**Update:** Completed
SC24.27 Para. 181	***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 2022.

APPENDIX 35A
WORKING PARTY ON NERITIC TUNAS PROGRAM OF WORK (2023 – 2027)

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				
		2023	2024	2025	2026	2027
1. Stock structure (connectivity)	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)					
2. Stock assessment / Stock indicators	Explore alternative assessment approaches and develop improvements where necessary based on the data available to determine stock status for longtail tuna, kawakawa and Spanish mackerel					
	1) The Weight-of-Evidence approach should be used to determine stock status, by building layers of partial evidence, such as CPUE indices combined with catch data, life-history parameters and yield-per recruit metrics, as well as the use of data poor assessment approaches (eg. CMSY, OCOM, LB-SPR, Risk based methods). 2) Exploration of priors and how these can be quantifiably and transparently developed 3) Take into consideration the outputs of genetic studies to investigate stock structure and regional differences in populations Improve the presentation of management advice from different assessment approaches to better represent the uncertainty and improve communication between scientists and managers in the IOTC.					
3. Data mining and collation	Collate and characterize operational level data for the main neritic tuna fisheries in the Indian Ocean to investigate their suitability to be used for developing standardised CPUE indices. The following data should be collated and made available for collaborative analysis: ➢ 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) 4) (Data support missions to priority countries: India, Oman, Pakistan)					

Other Future Research Requirements						
4. Biological information (parameters for stock assessment)	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 Bullet and Frigate tunas as well as Indo-Pacific King Mackerel.					
5. 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).

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 (2023 – 2027)

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				
		2023	2024	2025	2026	2027
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.					
3. Stock structure (connectivity and diversity)	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.					
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 (2023 – 2027)

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				
		2023	2024	2025	2026	2027
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 Historical data mining for the key species and IOTC fleets (e.g., as artisanal gillnet and longline coastal fisheries) including workshops:					
	1.1.2 Historical data mining for the key species, including the collection of information about catch, effort and spatial distribution of those species and fleets catching them					
	1.1.3 Catch composition reconstruction (initial focus Pakistan and Indonesia)					
	1.2 Implementation of the Pilot Project (Resolution 16/04) for the Regional Observer Scheme					
	1.2.1 Development of a Regional Observer database and population with historic observer data					
	1.2.2 Development, piloting and implementation of an electronic reporting tool to facilitate data reporting					
	1.2.3 Development and trial of Electronic Monitoring Systems for gillnet fleets					
	1.2.4 Port sampling protocols for artisanal fisheries					

2. Shark research plans	Consultancy to develop shark research plans Priority species: scalloped hammerhead sharks					
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)					

* The WPEB is not requesting funds for this activity at this time

Other Future Research Requirements (not in order of priority)

Topic	Sub-topic and project	2022	2023	2024	2025	2026
1. Fisheries data collection	1.1 Historical data mining for the key species and IOTC fleets (e.g., as artisanal gillnet and longline coastal fisheries) including (Workshops – leader?):					
	1.1.1 Capacity building of fisheries observers (including the provision of ID guides, training, etc. Fishing gear guides from SPC)					
	1.1.2 Historical data mining for the key species, including the collection of information about catch, effort and spatial distribution of those species and fleets catching them					
	1.2 Implementation of the Pilot Project (Resolution 16/04) for the Regional Observer Scheme					
	1.2.1 Definition of minimum standards and development of a training package for the ROS to be reviewed and rolled out in voluntary CPCs (Sri Lanka, I.R. Iran, Tanzania)					
	1.2.2 Development of a Regional Observer database and population with historic observer data					

	1.2.3 Development, piloting and implementation of an electronic reporting tool to facilitate data reporting					
	1.2.4 Development and trial of Electronic Monitoring Systems for gillnet fleets					
	1.2.5 Port sampling protocols for artisanal fisheries					
	1.3 Review the status of manta and mobula rays and their interaction with IOTC fisheries. Evaluation of data availability and data gaps. Include ID guide revision and translation. ID guides to be updated with help of CPC scientists					
2. Bycatch mitigation measures	Undertake a series of gear specific workshops focusing on multi-taxa bycatch issues					
	Develop studies on bycatch mitigation measures (operational, technological aspects and best practices)					
	2.1 Sharks a) Harmonise and finalise guidelines and protocols for safe handling and release of sharks and rays caught in IOTC fisheries					
	2.2 Sea turtles 2.2.1 Res. 12/04 (para. 11) Part I. The IOTC Scientific Committee shall request the IOTC Working Party on Ecosystems and Bycatch to:					
	a) Develop recommendations on appropriate mitigation measures for gillnet, longline and purse seine fisheries in the IOTC area; [mostly completed for LL and PS]					
	b) Develop regional standards covering data collection, data exchange and training					
	2.2.2 Res. 12/04 (para. 17) The IOTC Scientific Committee shall annually review the information reported by CPCs pursuant to this measure and, as necessary, provide recommendations to the Commission on ways to strengthen efforts to reduce marine turtle interactions with IOTC fisheries.					

	2.2.3 Regional workshop to review the effectiveness of marine turtle mitigation measures					
	2.2.4 Harmonise and finalise guidelines and protocols for safe handling and release of sea turtles caught in IOTC fisheries					
	2.3 Seabirds 2.3.1 Res. 12/06 (para. 8) The IOTC Scientific Committee, based notably on the work of the WPEB and information from CPCs, will analyse the impact of this Resolution on seabird bycatch no later than for the 2016 meeting of the Commission. It shall advise the Commission on any modifications that are required, based on experience to date of the operation of the Resolution and/or further international studies, research or advice on best practice on the issue, in order to make the Resolution more effective.					
	2.3.2 Bycatch assessment for seabirds taking into account the information from the various ongoing initiatives in the IO and adjacent oceans					
	2.3.3 Study on cryptic mortality of seabirds in tuna LL fisheries.					
	2.3.4 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 Collate all data available on bycatch of key species interacting with all tuna fisheries in the IOTC area (tuna drift gillnets, longlines, purse seines)					
	2.4.2 Collaborate with other organisations on the assessment of marine mammal abundance and collect data on marine mammal bycatch interactions with gillnets across the IOTC region					
	2.4.3 Testing mitigation methods for cetacean bycatch in tuna drift gillnet fisheries					
	2.4.4 Harmonise and finalise guidelines and protocols for safe handling and release of cetaceans caught in IOTC fisheries					
	2.4.5. 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. Bycatch and discards	4.1 Review proposal on retention of non-targeted species					
	4.1.1 The Commission requested that the Scientific Committee review proposal IOTC–2014– S18–PropL Rev_1, and to make recommendations on the benefits of retaining non-targeted species catches, other than those prohibited via IOTC Resolutions, for consideration at the 19th Session of the Commission. (S18 Report, para. 143). Noting the lack of expertise and resources at the WPEB and the short timeframe to fulfil this task, the SC RECOMMENDED that a consultant be hired to conduct this work and present the results at the next WPEB meeting. The following tasks, necessary to address this issue, should be considered for the terms of reference, taking into account all species that are usually discarded on all major gears (i.e., purse-seines, longlines and gillnets), and fisheries that take place on the high seas and in coastal countries EEZs:					
	i) Estimate species-specific quantities of discards to assess the importance and potential of this new product supply, integrating data available at the Secretariat from the regional observer programs,					

	ii) Assess the species-specific percentage of discards that is captured dead versus alive, as well as the post-release mortality of species that are discarded alive, in order to estimate what will be the added fishing mortality to the populations, based on the best current information, iii) Assess the feasibility of full retention, taking into account the specificities of the fleets that operate with different gears and their fishing practices (e.g., transhipment, onboard storage capacity).					
	iv) Assess the capacity of the landing port facilities to handle and process this catch.					
	v) Assess the socio-economic impacts of retaining non-target species, including the feasibility to market those species that are usually not retained by those gears,					
	vi) Assess the benefits in terms of improving the catch statistics through port-sampling programmes,					
	vii) Evaluate the impacts of full retention on the conditions of work and data quality collected by onboard scientific observers, making sure that there is a strict distinction between scientific observer tasks and compliance issues.					
5. Ecosystems	5.1 Develop a plan for Ecosystem Approach to Fisheries (EAF) approaches in the IOTC, in conjunction with the Common Oceans Tuna Project.					
	5.1.2 Workshop for CPCs on continuing efforts to the development of an EAF including delineation of candidate eco regions within IOTC.					
	5.1.3 Practical Implementation of EBFM with the development and testing of ecosystem report cards.					

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

APPENDIX 35E
WORKING PARTY ON TROPICAL TUNAS PROGRAM OF WORK (2023 – 2027)

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				
		2023	2024	2025	2026	2027
Stock assessment priorities	Address the issues identified as priorities by the yellowfin tuna peer review panel (February 2023)					
CPUE standardisation	Develop standardised CPUE series for each tropical tuna fleet/fishery for the Indian Ocean • Review period where stock was assessed as being overfished without experiencing overfishing. • Regional scaling parameters • Effect of piracy on CPUE after piracy period					
Fisheries impact analysis	Impact of individual fisheries on stock parameters					

Other Future Research Requirements (not in order of priority)						
1. Stock structure (connectivity and diversity)	1.1 Genetic research to determine the connectivity of tropical tuna species throughout their distribution (including in adjacent Pacific Ocean waters as appropriate) and the effective population size.					
	1.1.1 Population genetic analyses to decipher intraspecific connectivity, levels of gene flow, genetic divergence and effective population sizes based on genome-wide distributed Single Nucleotide Polymorphisms (SNPs).					
	1.2 Connectivity, movements and habitat use					
	1.2.1 Connectivity, movements, and habitat use, including identification of hotspots and investigate associated environmental conditions affecting the tropical tuna species distribution, making use of conventional and electronic tagging (P-SAT).					

	1.2.2 Investigation into the degree of local or open population in main fishing areas (e.g,, the Maldives and Indonesia – archipelagic and open ocean) by using techniques such flux in FAD arrays or used of morphological features such as shape of otoliths.					
2. Biological and ecological information (incl. parameters for stock assessment)	2.1 Biological sampling					
	2.1.1 Design and develop a plan for a biological sampling program to support research on tropical tuna biology. The plan would consider the need for the sampling program to provide representative coverage of the distribution of the different tropical tuna species within the Indian Ocean and make use of samples and data collected through observer programs, port sampling and/or other research programs. The plan would also consider the types of biological samples that could be collected (e.g. otoliths, spines, gonads, stomachs, muscle and liver tissue, fin clips, etc.), the sample sizes required for estimating biological parameters, and the logistics involved in collecting, transporting and processing biological samples. The specific biological parameters that could be estimated include, but are not limited to, estimates of growth, age at maturity, fecundity, sex ratio, spawning season, spawning fraction and stock structure.					
	2.1.2 Collect gonad samples from tropical tunas to confirm the spawning periods and location of the spawning area that are presently hypothesized for each tropical tuna species.					
3. Historical data review	3.1 Changes in fleet dynamics need to be documented by fleet					
	3.1.1 Provide an evaluation of fleet-specific fishery impacts on the stock of bigeye tuna, skipjack tuna and yellowfin tuna. Project potential impact of realizing fleet development plans on the status of tropical tunas based upon most recent stock assessments.					
4 CPUE standardisation	4.1 Develop standardised CPUE series for each tropical tuna fleet/fishery for the Indian Ocean					
	4.1.1 Further development and validation of the collaborative longline CPUE indices using the data from multiple fleets and to provide joint CPUE series for longline fleets where possible					

		4.1.2 That standardised CPUE index for juvenile yellowfin tuna and bigeye tuna caught by the EU purse seiner fleets, be estimated and submitted to the WPTT before the next round of stock assessments of tropical tunas.					
		4.1.3 Development of minimum criteria (e.g. 10% using a simple random stratified sample) for logbook coverage to use data in standardisation processes; and 2) identifying vessels through exploratory analysis that were misreporting, and excluding them from the dataset in the standardisation analysis.					
		4.1.4 Vessel identity information for the Japanese fleets for the period prior to 1979 should be obtained either from the original logbooks or from some other source, to the greatest extent possible to allow estimation of catchability change during this period and to permit cluster analysis using vessel level data.					
		Bigeye tuna: High priority fleets					
		Skipjack tuna: High priority fleets					
		Yellowfin tuna: High priority fleets					
		4.1.5 Gillnet CPUE standardization including further investigate and use of gillnet CPUE series from Sri Lankan gillnet fishery					
		4.1.6 Workshops to assist in standardising CPUEs for tropical tuna fleets					
		4.2 That methods be developed for standardising purse seine catch species composition using operational data, so as to provide alternative indices of relative abundance (see Terms of Reference, Appendix IXb IOTC-2017-WPTT19-R).					
		4.3 Investigate the potential to use the Indian longline survey as a fishery-independent index of abundance for tropical tunas.					
5	Stock assessment / stock indicators	5.1 Develop and compare multiple assessment approaches to determine stock status for tropical tunas 5.2 Scoping of ongoing age composition data collection for stock assessment 5.3 Develop a high resolution age structured operating model that can be used to test the spatial assumptions including potential effects of limited tags mixing on stock assessment outcomes (see Terms of Reference, Appendix IXa IOTC-2017-WPTT19-R).					
6	Fishery monitoring	6.1 Develop fishery independent estimates of stock abundance to validate the abundance estimates of CPUE series.					

		All of the tropical tuna stock assessments are highly dependent on relative abundance estimates derived from commercial fishery catch rates, and these could be substantially biased despite efforts to standardise for operational variability (e.g. spatio-temporal variability in operations, improved efficiency from new technology, changes in species targeting). Accordingly, the IOTC should continue to explore fisheries independent monitoring options which may be viable through new technologies. There are various options, among which some are already under test. Not all of these options are rated with the same priority, and those being currently under development need to be promoted, as proposed below: i. Acoustic FAD monitoring, with the objective of deriving abundance indices based on the biomass estimates provided by echo-sounder buoys attached to FADs ii. Longline-based surveys (expanding on the Indian model) or "sentinel surveys" in which a small number of commercial sets follow a standardised scientific protocol iii. Aerial surveys, potentially using remotely operated or autonomous drones iv. Studies (research) on flux of tuna around anchored FAD arrays to understand standing stock and independent estimates of the stock abundance. v. Investigate the possibility of conducting ongoing ad hoc, low level tagging in the region					
7	Target and Limit reference points	7.1 To advise the Commission, on Target Reference Points (TRPs) and Limit Reference Points (LRPs). Used when assessing tropical tuna stock status and when establishing the Kobe plot and Kobe matrices					
8	Fisheries Independent Monitoring	8.1 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). 8.2 Plan for a staged approach for implementation of a YFT CKMR project					
9	Fisheries Indicators	9.1 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.					
10	Peer review	10.1 Plan and ToRs for a peer review to be presented to the SC					

APPENDIX 35F
WORKING PARTY ON DATA COLLECTION AND STATISTICS PROGRAM OF WORK (2022 – 2026)

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	Timings				
		2023	2024	2025	2026	2027
Coastal fisheries data collection	Assist the implementation of data collection and sampling activities for fisheries insufficiently sampled. Priority to be given to the following fisheries:					
	• Indonesia					
	• India					
	• Bangladesh					
	• Pakistan					
	• I.R. Iran					
	• Kenya					
	• Somalia					
	• Sri Lanka					
Evaluation of catch and effort data uncertainties	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					

Other Future Research Requirements (not in order of priority)						
Topic	Sub-topic and project	Timings				
		2023	2024	2025	2026	2027
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)					
2 Compliance with IOTC data reporting requirements	**2.1** Data compliance support missions					
	2.1.1 Drafting of indicators to assess performance of IOTC CPCs against IOTC Data Requirements; evaluation of performance of IOTC CPCs with those Requirements; development of plans of action to address the issues identified, including timeframe of implementation and follow-up activities required. Priority to be given to the following CPCs / fisheries:					
	• Indonesia					
	• India					

		• Pakistan						
		• Oman						
		• Sri Lanka						
		• Somalia						
		• Other (as required / determined)						
	2.2	Workshops to clarify data reporting requirements						
	2.3	Support the documentation of sampling protocols and processing						
3 **Data access**	**3.1**	Improve discoverability of IOTC scientific assets through standard metadata and DOI						
4 **Support for the implementation of the IOTC Regional Observer Scheme (ROS)**	**4.1**	ROS e-tools						
	4.1.1	Support the adoption of the ROS e-Reporting and ROS national database tools by countries not having any existing observer data collection and management system in place						
	4.2	ROS Regional Database						
	4.2.1	Incorporate all historical observer data currently available in other proprietary data formats (e.g., ObServe, ICCAT ST09 and other custom observer forms)						
	4.3	ROS Electronic Monitoring Systems						
	4.3.1	Implement pilot EMS system on gillnet / coastal longline vessels for fleets insufficiently covered by on-board observers, possibly by providing support through remote / in-person meetings						
	4.4	Evaluate the combination of alternative data collection systems and protocols for the collection of scientific observer data for artisanal and coastal fisheries, with an initial expert to develop protocols and guidelines for minimum data collection requirements in coastal fisheries, including through EMS systems.						

APPENDIX 35G
WORKING PARTY ON METHODS PROGRAM OF WORK (2023 – 2027)

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				
		2023	2024	2025	2026	2027
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)					
1.3 Bigeye tuna					
1.3.1 Presentation of MP application and exceptional circumstances and resulting TAC to the TCMP and Commission meeting					
1.3.2 External peer review					
1.3.3. Run MP, consider exceptional circumstances and provide the TAC advice					
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 Revision of Operating Models based on WPM and SC feedback, including possible robustness tests					
1.5.2 Implementation of simulation runs and presentation of results at the TCMP					

1.5.3 Revision and evaluation of new set of Management Procedures after presentation of MP runs to TCMP and Commission (as needed)						
Multiple stock status derived from different model structures	3.1 Develop specific guidance for the most appropriate models to be used or how to synthesize the results when multiple stock assessment models are presented. (*see IOTC-2016-WPTT18-R, para.91*)					
Presentation of stock status advice for data limited stocks	2.1 Explore potential methods of presenting stock status advice to managers from a range of data limited scenarios, e.g. through the development of a 'Tier' approach for providing stock status advice, based on the type of indictors used to determine stock status (e.g. CPUE series, stock assessment model)					
Peer Review	External peer review based on Terms of Reference agreed to by the WPM and following the schedule recommended in Appendix V of the WPM12 report.					
Capacity Building	Ongoing development of tools, materials and courses to continue Capacity Building for increasing participation in the MSE process					

APPENDIX 36
SCHEDULE OF STOCK ASSESSMENTS FOR IOTC SPECIES AND SPECIES OF INTEREST FROM 2023–2027, AND FOR OTHER WORKING PARTY PRIORITIES

Working Party on Neritic Tunas					
Species	**2023***	**2024***	**2025****	**2026***	**2027***
Bullet tuna	Data preparation	**Assessment**	Data preparation	Data preparation	**Assessment**
Frigate tuna	Data preparation	**Assessment**	Data preparation	Data preparation	**Assessment**
Indo-Pacific king mackerel	Data preparation	**Assessment**	Data preparation	Data preparation	**Assessment**
Kawakawa	**Assessment**	Data preparation	Data preparation	**Assessment**	Data preparation
Longtail tuna	**Assessment**	Data preparation	Data preparation	**Assessment**	Data preparation
Narrow-barred Spanish mackerel	**Assessment**	Data preparation	Data preparation	**Assessment**	Data preparation

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

Working Party on Billfish					
Species	**2023**	**2024**	**2025**	**2026**	**2027**
Black marlin		**Full assessment**			**Full assessment**
Blue marlin			**Full assessment**		
Striped marlin		**Full assessment**			**Full assessment**
Swordfish	**Full assessment**		**Indicators****	**Full assessment**	
Indo-Pacific sailfish			**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	**2023**	**2024**	**2025**	**2026**	**2027**
Bigeye tuna	Indicators	Indicators **MP to be run**	**Data preparatory meeting** **Full assessment**	Indicators	Indicators
Skipjack tuna	**Data preparatory meeting** **Full assessment**	Indicators	Indicators	**Data preparatory meeting** **Full assessment**	Indicators
Yellowfin tuna	External Review of 2021 Assessment	**Data preparatory meeting** **Full assessment**	Indicators	Indicators	**Data preparatory meeting** **Full assessment**
Working Party on Ecosystems and Bycatch					
Species	**2023**	**2024**	**2025**	**2026**	**2027**
Blue shark	–	–	Data preparatory meeting Full assessment	-	–
Oceanic whitetip shark	–	Data preparation	Indicator analysis	-	Data preparation
Scalloped hammerhead shark	Workplan to be developed	–	–	-	–
Shortfin mako shark		Data preparation 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. 12/06	–
Marine Mammals	–	–	Review of mitigation measures	-	–
Ecosystem Based Fisheries Management (EBFM) approaches		Ecoregions pilot study			
Series of multi-taxa bycatch mitigation workshops	Focus: gillnets	Focus: gillnets	Focus: tbd	Focus: tbd	Focus: tbd

*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	**2023**	**2024**	**2025**	**2026**	**2027**
Albacore	–		Data preparatory Meeting (4 days) (April/May/June) Stock assessment meeting (5 days) (July/August)	–	–

APPENDIX 37
SCHEDULE OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE MEETINGS
(2022 and 2023)

	2023			2024		
Meeting	**No.**	**Date**	***Location**	**No.**	**Date**	***Location**
Yellowfin Tuna Stock Assessment Peer Review workshop	1st	6 – 10 February (5d)	Rome, Italy		NA	
Ad hoc Working Group on Electronic Monitoring Systems (WGEMS))	3rd	15-16 March (2d)	Virtual	20th	TBC if applicable	Virtual
Management Strategy Evaluation Task Force of the Working Party on Methods (WPM)	14th	28 – 31 March (4d)	Virtual	15th	February/March	Virtual
Working Party on Tropical Tunas (Data Preparatory meeting) (WPTT) and WGFAD	25th and 4th	29 May-2 June (5d) 5 hours per day	Virtual	26th	TBC if applicable	Virtual
Working Party on Neritic Tunas (WPNT)	13th	3-7 July (5d)	TBC	14th	July	TBC
Working Party on Billfish (WPB)	21st	6-9 September (4d) (with WPEB)	Reunion	20th	September (with WPB)	TBC
Working Party on Ecosystems and Bycatch (WPEB)	19th	11-15 September (5d) (with WPB)	Reunion	22nd	September (with WPEB)	TBC
Working Party on Methods	14th	26-28 October (3d) (with WPTT)	San Sebastian	15th	October (3d) (with WPTT)	TBC
Working Party on Tropical Tunas (Assessment meeting)	25th	30 October – 4 November (6d) (with WPM)	San Sebastian	26th	October (6d) (with WPM)	TBC
Working Party on Data Collection and Statistics	19th	28 November - 2 December (5d)	TBC	20th	November (5d)	TBC
Scientific Committee	26th	4-8 December (5d)	TBC	27th	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 25TH SESSION OF THE SCIENTIFIC COMMITTEE (5 – 9 DECEMBER 2022) TO THE COMMISSION

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

Tuna – Highly migratory species

SC25.01 (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

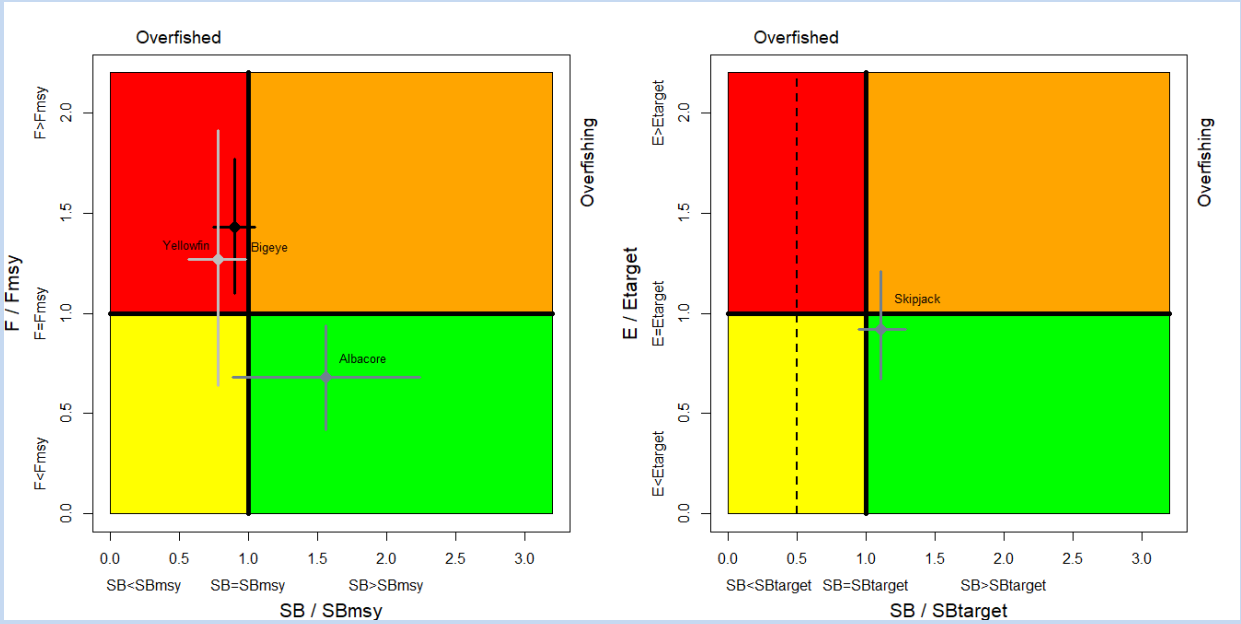

Fig. 1. (Left) Combined Kobe plot for bigeye tuna (black: status in 2021, based on the assessment conducted in 2022), and yellowfin tuna (light grey: 2020, with assessment conducted in 2021) and albacore (dark grey: 2020 with assessment conducted in 2022) showing the estimates of current spawning biomass (SB) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality. (Right) Kobe plot for skipjack tuna (2019 with assessment conducted in 2020) showing the estimates of the current stock status (The dashed line indicates the limit reference point at 20%SB0 while SBtarget=0.4 SB0). Cross bars illustrate the range of uncertainty from the model runs with an 80% CI (95% CI for albacore).

Billfish

SC25.02 (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):

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

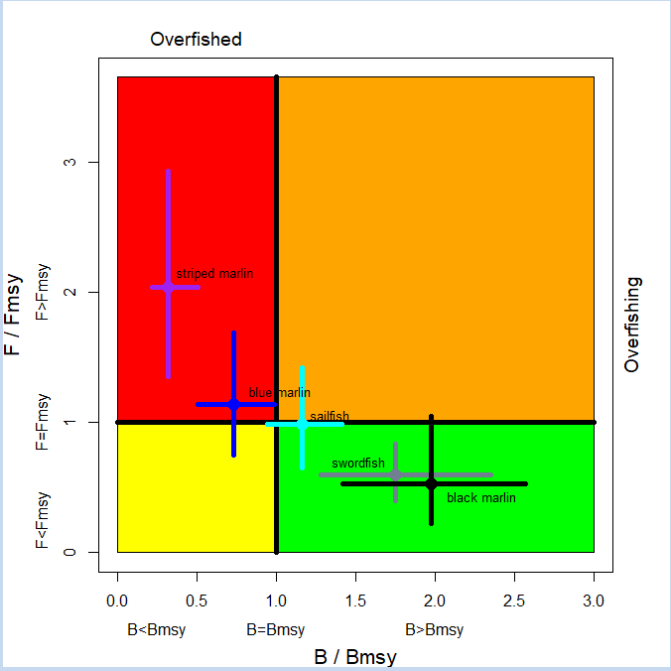

Fig. 3. Combined Kobe plot for swordfish (2018 with assessment conducted in 2020, grey), Indo-Pacific sailfish (2019 with assessment conducted in 2022, cyan), black marlin (2019 with assessment conducted in 2021, black), blue marlin (2020 with assessment conducted in 2022, blue) and striped marlin (2019 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.

Tuna and seerfish – Neritic species

SC25.03 (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 17
Frigate tuna (*Auxis thazard*) – Appendix 18
Kawakawa (*Euthynnus affinis*) – Appendix 19
Longtail tuna (*Thunnus tonggol*) – Appendix 20
Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix 21
Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix 22

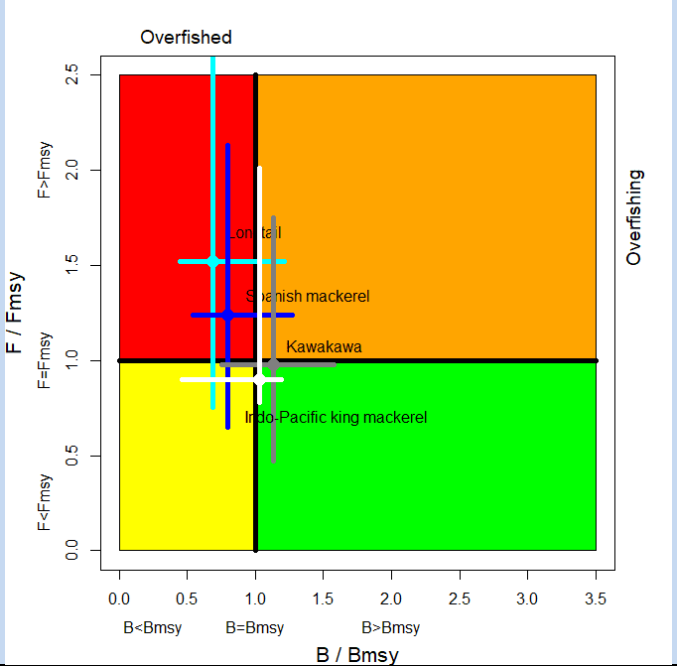

Fig. 2. Combined Kobe plot for longtail tuna (cyan), narrow-barred Spanish mackerel (blue), kawakawa (grey) (all for 2018 with assessment carried out in 2020, white) and Indo-Pacific king mackerel (2019 with assessment carried out in 2021(white)), showing the estimates of stock size (B) and current fishing 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.

Sharks

SC25.04 (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

SC25.05 (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

SC25.06 (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

SC25.07 (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

SC25.08 (para. 30) 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**.**

REPORT OF THE 12TH SESSION OF THE WORKING PARTY ON NERITIC TUNAS (WPNT12)

SC25.09 (para. 41) 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**.**

REPORT OF THE 20TH SESSION OF THE WORKING PARTY ON BILLFISH (WPB20)

Revision of catch levels of Marlins under Resolution 18/05

SC25.10 (para. 52) 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.

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.

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.

REPORT OF THE 18TH SESSION OF THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH (WPEB18)

SC25.13 (para. 62) 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 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).

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.

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.

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.

REPORT OF THE 24TH SESSION OF THE WORKING PARTY ON TROPICAL TUNAS (WPTT24)

Bigeye tuna MP

SC25.18 (para. 98) 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.

SC25.19 (para. 99) 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.

REPORT OF THE 13TH SESSION OF THE WORKING PARTY ON METHODS (WPM13)

SC25.20 (para. 118) 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

SC25.21 (para. 122) 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.

SC25.22 (para. 123) 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

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**.**

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.

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.

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 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.

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

SC25.29 (para. 151) 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.

Meeting participation fund

SC25.30 (para. 153) The SC reiterated its **RECOMMENDATION** that the IOTC Rules of Procedure (2014), for the administration of the Meeting Participation Fund be modified so that applications are due not later than 60 days, and that the full Draft paper be submitted no later than 45 days before the start of the relevant meeting. The aim is to allow the Selection Panel to review the full paper rather than just the abstract, and provide guidance on areas for improvement, as well as the suitability of the application to receive funding using the IOTC MPF. The earlier submission dates would also assist with visa application procedures for candidates.

IOTC species identification guides: Tuna and tuna-like species

SC25.31 (para. 154) 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

SC25.32 (para. 156) **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

SC25.33 (para. 157) 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

SC25.34 (para. 172) 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.

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

Consultants

SC25.35 (para. 186) 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

SC25.36 (para. 188) **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.

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.

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

SC25.38 (para. 192) The SC **RECOMMENDED** that the Commission consider the consolidated set of recommendations arising from SC25, provided at Appendix 38.