Report of the 12th Session of the IOTC Working Party on Neritic Tunas

Microsoft Teams Online, 4 – 8 July 2022

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ACRONYMS

B	Biomass (total)
BLT	Bullet tuna
B_{MSY}	Biomass which produces MSY
CMM	Conservation and Management Measure (of the IOTC; Resolutions and Recommendations)
C-MSY	Catch and Maximum Sustainable Yield data limited stock assessment method
COM	Narrow-barred Spanish mackerel
CPCs	Contracting parties and cooperating non-contracting parties
CPUE	Catch per unit of effort
current	Current period/time, i.e. $F_{current}$ means fishing mortality for the current assessment year.
EEZ	Exclusive Economic Zone
F	Fishing mortality; F_{2017} is the fishing mortality estimated in the year 2017
FAD	Fish aggregating device
F_{MSY}	Fishing mortality at MSY
FRI	Frigate tuna
GLM	Generalised Linear Model
GUT	Indo-Pacific king mackerel
IO	Indian Ocean
IOTC	Indian Ocean Tuna Commission
KAW	Kawakawa
LL	Longline
LOT	Longtail tuna
M	Natural mortality
MPF	Meeting Participation Fund
MSY	Maximum sustainable yield
n.a.	Not applicable
OCOM	Optimised Catch Only Method
PS	Purse seine
ROS	Regional Observer Scheme
SB	Spawning Biomass (sometimes expressed as SSB)
SB_{MSY}	Spawning stock Biomass which produces MSY
SC	Scientific Committee of the IOTC
SEAFDEC	Southeast Asian Fisheries Development Center
SRA	Stock Reduction Analysis
SWIOFP	South West Indian Ocean Fisheries Project
VB	Von Bertalanffy (growth)
WPDCS	Working Party on Data Collection and Statistics
WPNT	Working Party on Neritic Tunas of the IOTC
WWF	World Wide Fund for Nature (a.k.a World Wildlife Fund)

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.
NOTED/NOTING: Any point of discussion from a meeting which the IOTC body considers to be important enough to record in a meeting report for future reference.

Any other term: Any other term may be used in addition to the Level 3 terms to highlight to the reader of and IOTC report, the importance of the relevant paragraph. However, other terms used are considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3, described above (e.g. **CONSIDERED**; **URGED**; **ACKNOWLEDGED**).

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EXECUTIVE SUMMARY

The 12th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT12) was held online using the Microsoft Teams online platform from 4 - 8 July 2022. A total of 36 participants (33 in 2021, 43 in 2020, and 18 in 2019) attended the Session. The list of participants is provided at Appendix I. The meeting was opened by the Chairperson, Ms Ririk Sulistyaningsih from Indonesia, who welcomed participants to the meeting.

Revision of the WPNT Program of Work (2023–2027)

WPNT12.01 (para 79) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2023–2027), as provided in Appendix VI.

Review of the draft, and adoption of the Report of the 12th Working Party on Neritic Tunas

WPNT12.02 (para 81) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT12, provided in Appendix XIII, as well as the management advice provided in the draft resource stock status summary for each of the six neritic tuna (and seerfish) species under the IOTC mandate, and the combined Kobe plot for the species assigned a stock status in 2022:

- Bullet tuna (*Auxis rochei*) – Appendix VII
- Frigate tuna (*Auxis thazard*) – Appendix VIII
- Kawakawa (*Euthynnus affinis*) – Appendix IX
- Longtail tuna (*Thunnus tonggol*) – Appendix X
- Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix XI
- Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix XII

Table 1. Status summary for species of neritic tuna and tuna-like species under the IOTC mandate: 2022

Neritic tunas and seerfish: these six species have become as important or more important as the three tropical tuna species (bigeye tuna, skipjack tuna and yellowfin tuna) to most IOTC coastal states with a total estimated catch of 643,243 t landed in 2020. They are caught primarily by coastal fisheries, including small-scale industrial and artisanal fisheries. They 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	Previous	2017	2018	2019	2020	2021	2022	Advice to the Commission
Bullet tuna *Auxis rochei*	Catch 2020: 28,698 t Average catch 2016-2020: 21,979 t MSY (1,000 t) unknown F_{MSY}: unknown B_{MSY} (1,000 t): unknown $F_{current}/F_{MSY}$: unknown $B_{current}/B_{MSY}$: unknown $B_{current}/B_0$: unknown								No new stock assessment was conducted for bullet tuna in 2022 and so the results are based on 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 B_{MSY} 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 F_{MSY} and B_{MSY} were breached thereafter. Therefore, in the absence of a stock assessment of bullet tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (8,870 t). 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 VII
Frigate tuna *Auxis thazard*	Catch 2020: 127,516 t Average catch 2016-2020: 103,740 t								No new stock assessment was conducted for frigate tuna in 2022 and so the results are based on the assessment carried out in 2021 using the data-limited techniques

Stock	Indicators	Previous	2017	2018	2019	2020	2021	2022	Advice to the Commission
	MSY (1,000 t) unknown F_{MSY}: unknown B_{MSY} (1,000 t): unknown $F_{current}/F_{MSY}$: unknown $B_{current}/B_{MSY}$: unknown $B_{current}/B_0$: unknown								(CMSY and LB-SPR), however the catch, 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 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. Click here for a full stock status summary: Appendix VIII
Kawakawa *Euthynnus affinis*	Catch 2020[2]: 161,594 t Average catch 2016-2020: 154,388 t F_{MSY} (80% CI) 149 [124 –223] B_{MSY} (80% CI) 0.44 [0.21–0.82] 356 [192–765] $F_{current}/F_{MSY}$ (80% CI) 0.98 [0.47–1.75] $B_{current}/B_{MSY}$ (80% CI) 1.13 [0.75–1.58]								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 the weight-of-evidence available, the kawakawa stock for the Indian Ocean is classified as **not overfished** and **not subject to overfishing.** However, the assessment models rely on catch data, which is considered to be highly uncertain. The catch in 2018 (173,367 t) was above the then estimated MSY (152,000 t). 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 IX
Longtail tuna *Thunnus tonggol*	Catch 2020: 137,606 t Average catch 2016-2020: 134,576 t MSY (80% CI) 129 (100–151) F_{MSY} (80% CI) 0.32 (0.15–0.66) B_{MSY} (80% CI) 395 (129–751) $F_{current}/F_{MSY}$ (80% CI) 1.52 (0.75–2.87) $B_{current}/B_{MSY}$ (80% CI) 0.69 (0.45–1.21)								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 the weight-of-evidence currently available, the stock is considered to be both **overfished** and **subject to overfishing**. The catch in 2018 (136,906 t) was just below the estimated MSY (140,000 t) but the exploitation rate has been increasing over the last few years, as a result of the declining abundance. Despite the substantial uncertainties, this suggests that the

Stock	Indicators	Previous	2017	2018	2019	2020	2021	2022	Advice to the Commission
									stock is very close to being fished at MSY levels and that higher catches may not be sustained. A precautionary approach to management is recommended. Click here for a full stock status summary: Appendix X
Indo-Pacific king mackerel *Scomberomorus guttatus*	Catch 2020: 48,424 t Average catch 2016-2020: 46,060 t 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)								No new stock assessment was conducted for Indo-Pacific king mackerel in 2022 and so the results are based on the assessment carried out in 2021 using the data-limited techniques (CMSY and LB-SPR). 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 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 2019 was below the estimated MSY. This suggests that the stock is very 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 XI
Narrow-barred Spanish mackerel *Scomberomorus commerson*	Catch 2020: 169,407 t Average catch 2016-2020: 161,409 t MSY (80% CI) 158 (132–187) F_{MSY} (80% CI) 0.49 (0.25–0.87) B_{MSY} (80% CI) 324 (196–593) $F_{current}/F_{MSY}$ (80% CI) 1.24 (0.65–2.13) $B_{current}/B_{MSY}$ (80% CI) 0.80 (0.54–1.27)								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 the weight-of-evidence available, the stock appears to be **overfished** and **subject to overfishing.** The catch in 2019 was just below the estimated MSY and the available gillnet CPUE show a somewhat increasing trend in recent years although the reliability of the Index as abundance indices remains unknown. Despite the substantial uncertainties, the stock is probably very close to being fished at MSY levels and that higher catches may not be sustained. Click here for a full stock status summary: Appendix XII

*Indicates range of plausible values

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

1. Opening of the Meeting

1. The 12th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT12) was held online using the Microsoft Teams online platform from 4 - 8 July 2022. A total of 36 participants (33 in 2021, 43 in 2020, and 18 in 2019) attended the Session. The list of participants is provided at Appendix I. The meeting was opened by the Chairperson, Ms Ririk Sulistyaningsih from Indonesia, who welcomed participants to the meeting.

2. Adoption of the Agenda and Arrangements for the Session

2. The WPNT **ADOPTED** the Agenda provided at Appendix II. The documents presented to the WPNT12 are listed in Appendix III.

3. The IOTC process: Outcomes, updates and progress

3.1 Outcomes of the 24th Session of the Scientific Committee

3. The WPNT **NOTED** paper IOTC–2022–WPNT12–03 which outlined the main outcomes of the 24th Session of the Scientific Committee (SC24), specifically related to the work of the WPNT and **AGREED** to consider how best to progress these issues at the present meeting.

3.2 Outcomes of the 25th and 26th Sessions of the Commission

4. The WPNT **NOTED** paper IOTC–2022–WPNT12–04 which outlined the main outcomes of the 25th and 26th Sessions of the Commission, specifically related to the work of the WPNT. The WPNT further **NOTED** that the 26th Session of the Commission report is currently still unavailable and is awaiting adoption and therefore no new outcomes or Resolutions were available for discussions since the 25th Session.

5. Participants to WPNT12 were **ENCOURAGED** to familiarise themselves with the previously adopted Resolutions, especially those most relevant to the WPNT.

3.3 Review of Conservation and Management Measures relevant for neritic tunas

6. The WPNT **NOTED** paper IOTC–2022–WPNT12–05 which aimed to encourage participants at the WPNT12 to review some of the existing Conservation and Management Measures (CMM) relating to neritic tunas.

3.4 Progress on the Recommendations of WPNT11 and SC24

7. The WPNT **NOTED** paper IOTC–2022–WPNT12–06 which provided an update on the progress made in implementing the recommendations from the 11th Session of the WPNT for the consideration and potential endorsement by participants.

8. The WPNT **NOTED** that good progress had been made on these Recommendations, and that several of these, would be directly addressed by the participating scientists when presenting their updated results for 2022.

9. The WPNT participants were **ENCOURAGED** to review IOTC-2022-WPNT12-06 during the meeting and report back on any progress in relation to requests or actions by CPCs that have not been captured by the report, and to note any pending actions for attention before the next meeting (WPNT13).

10. The WPNT **REQUESTED** that the IOTC Secretariat continue to annually prepare a paper on the progress of the recommendations arising from the previous WPNT, incorporating the final recommendations adopted by the Scientific Committee and endorsed by the Commission.

4. New Information on Fisheries and Associated Environmental Data for Neritic Tunas

4.1 Review of the statistical data available for neritic tunas (IOTC Secretariat)

11. The WPNT **NOTED** paper IOTC–2022–WPNT12–07 which provided an overview of the standing of a range of information received by the IOTC Secretariat for the six species of neritic tuna and tuna-like species, in accordance with IOTC Resolution 15/02 On mandatory statistical reporting requirements for IOTC Members and Cooperating non-Contracting Parties (CPCs), for the period 1950–2020. A summary is provided at Appendix IV.

12. The WPNT **NOTED** the main data issues that are considered to negatively affect the quality of the statistics for neritic tunas and seerfish available at the IOTC Secretariat, which are provided in Appendix V by type of dataset and fishery, and **ENCOURAGED** the listed CPCs to make efforts to remedy the data issues identified and to report back to the WPNT at its next meeting.

13. The WPNT **NOTED** how the FAO global capture database estimates total catches of neritic tunas and seerfish to be in the range of around 2 million tons per year, and that these include captures of 17 distinct species.

14. **ACKNOWLEDGING** that only six neritic and seerfish species are currently under management mandate from the IOTC (i.e., bullet tuna *Auxis rochei*, frigate tuna *Auxis thazard*, kawakawa *Euthynnus affinis*, longtail tuna *Thunnus tonggol*, Indo-Pacific king mackerel *Scomberomorus guttatus* and narrow-barred Spanish mackerel *Scomberomorus commerson*), the WPNT **NOTED** that at global level captures of these species appear to be significant only for the Indian and Western Pacific oceans, and that catches of wahoo (*Acanthocybium solandri*) and striped bonito (*Sarda orientalis*) are also regularly reported to the Secretariat by several IOTC coastal states.

15. The WPNT **NOTED** that, due to the high uncertainty in the information provided for several gears and species by some key fleets in 2021 (data for reference year 2020), the Secretariat had to re-estimate a consistent fraction of nominal catches of neritic tuna and seerfish species, and **SUGGESTED** that relevant CPCs liaise with the Secretariat to determine whether updates to nominal catch data for their fisheries can be provided for 2020 and previous years.

16. The WPNT **ACKNOWLEDGED** that the fraction of nominal catch data which is considered to be of *good quality*[1] for all neritic tuna and seerfish species combined remained stable at around 50% in the years between 1990 and 2020, and that the availability of other important data such as geo-referenced catch and efforts and size-frequencies varies greatly with the species, gears and fleets considered.

17. The WPNT **NOTED** the relevant changes in captures of neritic and seerfish species for the years 2012-2019 compared to the information available at the previous session of this same working party, and **ACKNOWLEDGED** how the detected differences are mainly caused by revisions made by non-CPC coastal states to their official time series (e.g., United Arab Emirates) or by re-estimations performed by FAO which represent an important source of information for non-reporting IOTC CPCs (e.g., Yemen, Eritrea).

18. The WPNT **NOTED** the different patterns in terms of availability and quality of nominal catch data calculated for each neritic tuna and seerfish species in recent years (2016-2020), with frigate tuna ranking last in terms of general data quality levels, followed by narrow-barred Spanish mackerel, Indo-Pacific king mackerel, kawakawa, and finally longtail tuna and bullet tuna.

19. The WPNT **NOTED** that high levels of catches of bullet tuna were still present in 2020, and **RECALLED** that these originate mostly from data reported by the purse seine fisheries of Indonesia and Thailand.

20. In particular, the WPNT **ACKNOWLEDGED** that Thailand has recently (2018) introduced changes in their national collection systems which resulted in bullet tuna being reported disaggregated from other neritic species, as opposed to what generally done in the past.

21. Considering the importance of improving the quality of catch estimates for bullet tuna and all other neritic tuna species, the WPNT **REQUESTED** Thailand to also extend the disaggregation process to years prior to 2018, and report back the results of this exercise to the next session of the WPNT.

22. The WPNT **RECALLED** that two of the most common issues affecting the quality of reported data for neritic and seerfish species are species mis-identification and reporting of multiple species combined under an aggregated species code (such as bullet and frigate tuna reported as FRZ - *Frigate and bullet tunas*, or Indo-Pacific king mackerel, narrow-barred Spanish mackerel and kingfish reported as KGX - *Seerfish nei*), and that these are still of relevance and continue to have significant impacts on catch estimates reported by several CPCs.

23. The WPNT **NOTED** with concern that comprehensive geo-referenced catch-and-effort data are generally lacking, having only been provided on a regular basis by I.R. Iran (since 2007), Sri Lanka (since 2014), and

[1] Nominal catches are considered of *good quality* when their score is between 0 and 2 (see IOTC-2022-WPNT12-07) to indicate that the nominal catch data is either fully or partially available to the IOTC Secretariat, with very limited need for re-estimation or disaggregation.

Indonesia (since 2018), with data for Malaysia (2002-2012, 2016 and 2019), and Thailand (since 2005, with the exclusion of 2014) being affected by issues mainly related to quality assurance.

24. Additionally, the WPNT **NOTED** that geo-referenced catch-and-effort data are still unavailable or not reported according to IOTC standards for several important coastal fisheries such as those from India, Pakistan and Oman, and **REITERATED** its request that CPCs seek advice from the IOTC Secretariat to improve their national data collection and reporting processes.

25. The WPNT **ACKNOWLEDGED** that the Secretariat will soon deliver a data compliance and support mission to Indonesia to discuss about the current state-of-the-art in terms of national data collection, catch estimations, and fleet composition and clarify some outstanding data reporting issues that still are known to affect the data reported to the IOTC Secretariat.

26. **NOTING** that the crew-based data collection programme implemented by the Government of Pakistan with support from WWF-Pakistan has formally ceased operation in 2019, the WPNT **ACKNOWLEDGED** that Pakistan is now looking for additional funds and capacity development through phase II of the ABNJ-tuna project.

27. The WPNT **NOTED** how the WWF-Pakistan programme also collected size-frequency and catch-and-effort data which have been handled to the Government of Pakistan and currently await to be officially submitted to the IOTC Secretariat.

28. Considering the importance of gillnet fisheries for neritic and seerfish species, the WPNT **RECALLED** how IOTC Resolution 17/07 forbids the use of large-scale driftnets in the high-seas, and that starting from January 1st 2022 these provisions also extend to areas under national jurisdiction within the IOTC area of competence (territorial sea, contiguous zone and EEZ).

29. The WPNT also **RECALLED** how the maximum length of 2.5 km for drifting gillnets indicated by Resolution 17/07 applies not only to deployed gears, but also to the potential combined length of all nets available onboard each vessel.

30. In this regard, the WPNT **ACKNOWLEDGED** that proper mechanisms still need to be implemented at national level to guarantee that, starting from January 2022, all vessels abide by the newly enforced requirement expressed by Resolution 17/07.

31. The WPNT **ACKNOWLEDGED** that WWF-Australia is funding a project to monitor the fishing behaviour of tuna-targeting vessels through AIS data, and **NOTED** that the outcomes of this project could be further processed through machine-learning algorithms to determine the length of the drifting nets deployed by the gillnet fisheries operating in the Indian Ocean.

32. Notwithstanding the fact that neritic tunas and seerfish species are often non-targeted species for several industrial fisheries, the WPNT **NOTED** that little to no information on discards is available for these, and **ACKNOWLEDGED** that the only current reliable source of discard data for neritic tunas and seerfish still remains the scientific observer data recorded in the IOTC ROS.

33. The WPNT **ACKNOWLEDGED** that the IOTC ROS database contains limited size-frequency information for discarded species, and **NOTED** that these indicate ab average fish size of around 40 cm for bullet tunas and frigate tunas, while discarded kawakawa are reported as being generally larger.

34. The WPNT **NOTED** with concern that the availability of size-frequency information for neritic tunas and seerfish species is generally lacking, with samples being available in significant numbers only for selected years and fisheries (e.g., longtail tuna from the late 2000s for the gillnet fishery of I.R. Iran, kawakawa and frigate tuna for the years 1988-1993 for the gillnet fisheries of Sri Lanka and from the early 2010s for the gillnet fishery of I.R. Iran, narrow-barred Spanish mackerel from the early 2010s for the gillnet fishery of I.R. Iran).

35. The WPNT **NOTED** the magnitude of the size-frequency samples reported in recent years for neritic tuna by all purse-seine fisheries combined, and that the signal expressed by these data is similar to what already identified in the case of tropical species caught on log-associated schools, i.e., a tendency by these fisheries to capture smaller individuals than others.

36. The WPNT **ACKNOWLEDGED** that several of these coastal purse seine fisheries tend to operate around anchored-FOBs, but that in lack of explicit reporting of information regarding the fishing mode it is not possible to determine if the trends identified through the size-frequency samples are caused by this factor.

37. Furthermore, the WPNT **NOTED** that in recent years size-frequency samples are available for other important fisheries targeting seerfish and neritic tunas (e.g., fisheries operating with drifting gillnets) and **DISCUSSED** the possibility of using these size-frequency data (together with catch-based methods) to assess the status of the stocks in the future.

38. Finally, the WPNT **REITERATED** its request that CPCs facing issues with data collection and reporting, in particular for those fisheries interacting with neritic and seerfish species, seek support from the IOTC Secretariat by engaging in data compliance and support mission, and expressing their interest to participate to workshops and webinars specifically dealing with these matters.

5. Neritic Tuna Species – Review of New Information on Stock Status

5.1 Review new information on the biology, stock structure, fisheries and associated environmental data

39. The WPNT **NOTED** paper IOTC-2022-WPNT12-09 on Neritic Tuna fisheries of Pakistan: status and trends, including the following abstract provided by the authors:

> *"Neritic tuna are important component of the tuna fisheries of Pakistan. Neritic tuna has a share of about 47.68 % in the total landings of tuna in 2021. Of the five species of neritic tunas, longtail tuna (Thunnus tonggol) contributes 3,120 m, tons in 2021 and 3,320 m. tons in 2020. Landings of frigate tuna (Auxis thazard thazard) during 2021 was recorded to be 6,190 m. tons whereas it was 6,759 m. tons in 2020. Landings of kawakawa (Euthynnus affinis) in 2021 was 1,210 m. tons and 1,310 m. tons in 2020. Other two species i.e. bullet tuna (Auxis rochei) and striped bonito (Sarda orientalis) contributed insignificantly in the total tuna landings of Pakistan. Landings of neritic tuna were observed to have decreased in 2021 by 7.26 % as compared to 2020. This decrease in landings can be attributed to many factors including early closure of the fishing season in April 2021 and late start in August 2021. This decrease is also on account of partial closure of small scale fishing operations along Balochistan coast during September to December due to protest of fishermen on account of poaching of shrimp trawlers in waters of Balochistan. Overall annual tuna landings (including both tropical and neritic tuna) of Pakistan have shown a decrease of 15.80 % during 2021 as compared to year 2020."*

40. The WPNT **NOTED** a decline in the total catches of all neritic tuna species in Pakistan of 7.26% from 2020 to 2021. The WPNT **NOTED** that further declines may be seen in future years as a result of increasing fuel prices. The WPNT **NOTED** that the currency in I.R. Iran is highly unstable and this plays an important role in the price of tuna in Pakistan as the majority of tuna is exported from Pakistan to I.R. Iran.

41. The WPNT **NOTED** the requirements of IOTC Resolution 17/07 which prohibits the use of 'large-scale' driftnets (over 2.5km in length) in the entire IOTC area of competence from January 2022. The WPNT further **NOTED** that vessels registered in Pakistan and I.R. Iran are thought to still be using gillnets of lengths greater than this limit. The WPNT **NOTED** that this is a compliance issue and the IOTC scientific team does not have a way to verify CPC adherence with this Resolution. The WPNT **NOTED** a project that WWF Pakistan have planned which will use satellite technologies to monitor the movement of tuna vessels with AIS attached to the vessel as well as to the end of gillnets being deployed.

42. The WPNT **NOTED** the ongoing un-verified issue of vessels being registered to both Pakistan and I.R. Iran and the potential resulting double-counting of catches. The WPNT **NOTED** that due to the level of aggregation of catch data by fleet and gear, it is impossible for the Secretariat to know which vessels are responsible for which catches and so whether catches have been double counted. Geo-referenced data have also only been received by the Secretariat from I.R. Iran so it is not possible to cross-check these with data from Pakistan. The WPNT **NOTED** that a mission to I.R. Iran and/or Pakistan specifically to understand this could help to resolve the issue but that the first step would be for the ministry of fisheries from each CPC to work together to try to resolve this. The WPNT **NOTED** the need for a clear indication from the SC on how to mediate between Pakistan and I.R. Iran to sort out this issue.

43. The WPNT **NOTED** that the crew-based observer scheme which was being run by WWF Pakistan came to an end in 2019 but further **NOTED** that around 30 vessels are still providing data to WWF Pakistan which can be used to help estimate or verify landings information. The WPNT **NOTED** that WWF Pakistan have been providing

data from the programme to the government of Pakistan for submission to the IOTC Secretariat. The WPNT further **NOTED** that WWF Pakistan hopes to re-start this programme as part of the upcoming ABNJ Tuna Project Phase II.

44. The WPNT **ACKNOWLEDGED** that Pakistan has been working to develop databases for fisheries data, but that data entry and extraction is still challenging. The WPNT **NOTED** the support offered by the Secretariat in trying to manage this issue.

45. The WPNT **NOTED** that there are recorded catch of wahoo and striped bonito in the IOTC database but these are submitted on a voluntary basis as these are not part of the IOTC species list.

46. The WPNT **NOTED** paper IOTC-2022-WPNT12-10 on Evidence of genetic homogeneity in longtail tuna in the west coast of India and the distantly set Andaman Archipelago.

47. The WPNT **NOTED** that using molecular genetics techniques found insignificant levels of genetic differentiation between samples collected from three regions of the Indian EEZ (Veraval, Kochi and Andaman Islands), and so the authors ruled out the existence of any stock structure of longtail tuna in the wider northern Indian Ocean region. The WPNT also **NOTED** the conclusion drawn from the study that there is extensive gene flow and so connectivity between the Indian Ocean stock and the Western Central Pacific stock. The WPNT **NOTED** the authors' theory that the continuity of the shelf areas and absence of physical barriers in the entire northern Indian Ocean region facilitate the free movement of adults and larvae and the monsoon influenced currents aid the wide dispersal of eggs and larvae.

48. The WPNT **NOTED** the small number of samples used during this study and the need to conduct further work with more samples.

49. The WPNT **NOTED** that more advanced techniques such as Single Nucleotide Polymorphic markers could be used in the future to attempt to identify subpopulations and stock boundaries which can form distinct management units for conservation and management efforts.

50. The WPNT **NOTED** the need for an Indian Ocean basin-wide study to investigate the stock structure of Indian Ocean longtail and other neritic tuna fully. The WPNT **NOTED** that other studies have been conducted recently by SEAFDEC and CSIRO which could be expanded upon to create a wider sampling range for such work. The WPNT also **NOTED** the importance of including samples from the Pacific Ocean in future projects to further investigate the level of connectivity between the two oceans.

51. The WPNT **NOTED** the offer from a Malaysian scientist who was involved in the SEAFDEC project to put this group in touch with the relevant project team to help to coordinate a larger scale project.

52. The WPNT **NOTED** the support for the development of a gene bank which can be used to hold data on genetic samples.

53. The WPNT **NOTED** the utility of also conducting studies which would provide information on the location of spawning grounds around the Indian Ocean further **NOTING** that morphological tools may play a role in these studies.

54. The WPNT **NOTED** paper IOTC–2022-WPNT12–11 giving a synoptic review of the biological and population dynamic parameter studies on longtail tuna (*Thunnus tonggol*) in the Persian Gulf and Oman Sea, including the following abstract provided by the authors:

> *"Research studies on longtail tuna has been initiated in nineties in the Persian Gulf & Oman Sea. A synoptic review of the different research studies including size frequencies, length-weight relationship, growth and mortality parameters, biological studies, distribution pattern, stock structure, stock assessment, biological reference points, and management advice were reviewed, discussed and reported."*

55. The WPTN **THANKED** the author for the presentation and **ENCOURAGED** CPCs to continue to present work like this.

56. The WPNT **NOTED** that paper IOTC–2022-WPNT12–12 on the identification of two kingfish species caught by fishers in Kenyan waters was withdrawn.

5.2 Data for input into stock assessments

57. The WPNT **NOTED** that there are likely to be very few updates on the data provided in paper IOTC-2022-WPNT12-07 available for the stock assessments to be conducted next year with the exception of the additional data point for 2021. The WPNT **NOTED** that overall there is a lack of information and high levels of uncertainties in many catch series for neritic tuna species and **REQUESTED** that CPCs submit their data accurately and in a timely manner. The WPNT **NOTED** that data missions by the Secretariat to Indonesia and Oman may result in improvements to some catch series for neritic species.

58. The WPNT **NOTED** that in the past CPUE series from the Iranian gillnet fleet have been used in stock assessments for neritic tunas but further **NOTED** that these have not been updated for several years. The WPNT **NOTED** that the Secretariat are willing to collaborate further with scientists from I.R. Iran to update these CPUE series **NOTING** that this work is important as CPUE indices help to improve the stability of stock assessments.

59. The WPNT **NOTED** the plan for the Secretariat to run a CPUE workshop intersessionally to help to build further CPUE indices prior to the upcoming assessments if there is enough buy-in from CPC scientists.

5.3 Stock assessment updates

60. The WPNT **NOTED** paper IOTC-2022-WPNT12-13 on a preliminary stock assessment of kawakawa in the Indian Ocean, including the following abstract provided by the authors:

> *"This study conducted a preliminary assessment for the Indian Ocean Kawakawa by DCAC and CMSY methods. Monte Carlo simulation was used to integrate the uncertainty of some key parameters and potential assumptions. The results indicated that Kawakawa productivity was high, with the intrinsic rate of increase r may larger than 1; The results are sensitive to the final depletion level, and most scenarios reveal that the average of the last three-year catch is higher than MSY, and stock status is also very close to overfished. Given the high uncertainty in the catch series, future assessments need to consider more date-limited methods based on the different sources of data and improve the statistics of abundance index data."*

61. The WPNT **NOTED** that the default value of 0.4 for the ratio of F_{MSY} to M used as one of the model inputs for the DCAC method and suggested that it might be useful to check whether this is consistent with the estimate of F_{MSY} (hence F_{MSY}/M) from the CMSY method. The WPNT also **NOTED** that the DCSAC assumes a value of 0.4 for the ratio of B_{MSY}/B0, which is different to the standard production function used by the CMSY. The WPNT suggested that to the extent possible, the use of consistent assumptions will make it easier to comparison of different modelling approaches

62. The WPNT **NOTED** that if CPUE indices are created for the species scheduled for assessment the following year, alternative models may also be applied in addition to the Catch-only techniques. The WPNT agreed that even though the CPUE indices can significantly enhance the performance of the biomass dynamic models, evaluating the accuracy of CPUE as an index of abundance is still difficult, especially if the index is derived from regional fisheries with limited spatial coverage. The WPNT further **NOTED** that the value of diagnostics in determining whether CPUE is compatible with the model.

5.4 Stock status indicators for other neritic tuna species

63. The WPNT **NOTED** paper IOTC-2022-WPNT12-14 Population parameters and the stock status of longtail tuna (*Thunnus tonggol*) in the Indian EEZ with conservation and management measure advisories.

64. The WPNT **NOTED** four methods, including a per-Recruit analysis, the Schafer model, the Bayesian State-Space mode (BSM), and the CMSY methods were used to develop biological reference points for the longtail tuna in the Indian EEZ.

65. The WPNT **NOTED** the models were run up to 2016 due to the availability of the CPUE although the catch data are available up until a more recent year.

66. The WPNT **NOTED** the Schafer model is very close to the Bayesian State-Space model (BSM) therefore only the latter is presented and compared to other approaches. The WPNT **NOTED the** reasonable consistency of the results between the different models presented.

67. The WPNT suggested it would be useful to compare the CPUE of longtail tuna in the Indian EEZ to the index developed from the Iranian gillnet fishery to evaluate whether these indices are regional or are able to index the abundance for a wider area.

5.5 Development of management advice for neritic tuna species

68. The WPNT **NOTED** that as no formal assessment is being made this year, there will not be any updates to management advice for neritic tuna and seerfish species. The Secretariat will update the Species Executive Summary with the latest catch statistics and indicators.

6. Programme of Work (Research and Priorities)

6.1 CPUE workshop

69. The WPNT **NOTED** that to improve the stock assessments of several neritic species, population abundance trend information (such as CPUEs) would be required, as to date, species had generally been assessed using catch only data poor methods.

70. The WPNT **NOTED** that developing CPUE series for key species had been a priority for the WPNT for several years but little progress had been made.

71. The Chair in consultation with the SC Chair and Secretariat proposed that a workshop could be held involving CPC scientists to develop CPUE series for upcoming assessments. The WPNT **AGREED** that this would be beneficial and that CPC scientists should contact the secretariat to determine their interest in participating. The WPNT also **AGREED** that the workshop would not just be focused on the methods to standardise the CPUEs, but rather participants would be required to bring their actual data and develop their indices during the workshop. The confidentiality of the data would be strictly maintained.

72. The WPNT **SUGGESTED** that a Circular be distributed to CPCs to request their participation and determine the level of interest in participating in the workshop. Should the Chairs of the WPNT and SC along with the Secretariat determine that there is sufficient interest to hold the meeting, further details on the workshop date and data requirements would be distributed to interested parties.

6.2 Revision of the WPNT Program of Work 2023–2027

73. The WPNT **NOTED** paper IOTC–2022–WPNT12–INF01 on Calipseo: a FAO platform for data and fisheries statistics including the following summary provided by the authors:

> *"The Calipseo platform is developed by the FAO Fisheries and Aquaculture Division. This platform aims to provide a standard web-based application to FAO Members or RFMOs CPC having requested FAO support to reinforce their capacity to produce fisheries statistics. Calipseo is based on open source technologies to collect, securely store, process and disseminate fisheries dependent data for small scale fisheries as well as industrial sector. It also provides management solution to FAO Members for the fisheries administrative data (Fishers and vessel registries and licenses). It implements international concepts, standards and definitions to collect, harmonize and process all collected data, especially the small scale fisheries statistics based on stratified sampling. Data stored and processed in Calipseo are fully own by the Country not by FAO. The deployment of the platform comes in a broader approach of Member support for fisheries statistics with review and update of current methodologies, development of capacity and trainings, and adaptation and deployment of the platform to fill identified gaps (partial or complete implementation). Support from FAO Fisheries and Aquaculture Division requires Member to submit an official request to their National FAO Representation. It is not a mandatory tool but one among others technical solution to help Members and CPC to produce reliable and timely statistics to support national policy making and to help fulfilling, regional (like IOTC) and international reporting obligation*"

74. The WPNT **THANKED** the representative from FAO for presenting this interesting tool and explaining how it was being utilized in several countries.

75. The WPNT **ACKNOWLEDGED** that this is tool that is being developed to assist countries with the entry, storage and processing of their data and while useful is not mandatory for use.

76. The WPNT **NOTED** that the ongoing support of the tool by the developers would be key to its success. Past tools that aimed to serve a similar purpose were generally not successful as they were not supported beyond the life of the projects in which they were developed. This meant that they either quickly became obsolete or user support was unavailable. The presenter confirmed that the developers were trying to secure funds to ensure a stable support team to continue the maintenance of the tool into the future.

77. The WPNT **NOTED** paper IOTC-2022-WPNT12-08 on Revision of the WPNT Program of Work (2023-2027).

78. The WPNT **NOTED** that it is important to assign high priority to the most important work that is required from the WPNT in order to secure funding for this work when the Program of Work is presented by the SC to the Commission. The WPNT **AGREED** that the following work streams will be presented as high priority in the Program of Work:

- Stock structure;
- Improvement of stock assessment methodology, in particular further investigations of the effect of input priors and parameters on model outputs and further model validation analyses;
- Data mining and collation to improve stock assessments.

79. The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2023–2027), as provided in Appendix VI.

6.3 Development of priorities for an Invited Expert at the next WPNT meeting

80. The WPNT **AGREED** to the following core areas of expertise and priority areas for contribution that need to be enhanced for the next meeting of the WPNT in 2023, by an Invited Expert:

1) data poor assessment approaches (e.g. catch only methods, length-based approaches);
2) CPUE standardisations.

7. Other Business

7.1 Review of the draft, and adoption of the Report of the 12th Working Party on Neritic Tunas

81. The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT12, provided in Appendix XIII, as well as the management advice provided in the draft resource stock status summary for each of the six neritic tuna (and mackerel) species under the IOTC mandate, and the combined Kobe plot for the species assigned a stock status in 2022:

- Bullet tuna (*Auxis rochei*) – Appendix VII
- Frigate tuna (*Auxis thazard*) – Appendix VIII
- Kawakawa (*Euthynnus affinis*) – Appendix IX
- Longtail tuna (*Thunnus tonggol*) – Appendix X
- Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix XI
- Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix XII

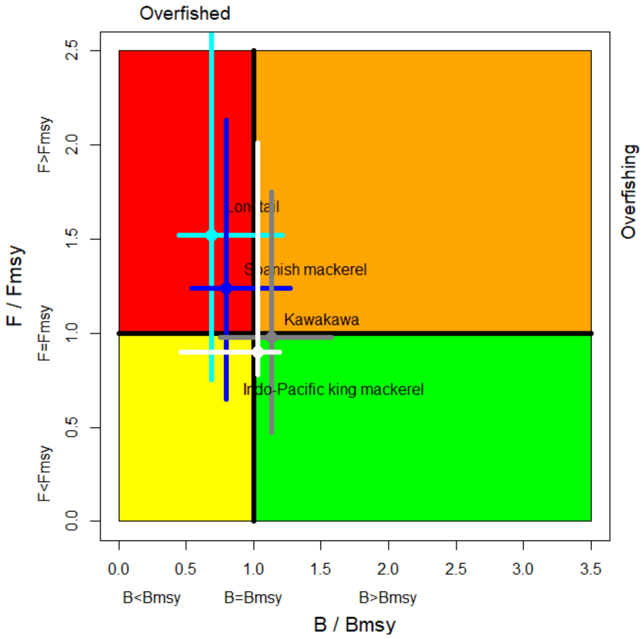

Fig. 10. Combined Kobe plot for longtail tuna (cyan), narrow-barred Spanish mackerel (blue), kawakawa (grey) (all for 2018 with assessment carried out in 2020) and Indo-Pacific king mackerel (2019 with assessment carried out in 2021, white), showing the estimates of stock size (B) and current fishing mortality (F) in relation to optimal biomass and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs.

82. The report of the 12th Session of the Working Party on Neritic Tunas (IOTC–2022–WPNT12–R) was **ADOPTED** by correspondence.

APPENDIX I
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APPENDIX II
AGENDA FOR THE 12TH WORKING PARTY ON NERITIC TUNAS

Date: 4–8 July 2022
Location: Online
Venue: NA
Time: 12:00 – 16:00 daily (Seychelles time)
Chair: Ms Ririk Sulistyaningsih; **Vice-Chair**: Dr Farhad Kaymaram

1. **OPENING OF THE MEETING** (Chair)

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

3. **THE IOTC PROCESS: OUTCOMES, UPDATES AND PROGRESS**

   3.1. Outcomes of the 24th Session of the Scientific Committee (IOTC Secretariat)
   3.2. Outcomes of the 25th and 26th Sessions of the Commission (IOTC Secretariat)
   3.3. Review of Conservation and Management Measures relevant to neritic tunas (IOTC Secretariat)
   3.4. Progress on the recommendations of WPNT11 (IOTC Secretariat)

4. **NEW INFORMATION ON FISHERIES AND ASSOCIATED ENVIRONMENTAL DATA FOR NERITIC TUNAS**

   4.1. Review of the statistical data available for neritic tunas (IOTC Secretariat)
   4.2. Review new information on fisheries and associated environmental data (general CPC papers)

5. **NERITIC TUNA SPECIES – REVIEW OF NEW INFORMATION ON STOCK STATUS**

   5.1. Review new information on the biology, stock structure, fisheries and associated environmental data (all)
   5.2. Data for input into stock assessments (all)
   5.3. Stock assessment updates (all)
   5.4. Stock status indicators for other neritic tuna species (all)
   5.5. Development of management advice for neritic tuna species (all)

6. **PROGRAM OF WORK (RESEARCH AND PRIORITES)**

   6.1. Revision of the WPNT Program of Work 2023–2027 (Chair)
   6.2. Development of priorities for an Invited Expert at the next WPNT meeting

7. **OTHER BUSINESS**

   7.1. Review of the draft, and adoption of the Report of the 12th Working Party on Neritic Tunas (Chair)

APPENDIX III
LIST OF DOCUMENTS

Document	Title
IOTC–2022–WPNT12–01a	Draft: Agenda of the 12th Working Party on Neritic Tunas
IOTC–2022–WPNT12–01b	Annotated agenda of the 12th Working Party on Neritic Tunas
IOTC–2022–WPNT12–02	List of documents of the 12th Working Party on Neritic Tunas
IOTC–2022–WPNT12–03	Outcomes of the 24th Session of the Scientific Committee (IOTC Secretariat)
IOTC–2022–WPNT12–04	Outcomes of the 25th Session of the Commission (IOTC Secretariat)
IOTC–2022–WPNT12–05	Review of current Conservation and Management Measures relating to neritic tuna species (IOTC Secretariat)
IOTC–2022–WPNT12–06	Progress made on the recommendations and requests of WPNT11 and SC24 (IOTC Secretariat)
IOTC–2022–WPNT12-07	Review of the statistical data available for the neritic tuna species (IOTC Secretariat)
IOTC–2022–WPNT12–08	Revision of the WPNT Program of Work (2022–2026) (IOTC Secretariat)
IOTC–2022–WPNT12–09	Neritic tuna fisheries of Pakistan: Status and Trends (M. Moazzam)
IOTC–2022–WPNT12–10	Evidence of genetic homogeneity in longtail in the west coast of India and the distantly set Andaman archipelago (M. Koya, S. Sukumara, P. Rohit, E. M. Abdussamad and A. Ratheesh)
IOTC–2022–WPNT12–11	A synoptic review of the biological and population dynamic parameter studies on longtail tuna (*Thunnus tonggol*) in the Persian Gulf and Oman Sea (F. Kaymaram, S. A. Taghavimotlagh and A. Vahabnezhad)
IOTC–2022–WPNT12–12	Identification of two kingfish species caught by fishers in Kenyan waters (S. Ndegwa)
IOTC–2022–WPNT12–13	A preliminary stock assessment of kawakawa in the Indian ocean (Z. Geng)
IOTC–2022–WPNT12–14	Population parameters and the stock status of longtail tuna (*Thunnus tonggol*) in the Indian EEZ with conservation and management measure advisories (M. Koya, P. Rohit, E. M. Abdussamad and A. P. Azeez)
IOTC–2022–WPNT12–INF01	Calipseo: a FAO platform for data and fisheries statistics (Y. Laurent)
IOTC–2022–WPNT12–INF02	Longtail tuna synopsis
IOTC–2022–WPNT12–INF03	Bullet tuna synopsis
IOTC–2022–WPNT12–INF04	Frigate tuna synopsis

APPENDIX IV
STATISTICS FOR NERITIC TUNAS AND SEERFISH

Extract from IOTC–2022–WPNT12–07

Historical trends (1950-2020)

The total nominal catches of the IOTC neritic tuna and seerfish species showed a major increase over the last seven decades, from less than 34,000 t in the 1950s to a maximum of about 673,000 t in 2020 (**Fig. A1**). Neritic tuna and seerfish species are mainly caught using drifting gillnets and purse seine nets in coastal waters where they are also caught using troll lines, hand lines, small longlines and other gears (e.g., beach seines). Very few catches are reported for pole and line and high seas longline fisheries (**Fig. A1**).

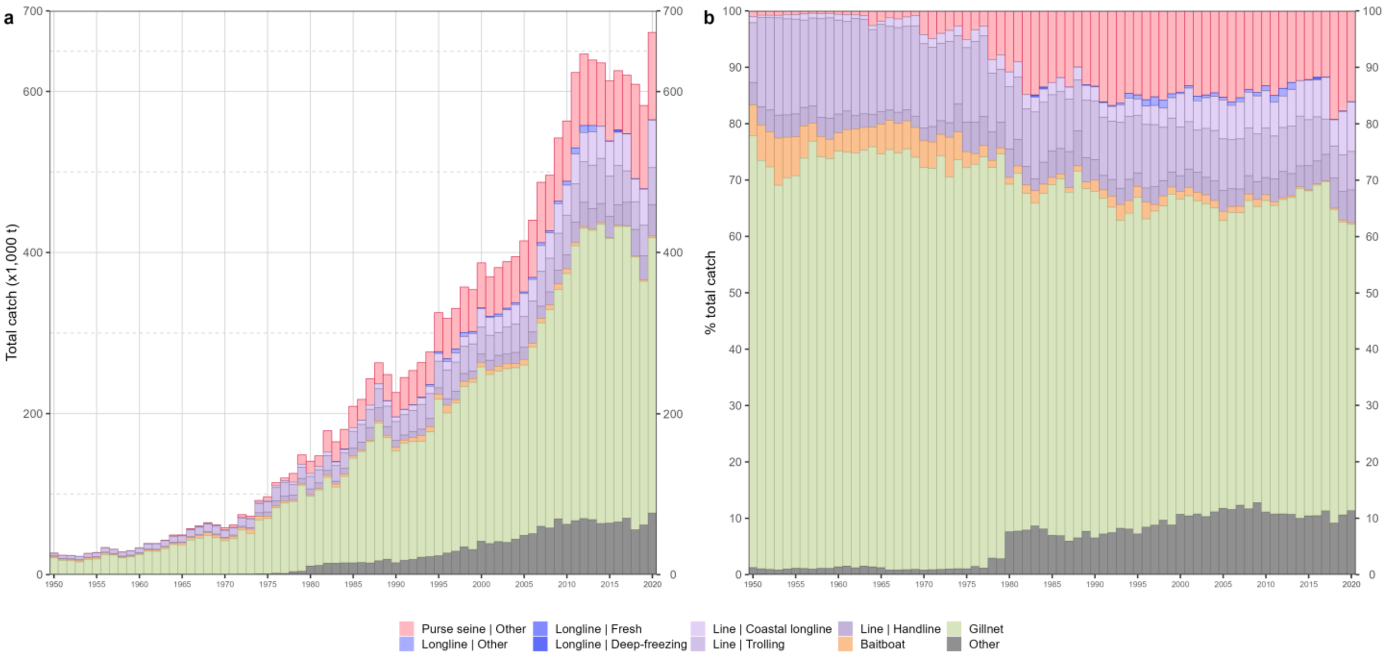

Fig. A1: Annual time series of (a) cumulative nominal absolute and (b) relative catches (t) of IOTC neritic tunas and seerfish by fishery for the period 1950-2020

Each of the six IOTC neritic tuna and seerfish species showed an increasing trend in nominal catches over time until recent years (**Fig. A2**). Following a period of steady increase for almost seven decades, the cumulative nominal catch of all species reached a peak at 646,000 t in 2012, before declining down to 583,000 t in 2019. This decrease - which concerned longtail tuna, frigate tuna, and (to a lesser extent) narrow-barred Spanish mackerel - has been essentially driven by the reduction of the catches of gillnetters from I.R. Iran and Pakistan and small-scale purse seiners from Malaysia.

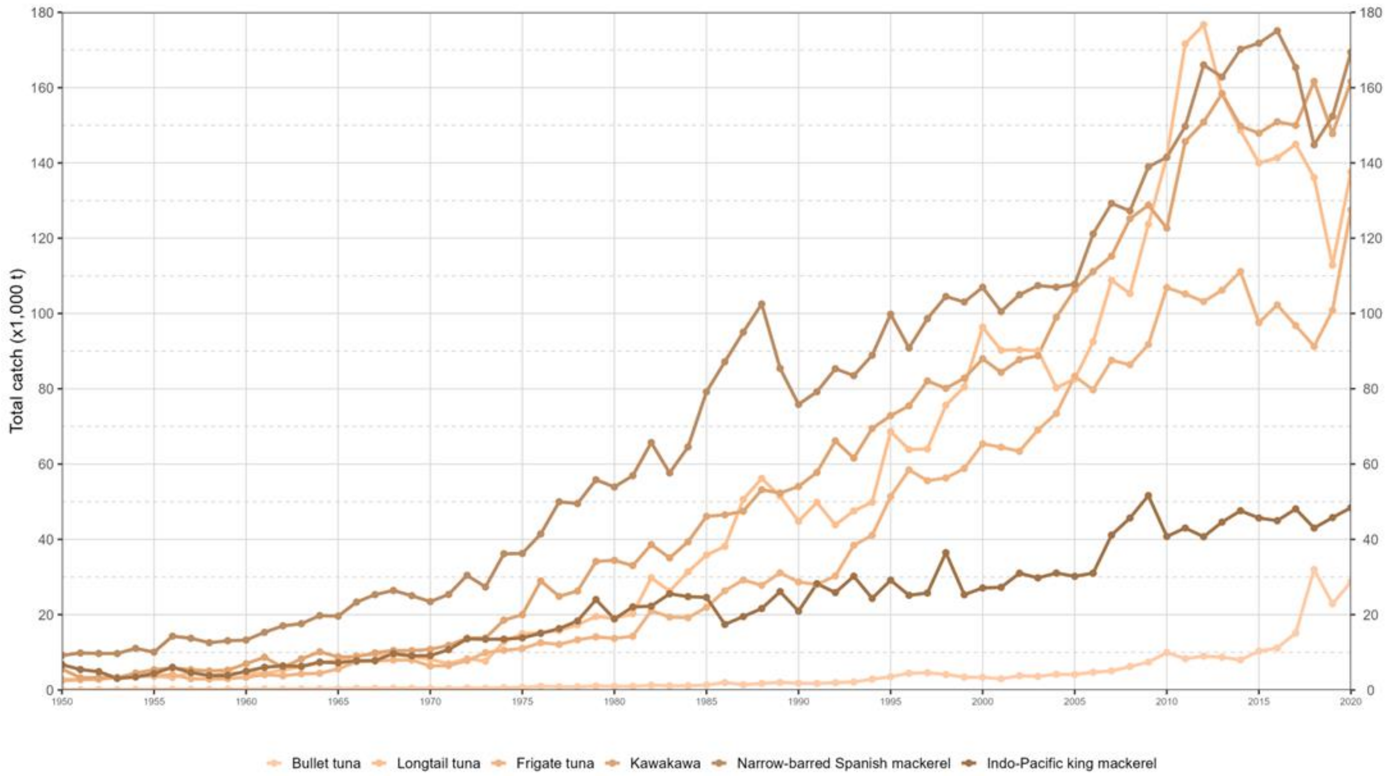

Fig. A2. Annual time series of nominal catches (t) of IOTC neritic tunas and seerfish by species for the period 1950-2020

Recent fishery features (2016-2020)

Between 2016 and 2020, the mean annual catches of the IOTC neritic tunas and seerfish have been dominated by a few CPCs, to the point that almost 70% of all catches was accounted for by three distinct fleets: Indonesia and India, which are characterized by a large diversity of coastal gears and fisheries, and I.R. Iran, where gillnet represents the large majority of the catches (**Fig. A3**).

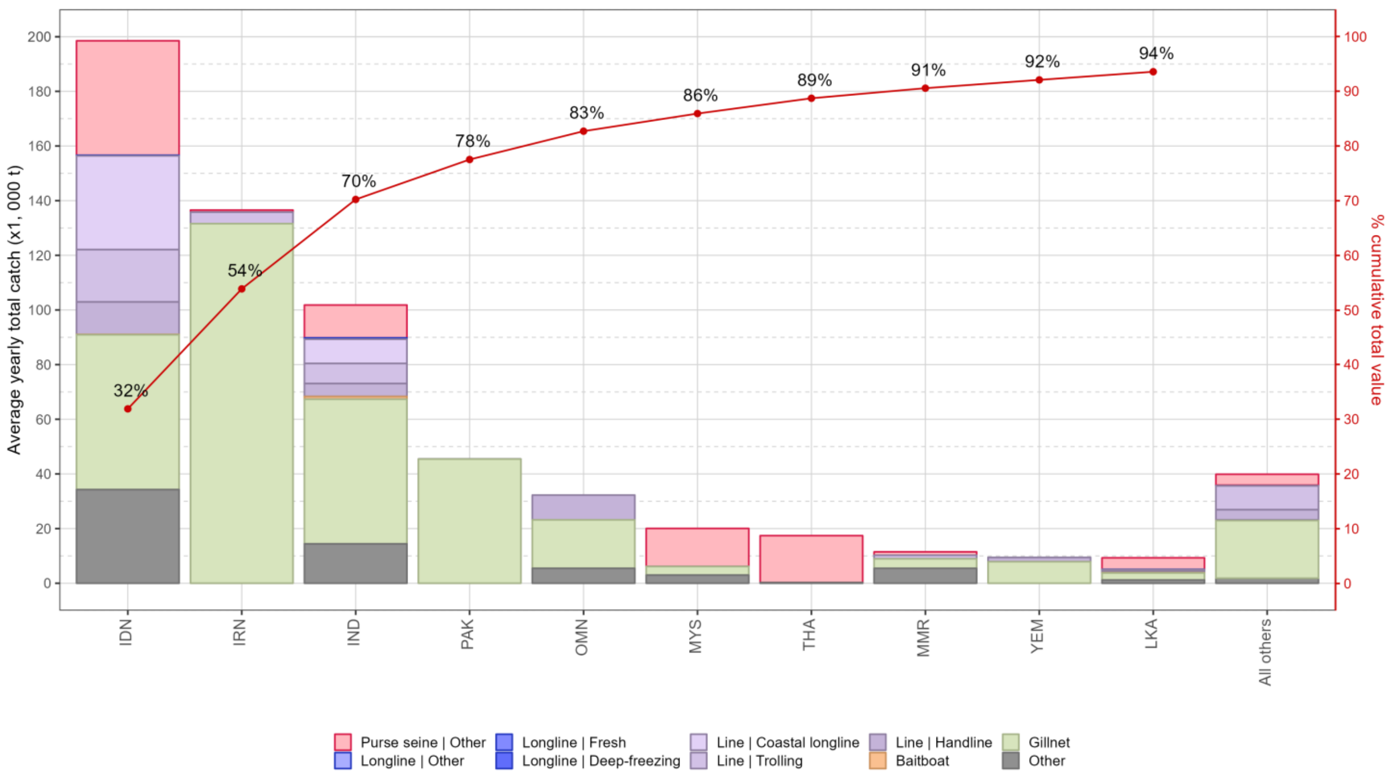

Fig. A3. Mean annual catches (t) of the IOTC neritic tunas and seerfish by fleet and fishery between 2016 and 2020, with indication of cumulative catches by fleet

Over that period, the total gillnet catches showed a substantial decline between 2016 to 2019 before increasing in 2020 (**Fig. A4**). In 2020, the total catches of IOTC neritic and seerfish species from gillnet fisheries was 342,000 t. Catches from line fisheries increased in recent years to reach 144,000 t while purse seine catches remained at relatively stable levels at around 110,000 t between 2018 and 2020 (**Fig. A4**).

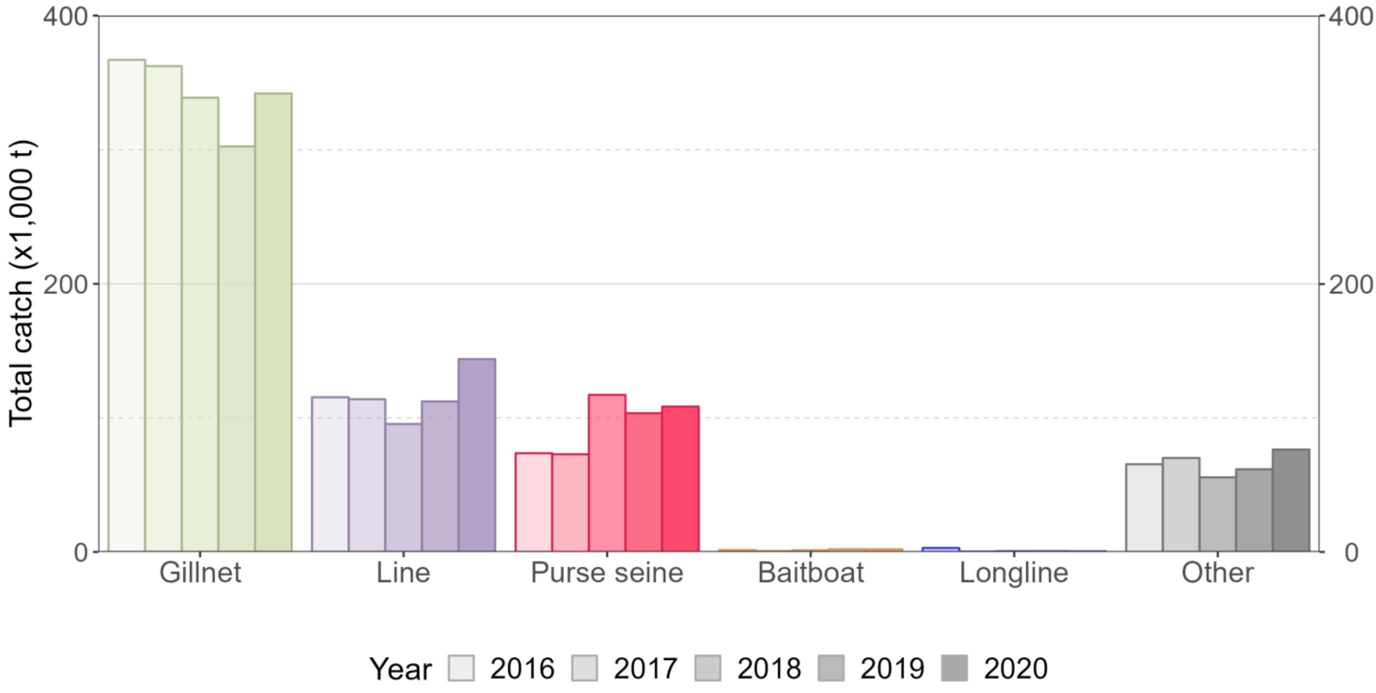

Fig. A4. Annual catch trends (t) of IOTC neritic tunas and seerfish by fishery group between 2016 and 2020

Uncertainties in nominal catch data

Overall, total estimated catches for neritic species in the Indian Ocean are considered to be highly uncertain. The majority of catches of neritic species in the Indian Ocean are caught within the areas of national jurisdiction of the coastal states, typically by small-scale or artisanal fisheries, which creates considerable challenges in terms of collecting reliable information from the diversity of vessels and fisheries operating in coastal waters. Difficulties in data collection are further compounded by species misidentification, particularly of juvenile tunas, that can lead to dramatic changes in catches by species between years.

In addition, a common problem through the region is the aggregation of neritic species under a common label. Small or juvenile neritic tunas are often also treated commercially as the same species – particularly in the case of frigate and bullet tuna – which are often reported to the Secretariat as species aggregates or commercial categories and therefore require disaggregation in order to produce estimates by species. Recently, Thailand started to breakdown the catch of combined frigate and bullet tuna to individual species, whereby the catches of bullet tuna increased from about 3,000 t in 2018 to 15,000 t in 2020. Likewise, catches of narrow-barred Spanish mackerel and Indo-Pacific king mackerel are often combined and reported to the IOTC Secretariat as species aggregates of seerfish.

Spatial distribution of catch and effort

Geo-referenced catch and effort data are not available or only available for a very limited time frame for several major fisheries catching neritic species in the Indian Ocean. Furthermore, time series of effort are generally inconsistent as different units of effort (e.g., trips, days) may be used over time. In particular, Indonesia and India have accounted for around half of the total catches of neritic species in the Indian Ocean in recent years while little information is available on the distribution of catch and effort for all their fisheries. Indonesia has started reporting time-area catches for some of its artisanal and industrial fleets since 2018 but the coverage appears to be very low (i.e., less than 5%) and not representative of the fishing grounds (see below). No geo-referenced catch and effort data have been reported for any of the coastal fisheries of India since 1981, although India reported about 100,000 t of fish caught in recent years. Furthermore, no geo-referenced data have been submitted to the Secretariat by Pakistan and Oman since 1991 and 2013, respectively, despite the significant contribution of the fisheries of these two CPCs to the total catches or neritic species in recent years.

Size composition of the catch

The number of fish sampled for size neritic and seerfish is dominated by gillnet fisheries which represent 77.5% of all size data available in the IOTC database. Some size samples are also available for purse seine (1985-2020), baitboat (1983-2020), and troll line (1983-2020) fisheries, although in smaller numbers than for gillnet fisheries, while very few samples are available for all other fisheries.

The number of size samples by species is very unbalanced and not representative of the importance of each species in the nominal catches. About two thirds of all samples are available for kawakawa (33.81%) and frigate tuna (31.29%). Samples for narrow-barred Spanish mackerel only represent 14.38% of the samples when this species has been the most abundant in the catch over the last four decades, i.e., it represented almost 30% of all catches of neritic species between 1980 and 2020. Only 554 fish samples are available for Indo-Pacific kingfish when more than 1.3 million tons of catch have been reported for this species since 1980.

Uncertainties in size-frequency data

The reporting quality of size frequency data is the lowest among all IOTC species groups. The overall quality – as measured by the percentage of nominal catches with size data of quality scores between 0-2 – of size data available for neritic tunas and seerfish is poor. Almost no size data are available prior to the 1980s and the fraction of data of acceptable quality between 1980 and 2020 averages around 6.2%.

APPENDIX V

MAIN ISSUES IDENTIFIED RELATING TO THE STATISTICS OF NERITIC TUNAS AND SEERFISH

Data type(s)	Fisheries	Issue	Progress
Nominal catch, catch-and-effort, size data	Coastal fisheries of Madagascar, Myanmar, and Yemen	Non-reporting countries Catches of neritic tunas and seerfish for these fisheries have been entirely estimated by the IOTC Secretariat in recent years – however the quality of estimates is thought to be poor due to a lack of reliable information on the fisheries operating in these countries	• Madagascar: a new sampling programme has been put in place in Madagascar since 2017. The country submitted nominal catch, catch and effort and size data for the years 2017 to 2020. However, the sampling level is very low and the data do not cover all fishing regions. Furthermore, there are variation in the data over the years, which is due to change in the sampling regions yearly due to various socio-economic factors: for these reasons, the information is still pending incorporation in the IOTC database as it cannot be adequately raised by the Secretariat • Myanmar (non-reporting, non-IOTC member): catch data for some years are based on estimates published by SEAFDEC and FAO • Yemen: catches are systematically based on information provided by FAO
Nominal catch, catch-and-effort, size data	Coastal fisheries of India, Indonesia, Kenya, Malaysia, Mozambique; Oman, Tanzania, and Thailand	Partially-reported data These fisheries do not fully report catches of neritic tunas and seerfish by species and/or gear, as per the reporting standards of IOTC Res. 15/02. For example: ● Nominal catches may have been partially allocated by gear and species by the IOTC Secretariat, where necessary. ● Catch -and-effort and size data may also be missing, or not fully reported according to Res. 15/02 standards	• India: catch-and-effort and size data for coastal fisheries have not been reported at all or are not reported according to standards • Indonesia: catch-and-effort and size data have been reported for coastal fisheries – albeit for a very small number of landing sites (i.e., less than 10) covered by the IOTC-OFCF pilot sampling project. Catch-and-effort data have been reported by Indonesia for several semi-industrial and coastal fisheries since 2019 (reference year 2018) but the coverage is very low (<5%) • Kenya: Kenya has recently undertaken a Catch Assessment Survey to improve catch estimates for artisanal fisheries. With the help of IOTC Secretariat, Kenya reported catch-and-effort and size data for the coastal fisheries for 2019 only. However, there are inconsistencies in the species between the two datasets. • Mozambique: an IOTC Data Compliance mission was conducted by the IOTC Secretariat in June 2014 and data reporting has improved since then although some issues remain with the reporting of catch-and-effort data for coastal fisheries. Mozambique currently facing difficulties to submit the coastal fisheries statistics • Oman: no size data have been submitted, although it is understood that some data have been collected. Biological information for some neritic species is known to have been collected in the past by national research institutions and could potentially be shared with the IOTC Secretariat.

			• Tanzania: following a compliance mission held in 2019 and liaison between a compliance expert and Tanzanian liaison officers, Tanzania managed to report catch-and-effort data for the different artisanal fisheries for the year 2019 only, although some key information is still missing, and there are some variations in catch data between sources. It is also still important to confirm if catches for Zanzibar are included in the reported data.
	Coastal fisheries of Indonesia, Malaysia, and Thailand	Reliability of catch estimates Several issues have been identified for the following fisheries, which compromise the quality of the data in the IOTC database	• Indonesia (nominal catch): catch estimates for neritic tunas are considered highly uncertain due to issues of species misidentification and aggregation of juvenile neritic and tropical tunas species reported as commercial category *tongkol*. Between 2014-2017 the IOTC Secretariat supported a pilot sampling project of artisanal fisheries in North and West Sumatra to improve estimates of neritic tunas and juvenile tuna species in particular. Following a recent data compliance mission in Indonesia, Indonesia is in the process of revising the catch data allocated by fisheries and species. It is important to note that the logbook coverage in coastal fisheries is low and estimates of neritic species are highly uncertain and likely under-estimated. • Malaysia (catch-and-effort): issues regarding the reliability of catch-and-effort reported in recent years have been raised by the IOTC Secretariat and, to date, remain unresolved (e.g., large fluctuations in the nominal CPUE, and inconsistencies between different units of effort recorded in recent years). Data submitted for 2019 included two fishing regions, however Malaysia was unable to break down the catch and effort data by region. In 2020, the data were processed using one of the grid squares. Malaysia needs to revise the data for previous years and re-submit the time series.
Catch and effort, size data	(Offshore) Surface and longline fisheries: I.R. Iran and Pakistan	Non-reporting or partially-reported data A substantial component of these fisheries is thought to operate in offshore waters, including waters beyond the EEZs of the flag countries concerned: although the fleets have reported total catches of neritic tunas, they have not reported catch-and-effort data as per the reporting standards of IOTC Res.15/02	• I.R. Iran – drifting gillnets (coastal / offshore): Following an IOTC Data Compliance mission in November 2017, I.R. Iran started submitting catch-and-effort data in accordance with the reporting requirements of Resolution 15/02 leading to substantial improvements in the data available for the Iranian fisheries in the IOTC database also for what concerns the newly developed coastal-longliners fleet. • Pakistan – drifting gillnets: Update: In 2018 Pakistan reported size data for some neritic tuna species (e.g., frigate tuna and kawakawa). However, no catch-and-effort has been reported to date, due to deficiencies in port sampling and absence of logbooks on-board vessels. WWF-Pakistan has been coordinating a crew-based data collection programme for over four years, which includes information on total enumeration of catches and fishing location (for sampled vessels) that could potentially be used to estimate catch-and-effort for Pakistan gillnet vessels in the absence of a national logbook program for its gillnet fleet. The information collected through this programme has been used to re-estimate the total catches of several

			species from 1987 onwards, and the IOTC Secretariat is currently liaising with WWF-Pakistan to evaluate the quality of the fine-grained data collected by the programme to determine whether it could be effectively used to officially provide C-E data according to Resolution 15/02.
Nominal catch, catch-and-effort, size data	<u>All industrial purse seine fisheries</u>	The total catches of frigate tuna, bullet tuna and kawakawa reported for industrial purse seine fleets are considered to be very incomplete, as they do not account for all catches retained onboard or include amounts of neritic tunas discarded. The same applies to catch-and-effort data.	There is a general lack of information on retained catches, catch-and-effort, and size data for neritic tunas retained by all purse seine fleets – in particular frigate tuna, bullet tuna, and kawakawa. Discard levels of neritic tunas by purse seiners are also only available for the EU purse seine fisheries during 2003-2017. <u>Update</u>: reporting coverage of the ROS is increasing and this might trigger an improvement in the estimates of catches for neritic species (both retained and discarded). In 2019 (with 2018 as reference year) Indonesia started reporting nominal catches as well as catch-and-effort data for a new industrial purse seine component of their fleet that seems to explicitly target neritic tunas (leading to remarkable increases in catches of bullet tuna reported for the year). Considering the relatively small dimensions (on average) of the Indonesian purse seine vessels listed in the IOTC Record of Authorised Vessels, it is still questionable whether this component of the fleet (as well as its associated catches) shall be properly considered as 'industrial' purse seiners rather than small, coastal ones; in any case, further clarification is required to properly attribute these catches to the originating fishery and determine the accuracy of the reported estimates. Following a mission in Indonesia made by the Secretariat in July 2022, Indonesia is in the process of revising the catch by fishing operation, which could change the catch allocated to industrial fisheries.
Discards	<u>All fisheries</u>	Although discard levels of neritic species are believed to be low for most fisheries, with the exception of industrial purse seiners, very little information is available on the level of discards.	The total amount of neritic tunas discarded at sea remains unknown for most fisheries and time periods, other than EU, Seychelles, and Mauritian purse seine fisheries during 2003–2017. <u>Update</u>: no update, although as reporting coverage of the ROS improves, there is the potential for an improvement in the estimates of catches of neritic species (retained and discarded).
Biological data	<u>All fisheries</u>	There is a general lack of biological data for neritic tuna and seerfish species in the Indian Ocean, in particular basic data that can be used to establish length-weight-age keys, non-standard measurements-fork length keys and processed weight-live weight keys.	Collection of biological information, including size data, remains very low for most neritic species. <u>Update</u>: The IOTC has been coordinating a Stock Structure Project, which commenced in 2016 and was completed in 2020. The project aimed to supplement gaps in the

			existing knowledge on biological data and provide an insight on whether neritic tuna and tuna like species should be considered as a single Indian Ocean stock.

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

The following is the Draft WPNT Program of Work (2023 to 2027) and is based on the specific requests of the Commission and Scientific Committee as well as topics identified during the WPNT12. The Program of Work consists of the following, noting that a timeline for implementation would be developed by the SC once it has agreed to the priority projects across all of its Working Parties:

- **Table 1**: Priority topics for obtaining the information necessary to develop stock status indicators for neritic tunas in the Indian Ocean;
- **Table 2**: Stock assessment schedule.

In selecting the priority projects, the SC is **REQUESTED** to take into consideration the data poor nature of the neritic tuna species and the potentially already fully exploited status of the species. Improved length frequency as well as improved abundance time series would improve stock assessments for these stocks so is a high priority.

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					
	● 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.					

3. Data mining and collation	Collate and characterize operational level data for the main neritic tuna fisheries in the Indian Ocean to investigate their suitability to be used for developing standardised CPUE indices. The following data should be collated and made available for collaborative analysis: 1) catch and effort by species and gear by landing site; 2) operational data: stratify this by vessel, month, and year for the development as an indicator of CPUE over time; and 3) operational data: collate other information on fishing techniques (i.e. area fished, gear specifics, depth, environmental condition (near shore, open ocean, etc.) and vessel size (length/horsepower)). 4) Reconstruction of historical catch by CPCs using recovered or captured information. 5) Re-estimation of historic catches (with consultation and consent of concerned CPCs) for assessment purposes (taking into account updated identification of uncertainties and knowledge of the history of the fisheries) ● (Data support missions to priority countries: India, Oman, Pakistan)					

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	➢ 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) ➢ Identify and utilise other sources of information, by engaging with other bodies such as SEAFDEC, SEAFO, RECOFI, BOBLME, SWIOFC, IOC, among others. ➢ Integrate or evaluate market support and recognition for neritic tuna (sub-regional markets) with a focus on data acquisition ➢ Explore alternate sources of data collection, including the rapid use of citizen science based approaches which are reliable and verified by the SC.					

	➢ Assess/scope/explore the significance and importance of neritic species for food security, nutrition and contribution to national GDP. ➢ 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. ➢ 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.					
6. CPUE standardisation	Develop standardised CPUE series for the main fisheries for longtail, kawakawa, Indo-Pacific King mackerel and Spanish mackerel in the Indian Ocean, with the aim of developing CPUE series for stock assessment purposes.					
	➢ Sri Lanka (priority species: Frigate tuna, Kawakawa, bullet tuna)					
	➢ Indonesia (priority species: Kawakawa, Bullet tuna, Frigate tuna)					
	➢ Pakistan (priority species: Longtail tuna, Kawakawa, narrow-barred Spanish mackerel)					
	➢ Iran gillnet CPUEs for all species					
	➢ India available CPUEs to be provided to next assessment session					
	Capacity building support for CPCs to develop standardised CPUEs for their fisheries					

Table 2. Proposed assessment schedule for the IOTC Working Party on 2023-2027

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

APPENDIX VII
EXECUTIVE SUMMARY: BULLET TUNA

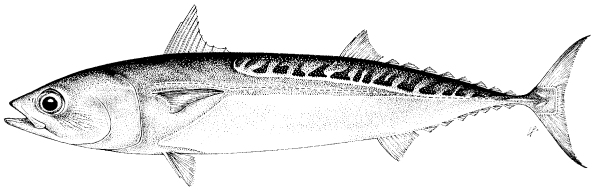

TABLE 1. Status of bullet tuna (*Auxis rochei*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch 2020[2] (t)	28,698	
	Mean annual catch (2016-2020) (t)	21,979	
	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 2020: 33%; [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. A new assessment was 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 2020 catches (reference year 2019), 40% 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 2016-2020)**: bullet tuna is caught using purse seine (55.8%), followed by line (21.3%) and gillnet (15.2%). The remaining catches taken with other gears contributed to 7.7% of the total catches in recent years (**Fig. 1**);
- **Main fleets (mean annual catch 2016-2020)**: most bullet tuna catches are attributed to vessels flagged to India (37.4%) followed by Indonesia (31.6%) and Thailand (22.8%). The 14 other fleets catching bullet tuna contributed to 8.2% of the total catch in recent years (**Fig. 2**).

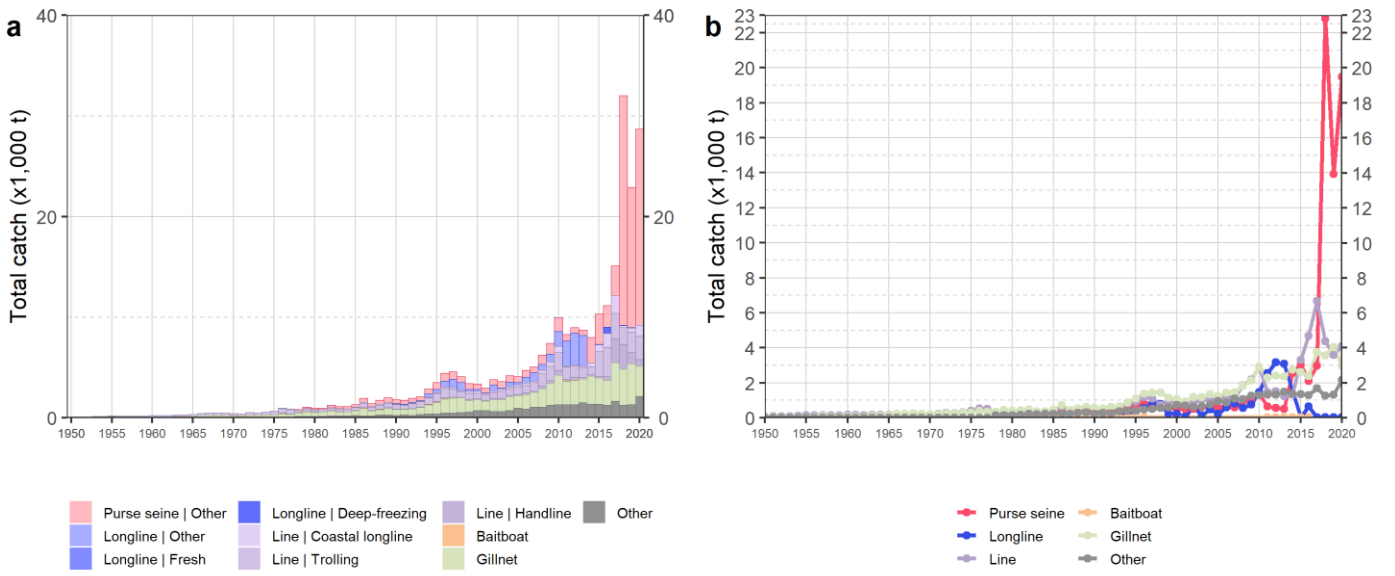

Fig. 1. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for bullet tuna during 1950-2020

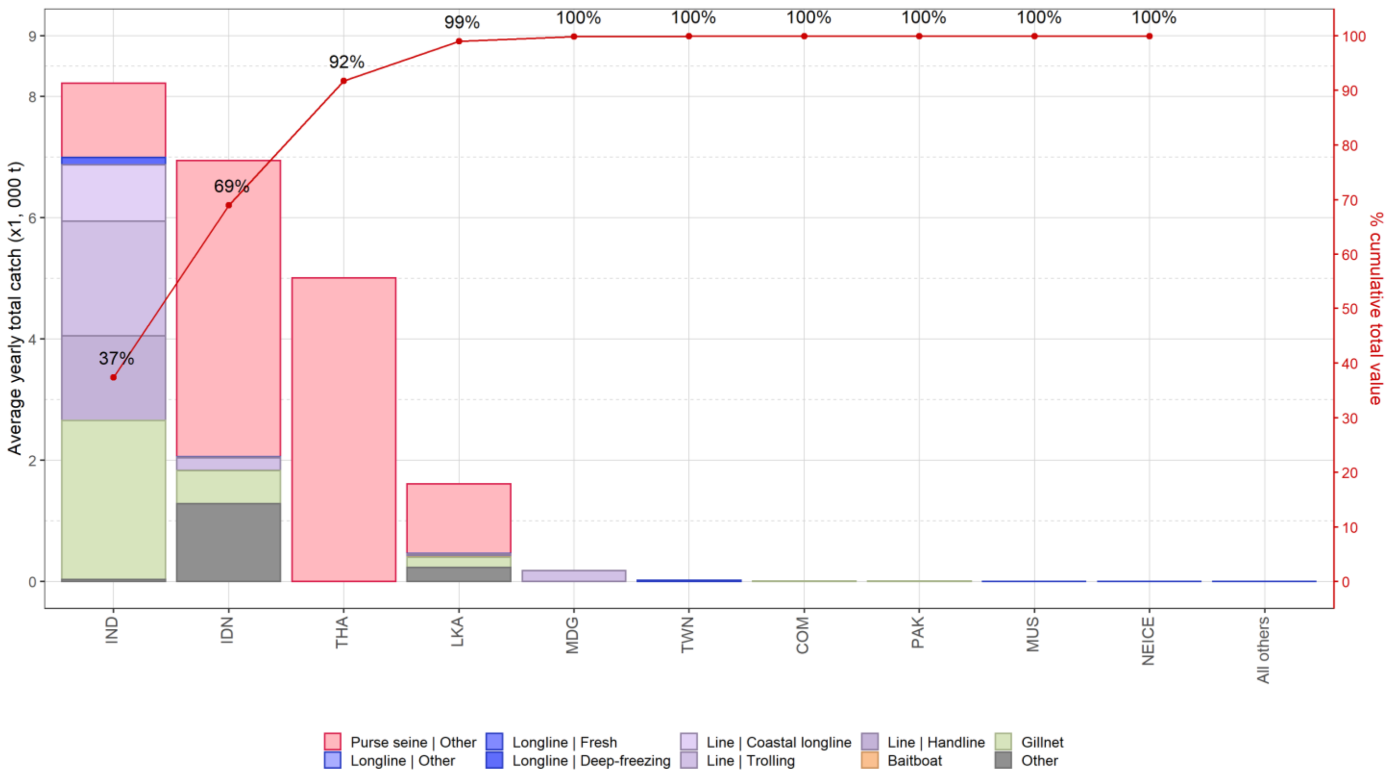

Fig. 2. Mean annual catches (t) of bullet tuna by fleet and fishery between 2016 and 2020, with indication of cumulative catches by fleet

APPENDIX VIII
EXECUTIVE SUMMARY: FRIGATE TUNA

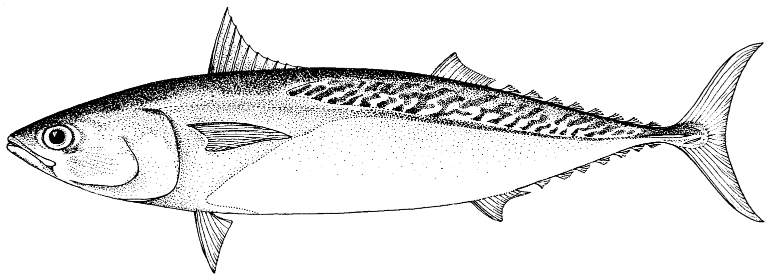

TABLE 1. Status of frigate tuna (*Auxis thazard*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch (2020) (t)[2]	127,516	
	Mean annual catch (2016-2020) (t)	103,740	
	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 2020: 74.3%; [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. A new assessment was carried out 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 2020 catches (reference year 2019), 40% of the total catches were either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore, the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.

Fisheries overview.

- **Main fisheries (mean annual catch 2016-2020)**: frigate tuna is caught using gillnet (38.8%), followed by line (32.8%) and purse seine (14.5%). The remaining catches taken with other gears contributed to 13.8% of the total catches in recent years (**Fig. 1**);
- **Main fleets (mean annual catch 2016-2020)**: most frigate tuna catches are attributed to vessels flagged to Indonesia (59.8%) followed by Pakistan (12.1%) and I. R. Iran (9.8%). The 27 other fleets catching frigate tuna contributed to 18.5% of the total catch in recent years (**Fig. 2**).

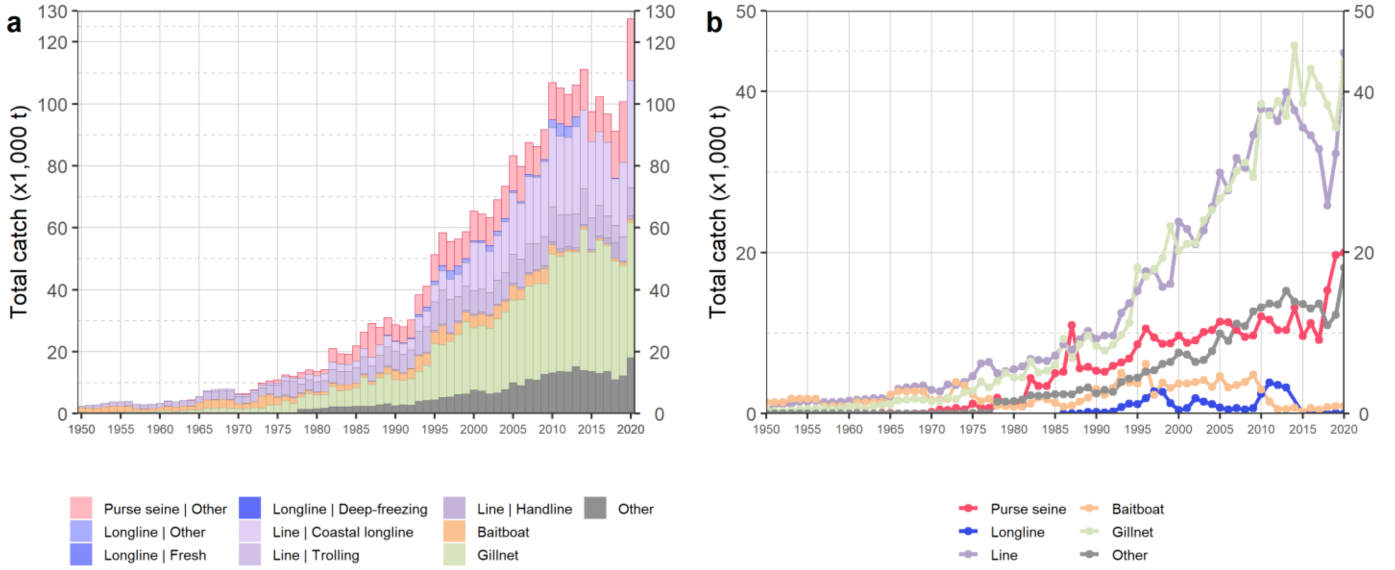

Fig. 1. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for frigate tuna during 1950-2020

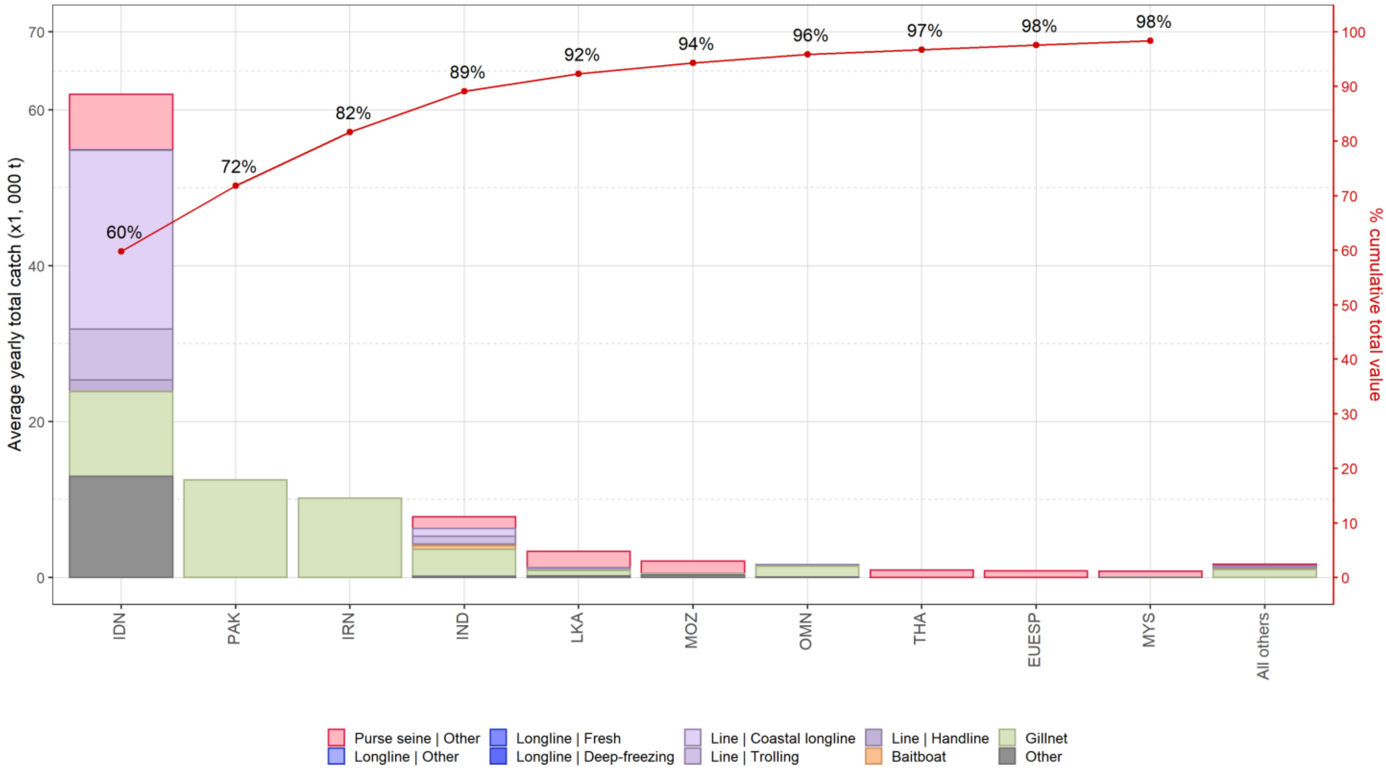

Fig. 2. Mean annual catches (t) of frigate tuna by fleet and fishery between 2016 and 2020, with indication of cumulative catches by fleet

APPENDIX IX
EXECUTIVE SUMMARY: KAWAKAWA

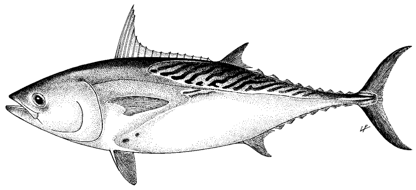

TABLE 1. Status of kawakawa (*Euthynnus affinis*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch 2020[2] (t)	161,594	**50%**
	Mean annual catch 2016-2020 (t)	154,388	
	MSY (t) (80% CI)	148,825 (124,114 – 222,505)	
	F_{MSY} (80% CI)	0.44 (0.21–0.82)	
	B_{MSY} (t) (80% CI)	355,670 (192,080 – 764,530)	
	$F_{current}/F_{MSY}$ (80% CI)	0.98 (0.85–1.11)	
	$B_{current}/B_{MSY}$ (80% CI)	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 2020: 57.8%; [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)	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 2021 and so the results are based on the assessment carried out in 2020 using data-limited assessment techniques. 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 all 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 2019 was equal to 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.

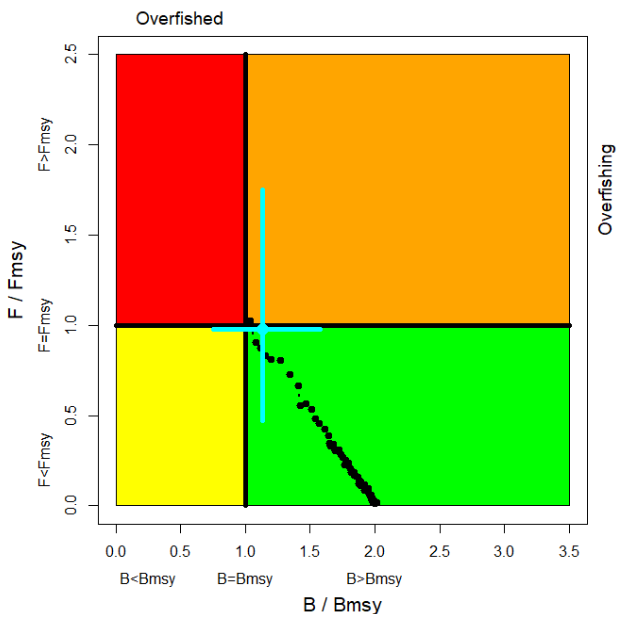

Fig. 1. COM Indian Ocean assessment Kobe plot for kawakawa. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018 (median and 80% confidence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

Fisheries overview.

- **Main fisheries (mean annual catch 2016-2020)**: kawakawa are caught using gillnet (49.1%), followed by purse seine (29.9%) and line (16.2%). 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 2016-2020)**: the majority of kawakawa catches are attributed to vessels flagged to Indonesia (30%) followed by I. R. Iran (23.1%) and India (21%). The 32 other fleets catching kawakawa contributed to 25.7% of the total catch in recent years (**Fig. 3**).

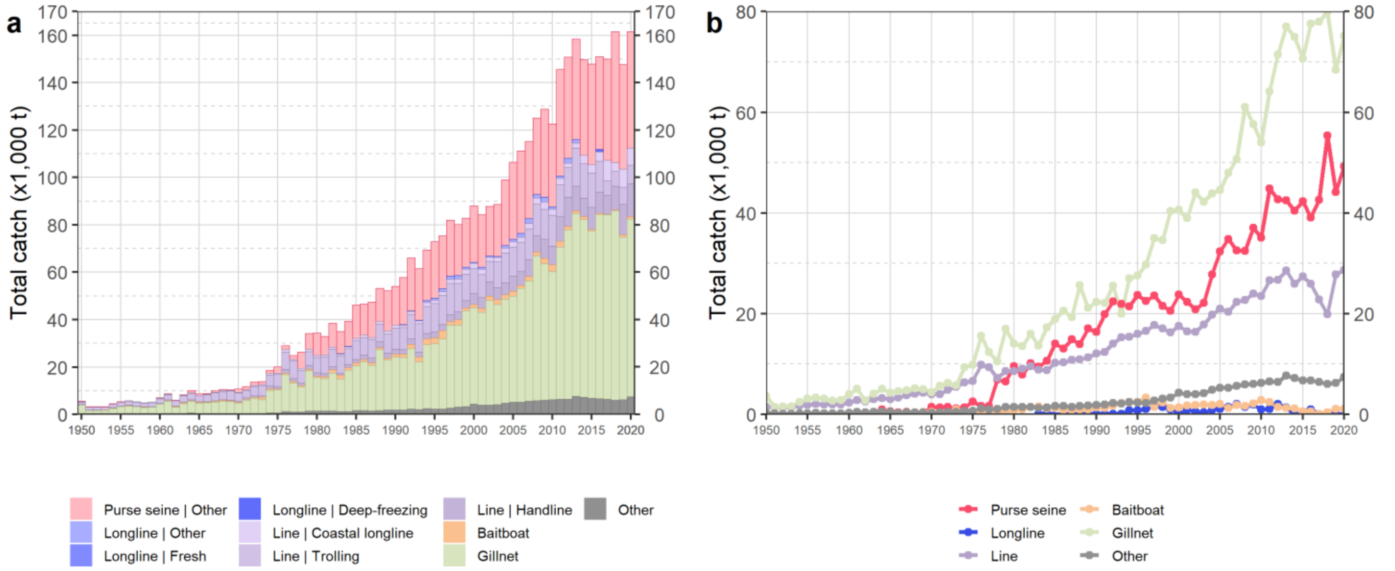

Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for kawakawa during 1950-2020

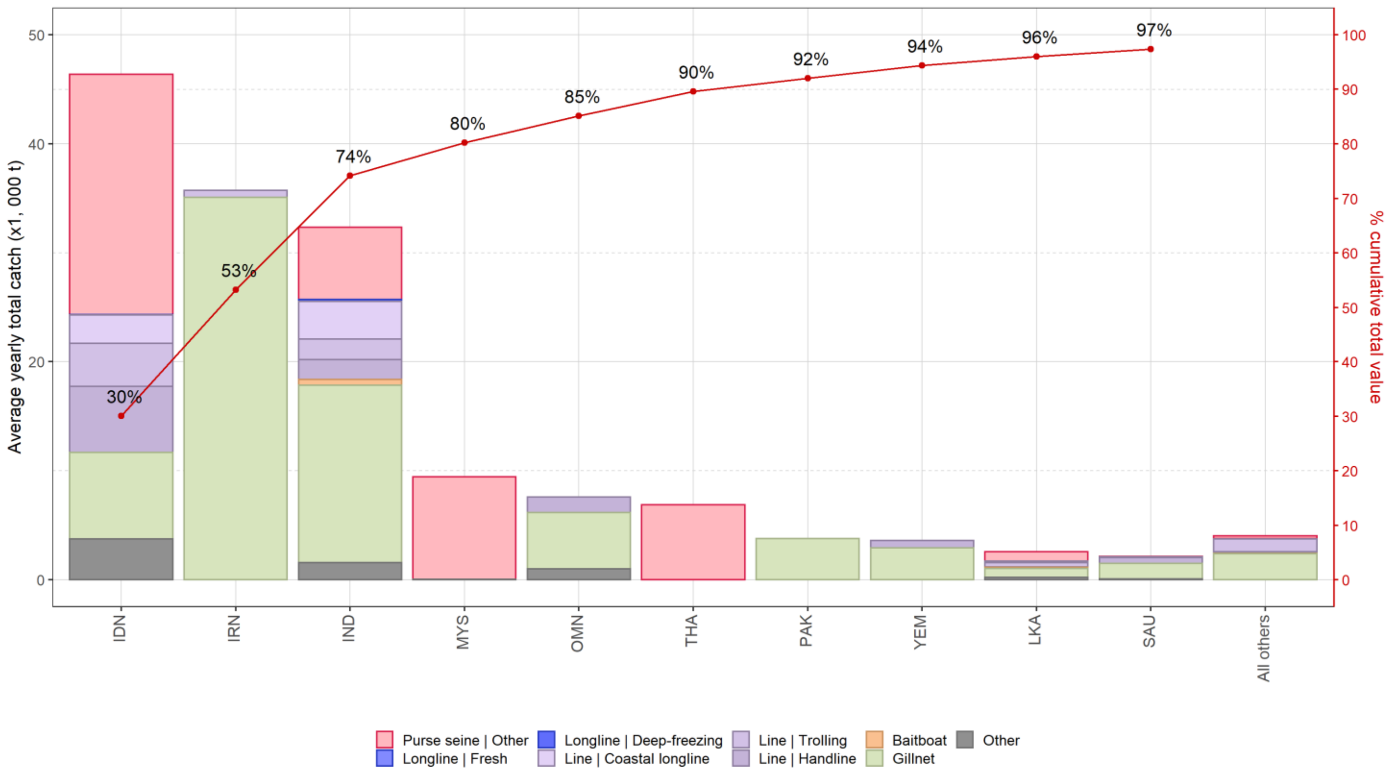

Fig 3. Mean annual catches (t) of kawakawa by fleet and fishery between 2016 and 2020, with indication of cumulative catches by fleet

APPENDIX X
EXECUTIVE SUMMARY: LONGTAIL TUNA

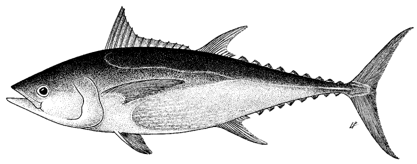

TABLE 1. Status of longtail tuna (*Thunnus tonggol*) in the Indian Ocean

Area[1]	Indicators		2020 stock status determination[3]
Indian Ocean	Catch 2020[2] (t)	137,606	**76%**
	Mean annual catch (2016-2020) (t)	134,576	
	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 2020: 32.1%; [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}≥ 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 2021 and so the results are based on the assessment carried out in 2020 using the Optimised Catch-Only Method (OCOM). Analysis using the OCOM indicates that the stock is being exploited at a rate that exceeded F_{MSY} in recent years and that the stock appears to be below B_{MSY} and above F_{MSY} (76% of plausible models runs) (**Fig. 2**). Catches were above MSY between 2010 and 2018 but steadily declined from 2012 to were 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. Therefore, 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 and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).

Management advice. The catch in 2019 was below the estimated MSY but the exploitation rate has been increasing over the last few years, as a result of the declining abundance. Despite the substantial uncertainties, this suggests that the stock is very close to being fished at MSY levels and that higher catches may not be sustained. A precautionary approach to management is recommended.

The following should be also noted:

- The Maximum Sustainable Yield estimate of around 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 2020 catches (reference year 2019) 30% 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.

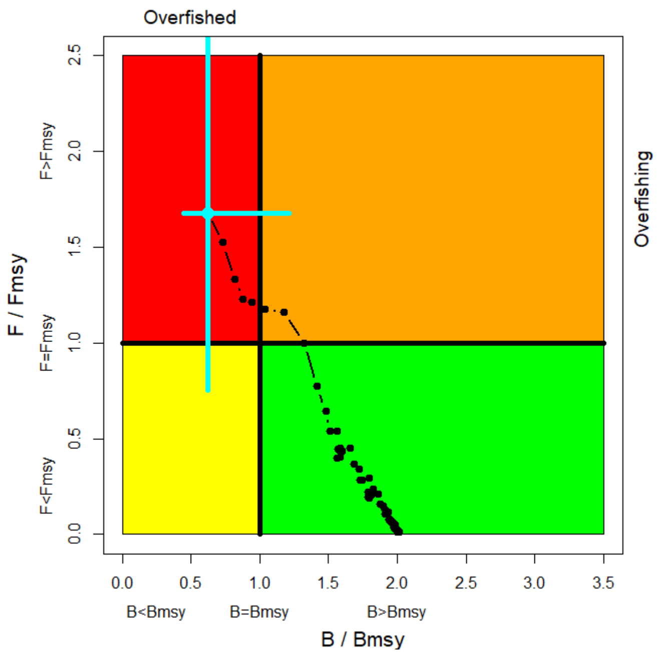

Fig. 1. Longtail tuna OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018 (median and 80% confidence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

Fisheries overview.

- **Main fisheries (mean annual catch 2016-2020)**: longtail tuna are caught using gillnet (71%), followed by line (14.2%) and purse seine (8.2%). The remaining catches taken with other gears contributed to 6.7% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2016-2020)**: the majority of longtail tuna catches are attributed to vessels flagged to I. R. Iran (41.9%) followed by Indonesia (19.7%) and Sultanate of Oman (14.1%). The 23 other fleets catching longtail tuna contributed to 24.1% of the total catch in recent years (**Fig. 3**).

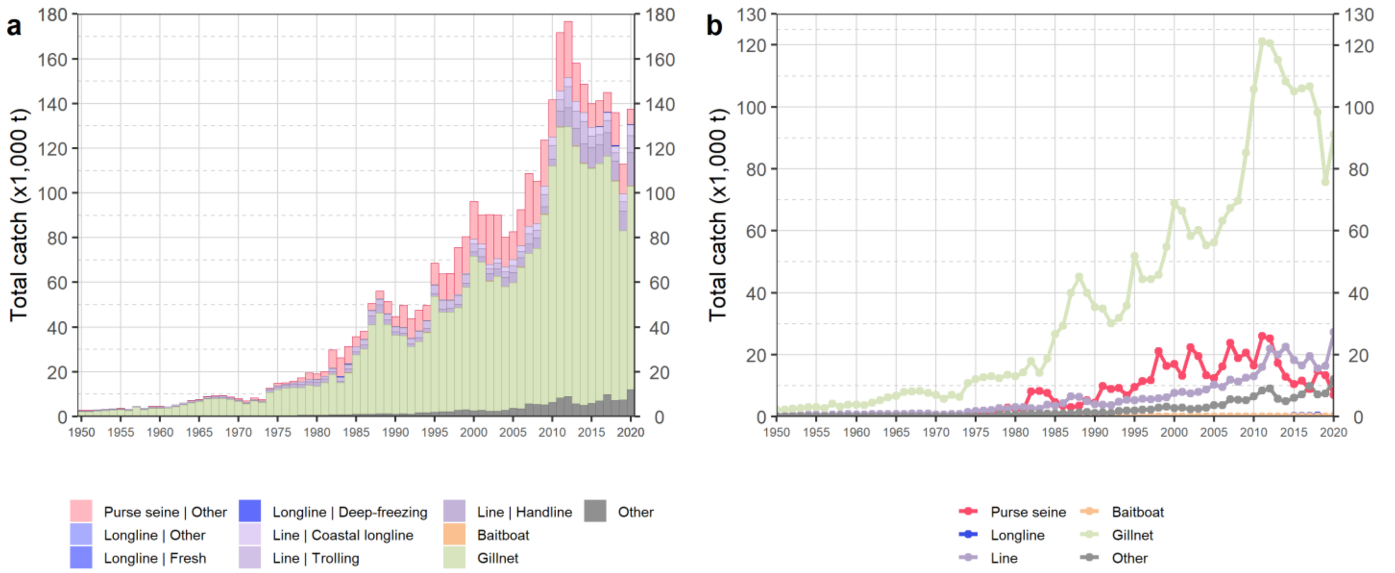

Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for longtail tuna during 1950-2020

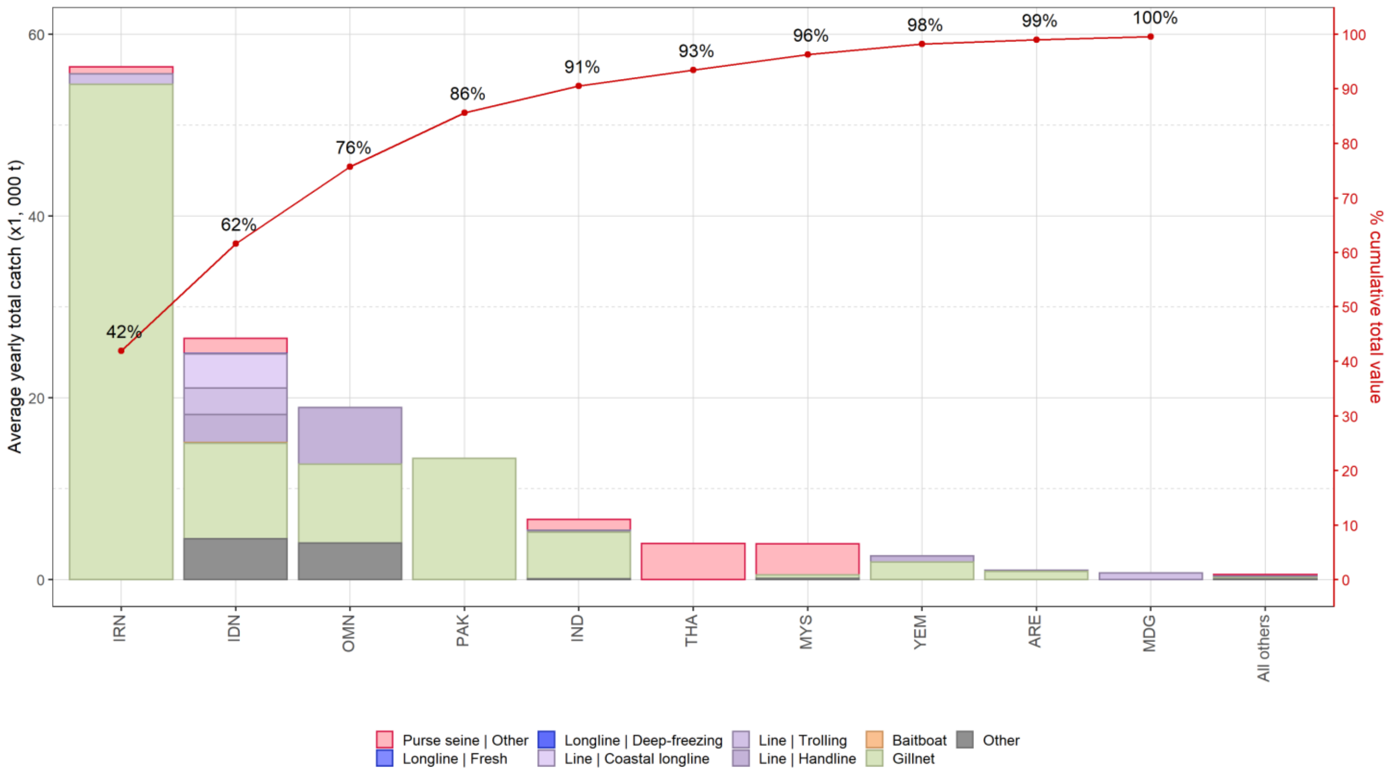

Fig. 3. Mean annual catches (t) of longtail tuna by fleet and fishery between 2016 and 2020, with indication of cumulative catches by fleet

APPENDIX XI
EXECUTIVE SUMMARY: INDO-PACIFIC KING MACKEREL

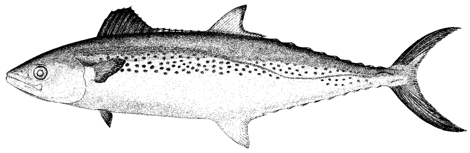

TABLE 1. Status of Indo-Pacific king mackerel (*Scomberomorus guttatus*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch (2020) (t)[2]	48,424	**35%**
	Mean annual catch (2016-2020) (t)	46,060	
	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 2020: 76.9%; [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)	16%	19%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	30%	35%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new assessment was carried out in 2021 using the data-limited techniques (CMSY and LB-SPR) . 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 2019 was below the estimated MSY. This suggests that the stock is very 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 2020 catches (reference year 2019), 75% 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.

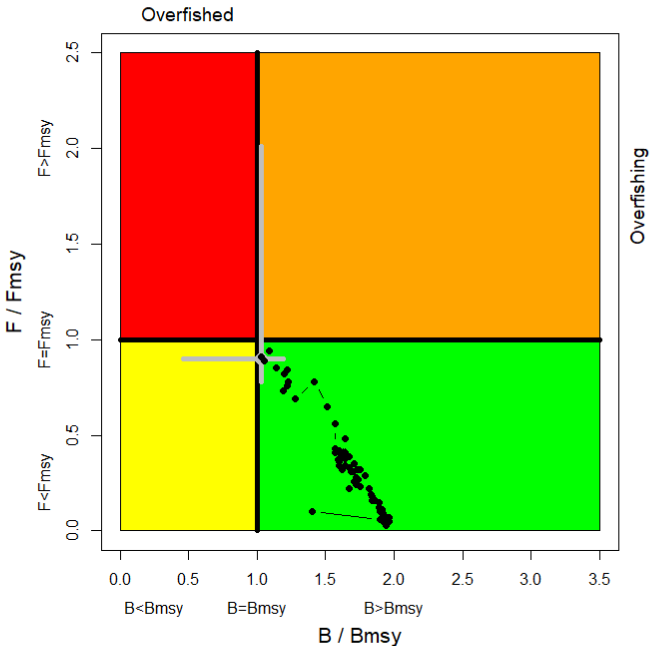

Fig. 1. Indo-Pacific king mackerel CMSY Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The gray cross represents the estimate of stock status in 2021 (median and 80% confidence interval)

Fisheries overview.

- **Main fisheries (mean annual catch 2016-2020)**: Indo-Pacific king mackerel are caught using gillnet (66.1%), followed by other (21.8%) and line (9.2%). The remaining catches taken with other gears contributed to 2.8% of the total catches in recent years (**Fig. 2**).
- **Main fleets (mean annual catch 2016-2020)**: the majority of Indo-Pacific king mackerel catches are attributed to vessels flagged to India (34.9%) followed by Indonesia (29.3%) and I. R. Iran (20.9%). The 15 other fleets catching Indo-Pacific king mackerel contributed to 14.8% of the total catch in recent years (**Fig. 3**).

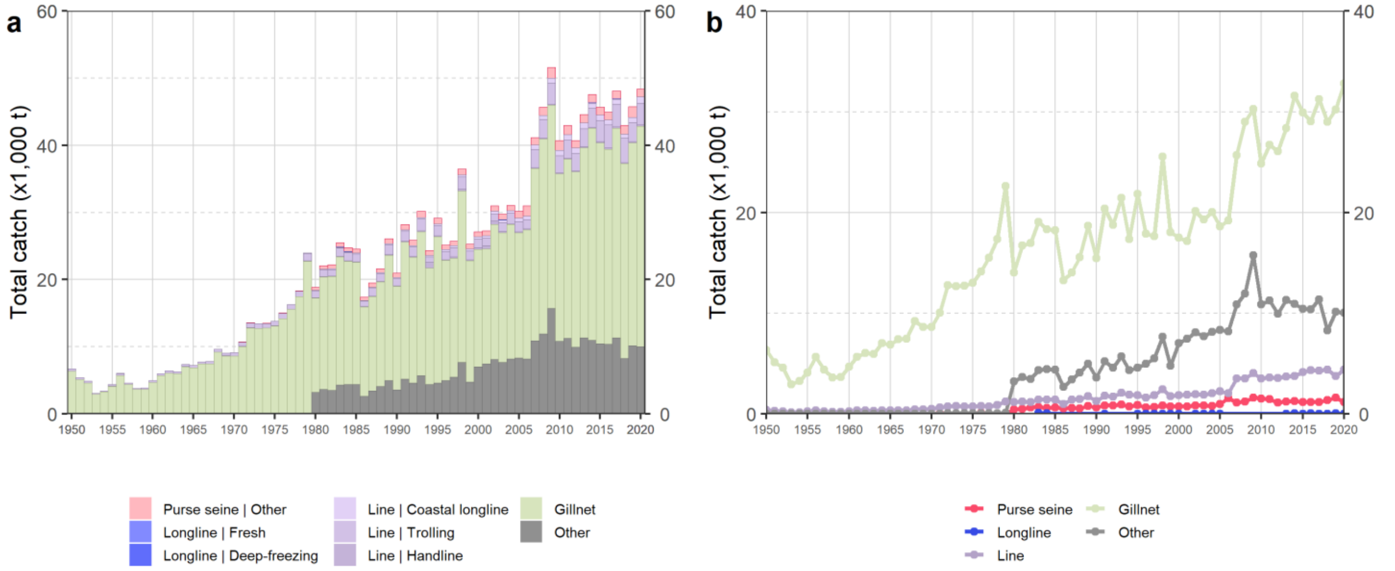

Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for Indo-Pacific king mackerel during 1950-2020

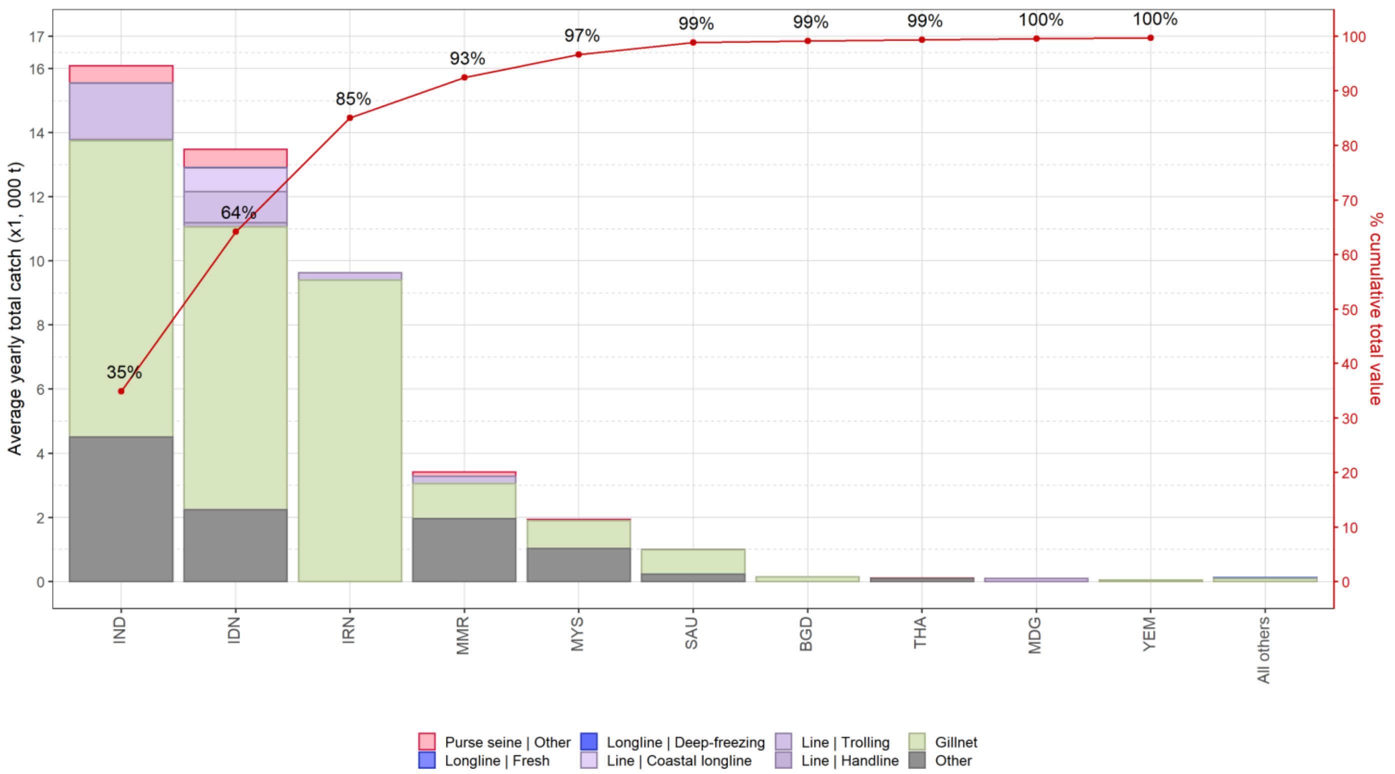

Fig. 3. Mean annual catches (t) of Indo-Pacific king mackerel by fleet and fishery between 2016 and 2020, with indication of cumulative catches by fleet

APPENDIX XII
EXECUTIVE SUMMARY: NARROW-BARRED SPANISH MACKEREL

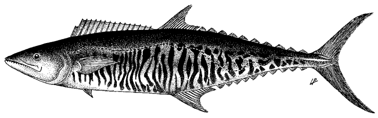

TABLE 1. Status of narrow-barred Spanish mackerel (*Scomberomorus commerson*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch (2020)[2] (t)	169, 407	73%
	Mean annual catch (2016-2020) (t)	161,409	
	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 2020: 70.2%; [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 2021 and so the results are based on the assessment carried out in 2020 using the Optimised Catch-Only Method (OCOM). The OCOM model indicates that the stock is being exploited at a rate exceeding F_{MSY} in recent years, and the stock appears to be below B_{MSY}. An analysis undertaken in 2013 in the Northwest Indian Ocean (Gulf of Oman) indicated that overfishing is occurring in this area and that localised depletion may also be occurring[2]. 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.).

Management advice. The catch in 2019 was just below 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 probably very close to being fished at MSY levels and higher catches may not be sustained.

[2] IOTC-2013-WPNT03-27

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 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 2020 catches (reference year 2019) 72% 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.

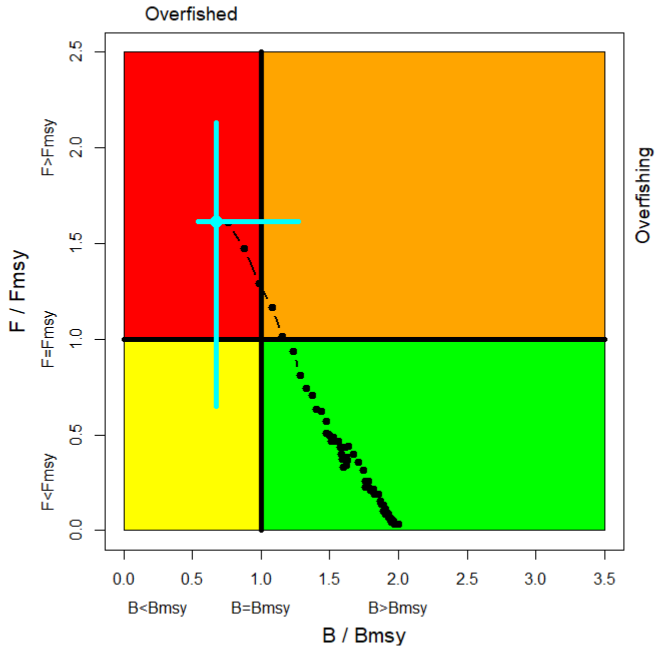

Fig. 1. Narrow-barred Spanish Mackerel OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018 (median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

Fisheries overview.

- **Main fisheries (mean annual catch 2016-2020)**: narrow-barred Spanish mackerel are caught using gillnet (60.2%), followed by line (18%) and other (15.7%). The remaining catches taken with other gears contributed to 6% of the total catches in recent years (**Fig. 2**).
- **Main fleets (mean annual catch 2016-2020)**: the majority of narrow-barred Spanish mackerel catches are attributed to vessels flagged to Indonesia (26.7%) followed by India (19.1%) and I. R. Iran (15.2%). The 28 other fleets catching narrow-barred Spanish mackerel contributed to 38.8% of the total catch in recent years (**Fig. 3**).

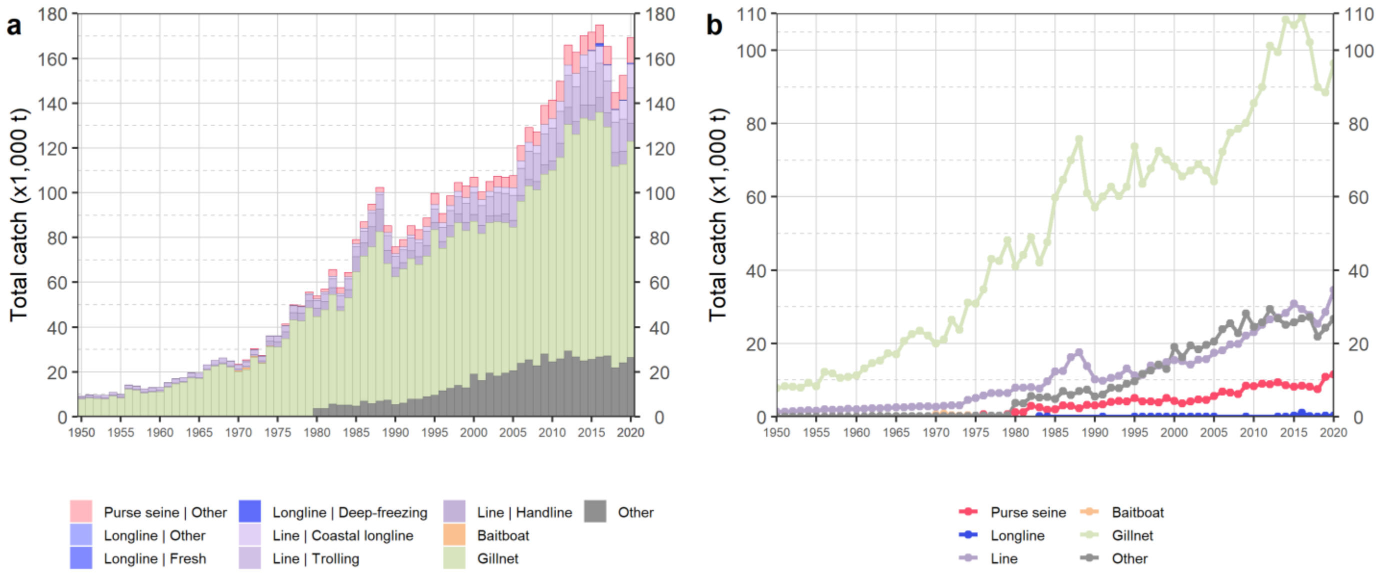

Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for narrow-barred Spanish mackerel during 1950-2020

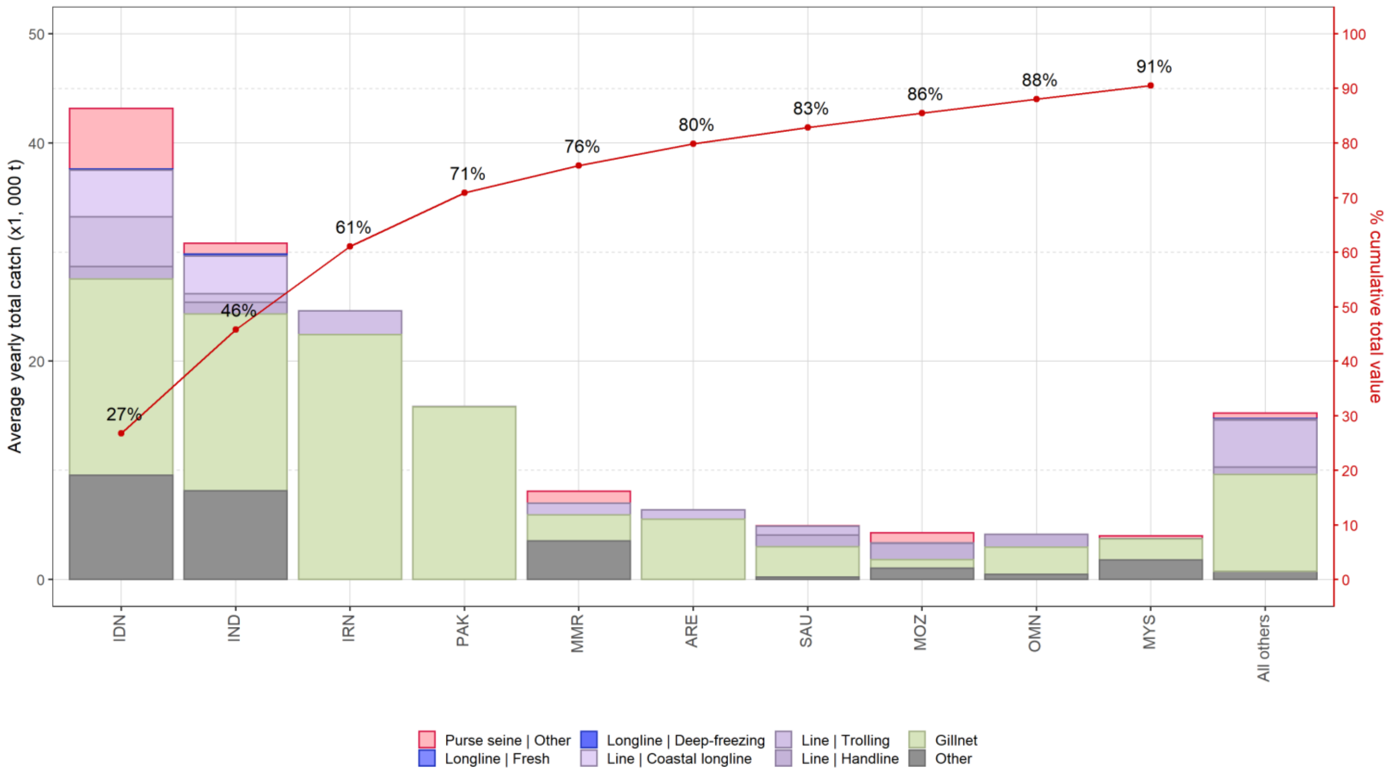

Fig. 3. Mean annual catches (t) of narrow-barred Spanish mackerel by fleet and fishery between 2016 and 2020, with indication of cumulative catches by fleet

APPENDIX XIII

CONSOLIDATED RECOMMENDATIONS OF THE 12TH SESSION OF THE WORKING PARTY ON NERITIC TUNAS

Note: Appendix references refer to the Report of the 12th Session of the Working Party on Neritic Tunas (IOTC–2022–WPNT12–R)

Revision of the WPNT Program of Work (2023–2027)

WPNT12.01 (para 79) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2023–2027), as provided in Appendix VI.

Review of the draft, and adoption of the Report of the 12th Working Party on Neritic Tunas

WPNT12.02 (para 81) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT12, provided in Appendix XIII, as well as the management advice provided in the draft resource stock status summary for each of the six neritic tuna (and mackerel) species under the IOTC mandate, and the combined Kobe plot for the species assigned a stock status in 2022:

- Bullet tuna (*Auxis rochei*) – Appendix VII
- Frigate tuna (*Auxis thazard*) – Appendix VIII
- Kawakawa (*Euthynnus affinis*) – Appendix IX
- Longtail tuna (*Thunnus tonggol*) – Appendix X
- Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix XI
- Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix XII