Report of the 13th Session of the IOTC Working Party on Neritic Tunas

Eden Bleu Hotel, Seychelles, 3 – 7 July 2023

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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_{2023} is the fishing mortality estimated in the year 2023
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 13th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT13) was held in a hybrid format in Seychelles and online using the Zoom online platform from 3 - 7 July 2023. A total of 35 participants (36 in 2022, 33 in 2021 and 43 in 2020) 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.

Progress on the Recommendations of WPNT12 and SC25

WPNT13.01 (para. 11) The WPNT **NOTED** that the current name of the working group may be misleading as two of the six species covered by the group are not classed as neritic tunas, they are in fact seerfish. The WPNT **DISCUSSED** the possibility of changing the name of the working group to clarify this with suggested options including the Working Party on: neritic tunas and seerfish; neritic tuna and tuna-like species; and neritic species. The WPNT **RECOMMENDED** that the SC discuss the necessity for a name change and the proposed options.

Review of the statistical data available for neritic tunas

WPNT13.02 (para 33) **NOTING** how issues in species identification are common for neritic tunas and seerfish in several fisheries and that this affects the accuracy of the time series of catch which are the main input for the assessment models, the WPNT **RECOMMENDED** that the SC endorse the organisation of training workshops for fish species identification.

WPNT13.03 (para 40) **ACKNOWLEDGING** that FAO, through its Coordinating Working Party on Fishery Statistics (CWP), is actively working on the standardization of effort definitions and on a proposal for standard effort units by gear type, the WPNT **RECOMMENDED** that the SC endorses the amendment of the IOTC data reporting requirements accordingly in order to reflect the results of these studies and guarantee homogeneous reporting of effort statistics in the future.

WPNT13.04 (para 44) **NOTING** the interest of size-based assessment models such as LB-SPR as an alternative or complement to catch-based approaches, the WPNT **RECOMMENDED** the SC to endorse the development of a large-scale regional sampling program focusing on the collection of size-frequency data from coastal fisheries and also including the collection of morphometric data required to develop robust conversion factors, length-length and length-weight relationships.

Revision of the WPNT Program of Work (2024–2028)

WPNT13.05 (para 116) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2024–2028), as provided in Appendix VI.

Review of the draft, and adoption of the Report of the 13th Working Party on Neritic Tunas

WPNT13.06 (para 123) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT13, 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 2023:

- 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: 2023

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	2018	2019	2020	2021	2022	2023	Advice to the Commission
Bullet tuna *Auxis rochei*	Catch 2021: 14,198 t Average catch 2017-2021: 22,771 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 2023 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 (8,590 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 2021: 105,547 t Average catch 2017-2021: 106,615 t								No new stock assessment was conducted for frigate tuna in 2023 and so the results are based on the assessment carried out in 2021 using the data-limited techniques (CMSY

Stock	Indicators	Previous	2018	2019	2020	2021	2022	2023	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								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 2021[2]: 150,170 t Average catch 2017-2021: 156,654 t MSY(80% CI) 154 (122 –193) F_{MSY} (80% CI) 0.60 (0.48–0.74) B_{MSY} (80% CI) 258 (185–359) $F_{current}/F_{MSY}$ (80% CI) 0.98 (0.82–2.20) $B_{current}/B_{MSY}$ (80% CI) 0.99 (0.45–1.20)							**27%**	A new assessment was conducted for kawakawa in 2023 which examined a number of data-limited methods include C-MSY, OCOM, and JABBA models (based on data up to 2021). The C-MSY model has been explored more fully and therefore is used to obtain estimates of stock status. The C-MSY model indicated that the fishing mortality F was very close to F_{MSY} (F/F_{MSY}=0.98) and the current biomass B was also very close to B_{MSY} (B/B_{MSY}=0.99). The estimated probability of the stock currently being in yellow quadrant of the Kobe plot is about 27%. Due to the quality of the data being used, the simple modelling approach employed in 2020 and 2023, and the large increase in kawakawa catches over the last decade, measures need to be taken in order to reduce the level of catches which have surpassed the estimated MSY levels for most years since 2011. Based on the C-MSY assessment, the kawakawa stock for the Indian Ocean is classified as **overfished** but **not subject to overfishing**. However, the assessment using catch-only method is subjected to high uncertainty and is highly influenced by several prior assumptions. 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 2021: 134,171 t Average catch 2017-2021: 134,171 t								A new assessment was conducted for longtail tuna in 2023 which examined a number of data-limited methods include C-MSY, OCOM, and JABBA models (based on data up

Stock	Indicators	Previous	2018	2019	2020	2021	2022	2023	Advice to the Commission
	MSY (80% CI) 133 (108–165) F_{MSY} (80% CI) 0.31 (0.22–0.44) B_{MSY} (80% CI) 433 (272–690) $F_{current}/F_{MSY}$ (80% CI) 1.05 (0.84–2.31) $B_{current}/B_{MSY}$ (80% CI) 0.96 (0.44–1.19)							35%	to 2021). The C-MSY model has been explored more fully and therefore is used to obtain estimates of stock status. The C-MSY analysis indicates that the stock is being exploited at a rate that exceeded F_{MSY} in recent years and that the stock appears to be below B_{MSY} and above F_{MSY} (35% of plausible models runs). Catches between 2017 and 2021 were slightly above MSY but steadily declined from 2012 to less than 113,000 t in 2019. The F_{2021}/F_{MSY} ratio is lower than previous estimates and the B_{2021}/B_{MSY} ratio was higher than in previous years. Based on the C-MSY assessment, the stock is considered to be both **overfished** and **subject to overfishing** (**Table 1**; **Fig. 1**). However, the assessment using catch-only method is subjected to high uncertainty and is highly influenced by several prior assumptions. The catch in 2021 (134,171 t) was just above the estimated MSY (133,000 t) and the exploitation rate has been increasing over the last few years, as a result of the declining abundance. Despite the substantial uncertainties, this suggests that the stock is 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 2021: 33,418 t Average catch 2017-2021: 44,508 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)					35%			No new stock assessment was conducted for Indo-Pacific king mackerel in 2023 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 XII
Narrow-barred Spanish mackerel *Scomberomorus commerson*	Catch 2021: 168,807 t Average catch 2017-2021: 160,352 t MSY (80% CI) 161 (132–197) F_{MSY} (80% CI) 0.60 (0.48–0.74) B_{MSY} (80% CI) 271 (197–373) $F_{current}/F_{MSY}$ (80% CI) 1.07 (0.88–2.38) $B_{current}/B_{MSY}$ (80% CI) 0.98 (0.44–1.19							31%	A new assessment was conducted for narrow-barred Spanish mackerel in 2023 which examined a number of data-limited methods include C-MSY, OCOM, and JABBA models (based on data up to 2021). The C-MSY model has been explored more fully and therefore is used to obtain estimates of stock status. The C-MSY analysis indicates that the stock is being exploited at a rate that exceeded F_{MSY} in recent years and that the stock appears to be below B_{MSY} and above F_{MSY} (31% of plausible models runs). Based on the C-MSY assessment, the stock appears to be **overfished** and **subject to overfishing**. However, the assessment using catch-only method is subjected to high uncertainty and is highly influenced by several prior assumptions. Click here for a full stock status summary: Appendix XI

*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 13th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT13) was held in a hybrid format in Seychelles and online using the Zoom online platform from 3 - 7 July 2023. A total of 35 participants (36 in 2022, 33 in 2021 and 43 in 2020) 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 WPNT13 are listed in Appendix III.

3. The IOTC process: Outcomes, updates and progress

3.1 Outcomes of the 25th Session of the Scientific Committee

3. The WPNT **NOTED** paper IOTC–2023–WPNT13–03 which outlined the main outcomes of the 25th Session of the Scientific Committee (SC25), 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 26th Sessions of the Commission

4. The WPNT **NOTED** paper IOTC–2023–WPNT13–04 which outlined the main outcomes of the 26th Sessions of the Commission, specifically related to the work of the WPNT. The WPNT further **NOTED** that the 27th 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 26th Session.

5. Participants to WPNT13 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–2023–WPNT13–05 which aimed to encourage participants at the WPNT13 to review some of the existing Conservation and Management Measures (CMM) relating to neritic tunas.

3.4 Progress on the Recommendations of WPNT12 and SC25

7. The WPNT **NOTED** paper IOTC–2023–WPNT13–06 which provided an update on the progress made in implementing the recommendations from the 12th 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 2023.

9. The WPNT participants were **ENCOURAGED** to review IOTC-2023-WPNT13-06 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 (WPNT14).

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.

11. The WPNT **NOTED** that the current name of the working group may be misleading as two of the six species covered by the group are not classed as neritic tunas, they are in fact seerfish. The WPNT **DISCUSSED** the possibility of changing the name of the working group to clarify this with suggested options including the Working Party on: neritic tunas and seerfish; neritic tuna and tuna-like species; and neritic species. The WPNT **RECOMMENDED** that the SC discuss the necessity for a name change and the proposed options.

4. CPUE Workshop

4.1 CPUE standardization materials (IOTC Secretariat)

12. The WPNT **NOTED** that the purpose of the CPUE workshop was to assist CPCs in building their capacity to undertake CPUE analysis. It also intended to encourage participants to develop abundance indices from their catch effort data that can be incorporated into assessments of neritic tuna. The workshop was facilitated by the IOTC Secretariat and the SC chair.

13. The workshop began with a number of presentations that provided introductions to the concepts and principles of CPUE standardization, case studies of CPUE analysis in IOTC fisheries, and fundamental theories of fitting linear and generalized linear models. These presentations were followed by a practical tutorial and exercises that involved running standardization models on datasets of simulated catch effort.

14. The WPNT **NOTED** that catch per unit effort is influenced by catchability and abundance, and that changes in raw CPUE therefore represented changes in both catchability and abundance. As such, catchability-related changes in CPUE must be removed and quantified in order to leave a component that can be presumed to index changes in abundance. The most common approaches for performing the task are linear and generalized linear models. The WPNT further **NOTED** the detailed explanation of the model fitting, extraction of standardised index (linear effects), and model diagnostic procedures.

15. The WPNT **NOTED** several applications of CPUE analyses in IOTC fisheries, including the longline fisheries (for tropical tuna), Maldives Pole and line fishery (for skipjack tuna), and Iranian gillnet Fisheries (for neritic tuna species). The case studies highlighted several issues that are important in the CPUE standardization processes, including the need to consider targeting effect and changes in fishing practices. In particular, the Maldives Pole and line fishery CPUE analysis illustrated the importance of incorporating vessel effect in estimating standardised effort.

16. The WPNT **NOTED** the introduction on the basics of linear and general linear modelling, and the explanation of the main principles underlying these various modelling approaches and their technological applications. The WPNT also **NOTED** the usefulness of these techniques and how they might be used to examine the catch and effort information gathered by the CPCs. This tutorial was a significant step in the direction of CPUE series standardization.

4.2 Hands on data analysis work (all)

17. The WPNT **NOTED** the tutorial on R studio, a free and open-source integrated development environment for R, as well as the general R programming environment. The R-Markdown toolbox, which allows the integration of scripting, analysis, and documentation into one interface and facilitates collaborative work between scientists as well as the production of analysis in a visible and repeatable manner, was also introduced to the participants.

18. The tutorial included a step-by-step walkthrough that showed participants how to import, prepare, and format data in R, fit both linear and generalized linear models, and interpret the model results. The use of residuals plots for diagnostic purposes and ANOVA analysis for model comparison were covered at length. These topics covered the fundamental steps in CPUE standardization.

19. The WPNT **NOTED** the further tutorial provided by the facilitator on manipulating and visualizing the data. Several basic data exploratory tools were demonstrated as well as visualization packages for plotting and analysing the data.

20. The WPNT **THANKED** the facilitator for providing this very useful tutorial as well as all the associated code for the participants to apply to their own data.

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

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

21. The WPNT **NOTED** paper IOTC–2023–WPNT13–07 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.

22. 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.

23. The WPNT **NOTED** that 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.

24. **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 a 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.

25. The WPNT **NOTED** that, due to the high uncertainty in the information provided for several gears and species by some key fleets up to 2022 (data for reference year 2021), the Secretariat had to re-estimate a consistent fraction of nominal catches of neritic tuna and seerfish species, and reiterated its **SUGGESTION** that all concerned CPCs liaise with the Secretariat to determine whether updates to nominal catch data for their fisheries can be provided for 2021 and previous years.

26. 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 2021, and that the availability of other important data such as geo-referenced catch and efforts and size-frequencies varies greatly by species, gear and fleets considered.

27. The WPNT **NOTED** the different patterns in terms of availability and quality of nominal catch data estimated for each neritic tuna and seerfish species in recent years (2017-2021), with frigate tuna ranking last in terms of overall data quality levels.

28. The WPNT **NOTED** a reduction in catch levels of bullet tuna in 2021 compared to 2018-2020 and **RECALLED** how these captures are mostly reported by the purse seine fisheries of Indonesia and Thailand, whereas in other relevant fisheries (e.g., Iranian and Pakistani gillnet fisheries) the species is caught very rarely.

29. The WPNT **RECALLED** 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 had been generally done in the past, when the species was combined with frigate tuna.

30. The WPNT **ACKNOWLEDGED** that Thailand confirmed the possibility of revising their historical catches backwards as many years as possible depending on the data availability to increase the species-level resolution and report these updates back to the Secretariat for inclusion in the IOTC databases.

31. 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.

32. In this regard the WPNT **ACKNOWLEDGED** that the reason for Thailand to report aggregated data for seerfish was purely statistical, and not related to species misidentification issues as the two species of relevance to the IOTC are easily distinguishable and **RECALLED** how IOTC Res. 15/02 explicitly calls for the reporting of data to the level of each distinct IOTC species.

[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.

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

34. The WPNT further **NOTED** that such sessions could be organized at a regional level and involve several CPCs at the same time, with the aim of *training the trainers* who could then teach the methods to the enumerators of their respective countries.

35. 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 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.

36. 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.

37. The WPNT **NOTED** that the geo-referenced effort data for coastal fisheries currently available to the Secretariat might include fisheries catching species other than neritic tunas and seerfish, and that often the effort is expressed as *number of trips*, with no explicit indication of the actual trip duration in number of days, which varies greatly across fisheries and fleets.

38. The WPNT **RECALLED** that the new IOTC data reporting forms presented at the WPDCS18 allow for the provision of multiple units of effort for the same stratum, and **ACKNOWLEDGED** that this approach could be used to report both the number of trips and their overall duration in days by fisheries that are already collecting both effort measures.

39. The WPNT **NOTED** the high variability in effort units by gear as reported to the Secretariat by several Indian Ocean coastal countries and **ACKNOWLEDGED** the adverse impact this has on the possibility of deriving nominal CPUE indexes.

40. **ACKNOWLEDGING** that FAO, through its Coordinating Working Party on Fishery Statistics (CWP), is actively working on the standardization of effort definitions and on a proposal for standard effort units by gear type, the WPNT **RECOMMENDED** that the SC endorses the amendment of the IOTC data reporting requirements accordingly in order to reflect the results of these studies and guarantee homogeneous reporting of effort statistics in the future.

41. The WPNT **ACKNOWLEDGED** that the Secretariat delivered three data compliance and support mission to Indonesia between July 2022 and March 2023, to discuss the current status in terms of national data collection, catch estimations, and fleet composition and to clarify some outstanding data reporting issues that still are known to affect the data reported to the Secretariat, including those of neritic tunas and seerfish species.

42. 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 to be the scientific observer data recorded through the IOTC Regional Observer Scheme.

43. The WPNT **NOTED** with great concern the paucity of size-frequency data available at the Secretariat for many neritic fisheries, particularly for Indo-Pacific king mackerel and bullet tuna, and **REQUESTED** all CPCs to work to find and report historical data that may not have been reported and to develop and implement procedures for the collection of size data when necessary.

44. **NOTING** the interest of size-based assessment models such as LB-SPR as an alternative or complement to catch-based approaches, the WPNT **RECOMMENDED** the SC to endorse the development of a large-scale regional sampling program focusing on the collection of size-frequency data from coastal fisheries and also including the collection of morphometric data required to develop robust conversion factors, length-length and length-weight relationships.

45. **NOTING** how it is common practice in other tRFMOs (e.g., ICCAT) to focus each year on a specific species of interest and purposefully set aside extra funds to dedicate to its study, the WPNT **CONSIDERED** the possibility

of adopting the same approach in its workplan, to more effectively resolve the well-known problems affecting the availability of information in support of the assessment of neritic tuna and seerfish stocks.

46. The WPNT **REITERATED** its **REQUEST** that CPCs facing issues with data collection and reporting (and particularly in those fisheries interacting with neritic and seerfish species) seek support from the IOTC Secretariat by engaging in data compliance and support missions.

47. The WPNT **ACKNOWLEDGED** that OFCF Japan is collaborating with IOTC by setting up a desk study on the current level of implementation of electronic data collection tools for Indian Ocean coastal fisheries to assess the feasibility of and interest in developing a region-wide tool in support of countries and fisheries where no such systems exist.

48. The WPNT **THANKED** OFCF Japan for their continuous contributions towards the improvement of data collection and reporting for Indian Ocean coastal fisheries and **INVITED** CPCs to collaborate to this activity by responding to the online questionnaire whose results would be instrumental for further drive OFCF Japan's work.

5.2 Demonstration of tools for accessing IOTC statistical data (IOTC Secretariat)

49. The WPNT **ACKNOWLEDGED** the effort made by the IOTC Secretariat in progressively developing new interactive tools and methodologies to better support standardization and dissemination of IOTC datasets as currently accessible through the IOTC website.

50. In particular the WPNT **NOTED** how through the new IOTC data browser, users can access several public IOTC datasets, namely: i) raw and best-scientific estimates of nominal catches; ii) geo-referenced quarterly efforts; iii) geo-referenced quarterly catches; and iv) raw and standardized size-frequencies, and can produce a number of different charts (bar charts, line charts, pareto charts, tree maps, pie maps, heatmaps, size-distribution charts, etc.) to display a filtered subset of the categorized data.

51. The WPNT also **NOTED** that the IOTC data browser allows downloading data in tabular (CSV) form, and that this could be further processed using external data manipulation and analysis tools (Excel, R, Python, etc.) **ACKNOWLEDGING** that the IOTC Secretariat will also share sample scripts (in R) to better demonstrate these capabilities.

52. The WPNT also **NOTED** the adoption of simple metadata to better qualify each dataset available through the IOTC data browser, as well as the introduction of the IOTC reference data catalogue, which supports the production of well-formed statistical data submissions as well as the ROS data reporting workflow.

5.3 Review new information on fisheries and associated environmental data (all)

53. The WPNT **NOTED** paper IOTC-2023-WPNT13-09 on Artisanal fishing gears efficiency on kingfish species *Scomberomorous commerson,* including the following abstract provided by the authors:

> "*A survey was conducted along the Kenyan marine Coastline to ascertain the most effective fishing gear applied to catch kingfish (Scomberomorous commerson). The survey involved administration of structured questionnaires that were administered to fishers by trained fisheries personnel (Enumerators). Four gears that are predominantly used to catch Kingfish (Scomberomorous commerson) were selected from among other gears viz. Gillnet, handlines, trolling lines and long lines. The survey compared the frequency counts of Kingfish caught per each fishing gear recorded in the questionnaire. The main objective of this study was to identify the most effective gear used to catch Kingfish, identify which landing sites have the highest frequency of the gear with the aim of recommending appropriate management measures for the fishing gear and the species caught*" – see paper for full abstract.

54. The WPNT **NOTED** that narrow-barred Spanish mackerel are an important species to Kenya both for the local and export markets. The WPNT **NOTED** that approximately 75% of landings of the species are processed in Mombasa for export to the EU market while the rest is sold locally.

55. The WPNT **NOTED** that currently Kenya is not using standardised species codes to record distinct species but instead are using local names for species and **SUGGESTED** using species codes in the future. The WPNT **NOTED** that Kenya hopes to train enumerators for future surveys on the common species to improve species identification which should help to improve data collection.

56. The WPNT **NOTED** that official logbook data are only being reported by the industrial fleet in Kenya and so the intention of these surveys was to collect data from semi-industrial fleets which operate in the same areas as the industrial fleets to obtain a fuller picture of the overall catches and impact on the various species of interest in these areas.

57. The WPNT **NOTED** that the use of electronic tools (ODK and KoboCollect) has helped to improve the quality of the data being collected through these surveys as the data collection is georeferenced so the data must be input at the landing site by enumerators and so Kenya intends to keep using these tools for similar surveys in the future.

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

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

58. The WPNT **NOTED** paper on IOTC-2023-WPNT13-10 on Status of Frigate tuna (*Auxis thazard*) and Kawakawa (*Euthynnus affinis*) fishery in the Maldives, including the following abstract provided by the authors:

> *"Pole-and-line tuna fishery in the Maldives date back to the 19th century CE. The significance of this fishery in the culture and livelihood of Maldivians in the past and present contributes greatly towards its continued success and sustainability. Of the five tuna species commonly caught in the tuna fishery, neritic tuna species, kawakawa (Euthynnus affinis) and frigate tuna (Auxis thazard) form a minor component, contributing to about 1 % of all tuna landings in the Maldives. Throughout history, pole-and-line, handline and trolling gear have been used to catch neritic tunas. Prior to the mechanization of the fishing fleet in the 1970s, the majority of the frigate tuna catch was landed by pole-and-line vessels and kawakawa by trolling vessels. Nominal catch of frigate tuna and kawakawa has fluctuated significantly throughout the years, with catches declining since 2010 and stabilizing since 2015. In 2021, 62 tons of frigate tuna and 15 tons of kawakawa were landed. The distribution of these two species in the Maldives waters has been reported to vary based on oceanographic conditions such as oscillating monsoon currents. Neritic tunas are not favored by the dominant commercial tuna processors and exporters. A survey among the small-scale processors suggests that neritic tunas caught in the pole-and-line fishery are sold to the processors who make value added products. The study also informed that neritic species fetch a lower value compared to tropical tunas, skipjack and yellowfin. This paper reviews the status of frigate tuna and kawakawa fishery and fish processing operations in the Maldives."*

59. The WPNT **NOTED** that the stock structure of kawakawa and frigate tuna in the Maldives is unknown and although both species can be caught offshore, they seem to be more abundant in coastal areas closer to the atolls.

60. The WPNT **NOTED** that while most of the kawakawa and frigate tuna landings are sold to small processors on the local islands to produce value-added products that are often sold in local markets, skipjack and yellowfin tuna dominate the export market.

61. The WPNT **NOTED** that the decline in pole-and-line fishing effort and catches of frigate tuna and kawakawa is thought to be a result of the shift to tropical tuna species. The WPNT further **NOTED** that even though targeted fishing exclusively for neritic tuna by commercial pole-and-line vessels is infrequent (although this does occur on occasion), they are sometimes caught on FADs mixed with skipjack and yellowfin tuna. In addition, sometimes neritic species are caught in conspecific schools and are not discarded in the pole and line fishery.

62. The WPNT **NOTED** that of the six species covered by the working party, only kawakawa and frigate tuna are caught in Maldives fisheries.

63. The WPNT **NOTED** paper on IOTC-2023-WPNT13-11 on Management measures for sustainable exploitation of Neritic tuna stocks in Iran, including the following abstract provided by the authors:

> *"In 2021, the country produced an estimated total of 1,258 thousand tonnes of aquatic products, with 702 thousand tonnes originating from marine capture fisheries and 556 thousand tonnes from aquaculture activities. The large pelagic species group, with its significant and important share in the country's fishing, accounts for approximately 334 thousand tonnes, representing approximately 48% of the country's total catch in 2021. The total estimated quantity of tuna and tuna-like species is around 274 thousand tonnes.*

The neritic tuna catch comprises about 136 thousand tonnes, of which the dominant species are longtail tuna, Narrow-barred Spanish Mackerel, Indo-Pacific King Mackerel, Kawakawa, and Frigate tuna." – see paper for full abstract.

64. The WPNT **NOTED** that Iran has implemented some conservation and management measures including: the application of limitations on the engine power and dimensions of active fishing vessels in accordance with the Vessel Replacement Guidelines; the application of a 20-day moratorium on all fishing activities by fishing vessels in all provincial fishing grounds; the establishment of a seasonal closure of fishing for specific neritic tuna species; and the implementation of a Fishing Effort Management Plan in a designated area of the fishery to monitor and adapt fishing effort.

65. The WPNT **NOTED** that the reported catches of all species of neritic tuna showed an increasing trend reaching 51% of catches in 2021, particularly for kawakawa and narrow-barred Spanish mackerel although for longtail tuna a decline was recorded after the peak in catches was reached in 2001.

66. The WPNT **NOTED** that no catches of bullet tuna were reported from Iranian waters and further **NOTED** that in Pakistan very few bullet tunas are landed as they are rarely caught in commercial quantities. The WPNT **NOTED** that in Pakistan this is the only pelagic species that is thought to be discarded as the fish are delicate and so are difficult to preserve for the amount of time required to bring them back to port for landing purposes. The WPNT **NOTED** that this is also likely to be the case in the Iranian pelagic fisheries.

67. The WPNT **NOTED** that some gillnet vessels in the Iranian pelagic fishery are now using longline fishing gears due to the increased quality and so, value of fish caught in longline fisheries and **NOTED** that this transition is unlikely to lead to changes in the species composition of the pelagic fisheries (or an increase in catches of neritic species) as they will continue to operate in offshore areas and will continue to target the high-value species of yellowfin and skipjack tunas[2]. The WPNT **NOTED** that these vessels, which are transitioning from gillnet to longline fishing, might also use longline and gillnet gears in different seasons but not at the same time and same trip.

68. The WPNT **NOTED** that Iran continues to work to resolve challenges related to multi-species/multi-gear issues, non-standard fishing gear and unauthorised or illegally modified fishing gears but further **NOTED** that monitoring and enforcement of some measures is proving to be challenging.

69. The WPNT **NOTED** the work that has been done onboard gillnet vessels in Pakistan trialling sub-surface setting of gillnets which appears to help to reduce the bycatch of cetacean and turtle species and queried whether this measure has been trialled onboard Iranian gillnet vessels. The WPNT **NOTED** that many smaller gillnet vessels operating from Iran are thought to have shifted to the sub-surface setting of the gillnets but **NOTED** that this configuration is not possible on the larger vessels as the deck is too high above the surface of the water to allow the setting the nets below the surface of the water without causing an acceptable level of fouling.

70. The WPNT **NOTED** paper on IOTC-2023-WPNT13-12 on A synoptic review of the biology & population dynamic parameter studies on Narrow barred Spanish mackerel (*Scomberomorus commerson*) in the Persian Gulf & Oman Sea

"Research studies on Narrow – barred Spanish mackerel has been initiated in eighties in the Indian Ocean. A synoptic review of the different research studies including size frequencies, growth and mortality parameters, biological studies, gear selectivity, environmental impacts, stock structure, stock assessment, and management advice were reviewed, discussed and reported. In 2020, the last stock assessment study was carried out by two data-limited methods (C-MSY and Bayesian Schaefer production model (BSM), in evaluating the status of Indian Ocean Spanish mackerel, both of which are based on an aggregated biomass dynamic model. The C-MSY requires only the catch series as model input and uses simulations to locate feasible historical biomass that support the catch history provided an update to the C-MSY

[2] Currently the infrastructure required for exporting yellowfin tuna (value added products such as sashimi or sushi) are not in place in order to make the longline fishery profitable. Some requirements include supporting vessels for freezing -60 degree centigrade and direct flights from two provinces in south of Iran to countries (Oman, UAE or..), neither of which are currently available or in operation.

assessment based on the nominal catch series of IOTC 1950 to 2018 and a Bayesian biomass dynamic model was also implemented to include the recently available CPUE indices of Spanish mackerel developed from the Iranian gillnet fishery carried out by the secretariat. The authors recommended that future assessments could consider more realistic population models, including age structured models that could utilize more biological and fishery data beyond simple catch series. Despite the substantial uncertainties, the stock is probably very close to being fished at MSY levels and higher catches may not be sustained."

71. The WPNT **NOTED** that when comparing the mono- and multi-filament materials used to make gillnets, a study conducted in Iran found that each material showed a different selectivity curve. The WPNT **NOTED** that as the Iranian gillnet CPUE is being used in the data-limited stock assessments conducted for neritic species, the shape of the selectivity curve is important as it will affect the application of some of these methods and so it is important to try to understand the proportion of the fleet using each type of net. The WPNT **NOTED** that while monofilament materials were banned from being used to construct nets by the Iranian Fisheries Organisation, these materials are cheaper and easy to find so are probably still being used by a large (but unknown) proportion of the fleet.

72. The WPNT **NOTED** the possibility of conducting collaborative work between CPCs such as India, Iran, Indonesia and Pakistan in relation to harmonising data collection systems, further **NOTING** that the Secretariat could help to facilitate this type of work. The WPNT **DISCUSSED** this in more detail when finalising the revised workplan for 2024-2028.

73. The WPNT **NOTED** paper on IOTC-2023-WPNT13-13 on Catch composition and size distribution of neritic tuna caught in the Indonesian waters FMA 572 and 573, including the following abstract provided by the authors:

"Neritic tuna commodity has a high economic value and generate state income especially for the coastal states. In Indonesia, the main catch of neritic tuna commodity consists of Auxis rochei (bullet tuna), Auxis thazard (frigate tuna), and Euthynnus affinis (kawakawa). This study describes the nominal catch estimation and size frequency distribution of those three species neritic tuna caught in the Indonesian waters FMA 572 and 573. The data were collected daily by enumerators on fish landing site from 2017 to 2021. The results showed that the lowest catch occurred in 2017 for bullet tuna with and 22.102 ton. While in the next observation year, the bullet tuna catches increased significantly become 9600.171 ton. The length frequency data collected from 63,743 BLT; 27,733 FRI; 23,844 KAW. The mean length of BLT, FRI, KAW were 23.1 cm FL, 29.6 cm FL, 37.4 cm FL, respectively. Finally, the catch proportion of neritic tuna in Indonesian waters mostly above the length of maturity (Lm)."

74. The WPNT **NOTED** that there are some inconsistent trends in the presented Indonesian catch data, particularly regarding catches of bullet tuna which have displayed a large variability and longtail tuna which appeared in logbooks but is thought to have been missed during sampling. The WPNT **NOTED** that these issues may be a result of an imbalance in the sampling across the sites (which may have come about due to research budget constraints in recent years) and further **NOTED** that caution is required if using these data for species composition purposes.

75. The WPNT **NOTED** that the size data presented in this study would be of interest to the wider scientific community and so **REQUESTED** that Indonesia share these data with the Secretariat so that they can be included in the morphological database that is under development for all species managed by the IOTC.

76. The WPNT **NOTED** paper on IOTC-2023-WPNT13-18 on Population dynamics of Kawakawa (*Euthynnus affinis* (Cantor, 1849)) in Sri Lankan waters, including the following abstract provided by the authors:

"Neritic tuna species play an important role in the tuna fishery conduct in Sri Lankan waters. Kawakawa (Euthynnus affinis (Cantor, 1849)) is the third dominant species in this group in the commercial catch contributing around 20.8 % of the total neritic tuna landings in Sri Lankan waters during the 2020-2021 period. Kawakawa in Sri Lankan waters is mainly caught by gillnets, handlines, coastal longlines, and ring nets. Despite its significance, very few studies have been conducted on kawaka in Sri Lankan waters. This study attempts to estimate the von Bertalanffy growth parameters and mortality parameters of kawakawa by length-based population dynamic models. The length frequency data collected in 2020/2021 by measuring the Fork Length (FL) of kawakawa in Sri Lankan waters were made used for this

study. Accordingly, monthly length frequency data of kawakawa were analyzed by the Electronic LEngth Frequency ANalysis (ELEFAN) of the R package "TropFishR". A total of 2049 FL data were used for the analysis. The estimated growth parameters were L∞ = 62.98 cm (FL); K = 0.70 yr-1; Ø = 3.44. The estimated values of total mortality (Z), natural mortality (M) and fishing mortality (F) were 1.60 yr-1, 0.81 yr-1 and 0.79 yr-1 respectively. The Exploitation ratio (E) was estimated at 0.50. The fishing mortality that led to the maximum yield per recruit (Fmax) was estimated at 1.22 yr-1. The estimated target reference points of F0.1 and F0.5 were 0.63 yr-1 and 0.45 yr-1 respectively, which were lower than the current F. Based on the findings it was fair to conclude that the current exploitation level of kawakawa in Sri Lanka is sustainable. However, there is a risk of growth overfishing of the kawakawa stock in Sri Lankan waters. The estimated values for the abovementioned parameters could be made used when stock assessments are conducted."

77. The WPNT **NOTED** that the study used the ELEFAN method to estimate growth parameters for kawakawa and **NOTED** that it would be beneficial to use other methods of estimation for these parameters and compare with those parameters estimated by this study to determine their accuracy and to check that they are properly tracking the mode of the size data which may be coming from a variety of fisheries.

78. The WPNT **NOTED** that smaller sized fish are being caught in ring nets rather than in gillnets so suggested that it may be more beneficial to introduce management measures related to reducing effort in the ring net fishery rather than the gillnet fishery which were being proposed.

79. The WPNT **NOTED** paper on IOTC-2023-WPNT13-20 on Neritic Tunas and Seerfishes Fisheries from Purse Seiners in the Andaman Sea of Thailand, including the following abstract provided by the authors:

"Catch per unit effort (CPUE), species composition and size of neritic tunas and seerfishes from purse seine fisheries in the Andaman Sea of Thailand were studied by collecting the data from purse seiners landing along the Andaman Sea Coast from January to December 2022. The results showed that the CPUE of purse seiners operated in the Andaman Sea of Thailand in 2022 was 2,232.61 kilogram/day. Species composition of neritic tunas was 13.62% of the total catch divided into Longtail tuna (Thunnus tonggol) 5.57%, Kawakawa (Euthynnus affinis) 5.24%, Frigate tuna (Auxis thazard) 2.17% and Bullet tuna (A. rochei) 0.64% and species composition of seerfishes was 0.25% of the total catch divided into Indo-Pacific king mackerel (Scomberomorus guttatus) 0.13% and Narrow-barred Spanish mackerel (S. commerson) 0.12%. The size measurement of those species found that the fork length of longtail tuna ranged from 9.50-80.00 cm and the average length was 36.93 ± 9.21 cm, the fork length of Kawakawa ranged from 10.00-56.50 cm and the average length was 20.73 ± 8.68 cm, the fork length of frigate tuna ranged from 9.00-49.50 cm and the average length was 25.41 ± 7.51 cm, the fork length of bullet tuna ranged from 10.00-38.00 cm and the average length was 20.28 ± 5.24 cm, the fork length of Indo-Pacific king mackerel ranged from 15.00-59.50 cm and the average length was 43.66 ± 6.05 cm and the fork length of narrow-barred Spanish mackerel ranged from 10.50-110.00 cm and the average length was 59.01 ± 22.14 cm."

80. The WPNT **NOTED** that very small fish caught in the pelagic fisheries are sold for raw material for fish meal as these are low value species and sizes.

81. The WPNT **NOTED** that currently both seerfish species are being reported as one species in Thailand and **ENCOURAGED** Thailand to consider methods to improve the individual species reporting.

7. STOCK ASSESSMENT UPDATES

7.1 Stock assessment updates

82. The WPNT **NOTED** paper IOTC-2023-WPNT13-14 on Assessment of Indian Ocean longtail tuna (*Thunnus tonggol*) using data-limited methods, including the following abstract provided by the authors:

"Assessing the status of the stocks of neritic tuna species in the Indian Ocean is challenging due to the paucity of data. There is lack of reliable information on stock structure, abundance and biological parameters. Stock assessments have been conducted for Longtail tuna (Thunnus tonggol) from 2013 through 2017 utilising a variety of data-limited methods. In 2020 the C-MSY method (was used to assess the status of T. tonggol using historical catches. This paper provides an update to the C-MSY assessment based on the most recent catch information. This assessment also explored several alternative methods

including the Optimised Catch-Only method, the JABBA model (Winker et.al. 2014), and the length-based spawning potential ratio model. In addition to examining various population dynamic assumptions, these models allow for the evaluation of the usefulness of alternative data in determining the status of T. tonggol".

83. The WPNT **NOTED** the results from the CMSY method (Table 1, Fig. 1).

Table 1. Longtail tuna: Key management quantities from the C-MSY model used in 2023.

Management Quantity	Aggregate Indian Ocean
Most recent catch estimate (year)	134,171 (2021)
Mean catch – most recent 5 years	134,170 (2017 – 2021)
MSY (95% CI)	133,000 (108 –165)
Data period used in assessment	1950 – 2021
F_{MSY} (95% CI)	0.31 (0.22 – 0.44)
B_{MSY} (95% CI)	433,000 (272000 – 690000)
$F_{current}/F_{MSY}$ (95% CI)	1.05 (0.84 – 2.31)
$B_{current}/B_{MSY}$ (95% CI)	0.96 (0.44 – 1.19)
$B_{current}/B_0$ (95% CI)	0.48 (0.22 – 0.60)

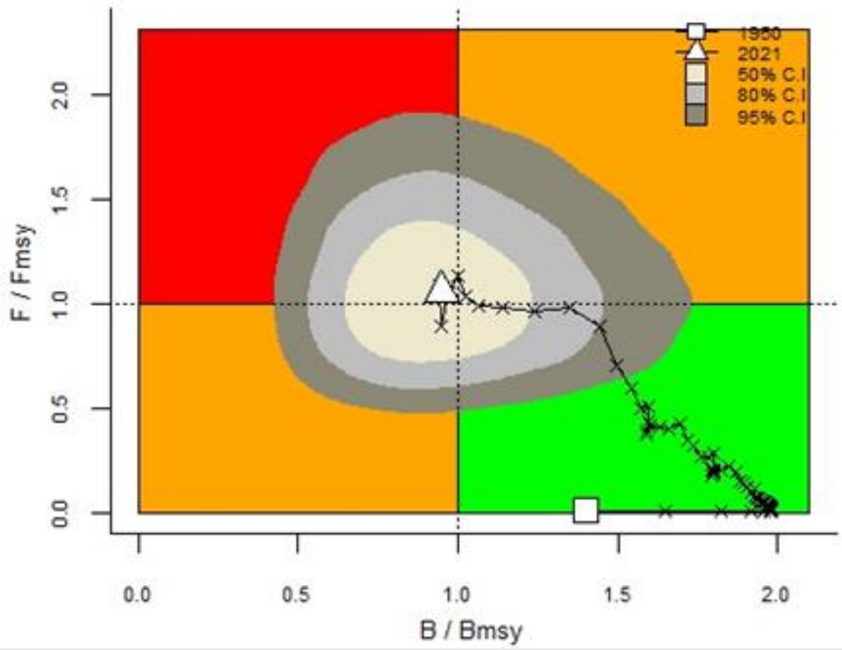

Fig. 1. Longtail tuna C-MSY Indian Ocean assessment Kobe plot.

84. The WPNT **THANKED** the author for the extensive explanations of the four data-limited methods used to assess the stocks of neritic species, including: a surplus production model with informative prior distributions on parameters (C-MSY; Martell and Froese 2013, Froese et al. 2017); the optimised catch-only method based on the Schaefer surplus production model with informative priors on growth rate and stock depletion (OCOM; Zhou et al. 2018); a Bayesian biomass dynamics model (JABBA; Winker et al. 2018); and a length-based method for estimating the spawning potential ratio (LB-SPR; Hordyk et al. 2015).

85. The WPNT **CONGRATULATED** the Secretariat for the work and **ACKNOWLEDGED** the major interest of extending the catch-based assessments with analyses based on length-composition data (i.e., LB-SPR), **NOTING** that this would increase the range of options available to the WPNT for stock assessments.

86. The WPNT **RECALLED** that the application of length-based assessment models requires long, consistent time series' of size data that are currently missing for most neritic species, **NOTING** that the use of the LB-SPR method is particularly adapted to fisheries with an asymptotic selectivity pattern because the level of fishing intensity is mostly informed by the component of older fish.

87. The WPNT **NOTED** the results of the C-MSY model applied to longtail tuna suggested that the stock is **overfished** ($B_{2021}<B_{MSY}$) and **subject to overfishing** ($F_{2021}>F_{MSY}$), but that the status is very close to the target. The WPNT further **NOTED** that the alternative assumption on resilience resulted in slightly more optimistic stock status, i.e., no overfishing, and that recent catches were very close to the estimated MSY suggesting that the stock is probably very close to being fished at MSY levels and that higher catches may not be sustained.

88. The WPNT **NOTED** that the stock status derived with the OCOM model was similar to the C-MSY model, but found to be more pessimistic, with a larger probability that the stock is in the Kobe red quadrat, and that this is most likely because the C-MSY method chose higher r values as the most viable values (located in the top 75% quantile of the posterior probability range).

89. The WPNT **NOTED** that the estimates obtained with the JABBA model were also close to the C-MSY estimates but were found to be more optimistic. The model suggested that the stock is not overfished (B_{2021}/B_{MSY} = 1.02) and not subject to overfishing (F_{2021}/F_{MSY}=0.96).

90. The WPNT **NOTED** that while the CPUE indices derived from Iranian gillnet fisheries were included in the model, they provided little information due to the shortness of the time series and inconsistency with historical catches.

91. **NOTING** the apparent conflicts between the standardised indices of abundance derived from Iranian gillnets and the time series of catches for kawakawa, longtail tuna, frigate tuna, and narrow-barred Spanish mackerel (which end in 2018), the WPNT **REQUESTED** the Secretariat to work further with scientists from I.R. Iran on the development of an extended standardised CPUE time series, and also explore the possibility of deriving abundance indices for some fisheries from other CPCs such as Sri Lanka, Pakistan, India and Indonesia.

92. The WPNT further **REQUESTED** that all CPCs work to develop CPUE series for their own fisheries to improve the data available for use in stock assessments **NOTING** the availability of the Secretariat to assist with this work. The WPNT **NOTED** that without additional CPUE series', stock assessments for all neritic species will continue to be full of uncertainties and so the WPNT will continue to be unable to provide robust management advice to the Commission for these species.

93. The WPNT **NOTED** that the C-MSY modelling framework allows for the inclusion of abundance indices as with JABBA, but further **NOTED** that this latter model offers more flexibility and is considered to be better optimised for that purpose.

94. The WPNT **NOTED** the results from the LB-SPR approach that indicated that there was a significant shift in the gillnet fishery toward the selection of younger fish over time. However, the WPNT **NOTED** that the fishing mortality (F/M) has shown a decreasing trend since the mid-2000s while the spawning potential ratio (SPR) has increased over the last decade, with values of SPR having been below 0.4 in recent years, suggesting the stock is still depleted in relation to the target.

95. From a general perspective, the WPNT **NOTED** that the results of the three biomass dynamic models are largely comparable, but that the OCOM model is more pessimistic overall while the JABBA model is more optimistic. The consistency between the models is largely due to the assumptions made about population dynamics and stock productivity which are common across all of the models.

96. The WPNT **NOTED** that the values of B_{MSY} estimated with OCOM and C-MSY were very different between the assessments performed in 2020 and 2023, and that this was related to the range of values of r (intrinsic population growth rate parameter), which may result in very different levels of *K* (carrying capacity) and $B_{MSY.}$ However, the WPNT further **NOTED** that the ratios between B and B_{MSY} (as well as F and F_{MSY}) were very similar.

97. The WPNT **NOTED** that the choice of the 75th percentile value of *r* obtained through the Monte-Carlo approach implemented in C-MSY to get an estimate consistent with the maximum intrinsic value of growth rate is not entirely convincing, **ARGUING** that more work is required in the future to elicit more informative priors on *r* for longtail tuna regarding their impact on the absolute values of biomass estimated by the models.

98. The WPNT **NOTED** that the values of depletion levels used at the start of the fishing period did not affect the assessment results as the initial biomass levels quickly increase in the absence of intense fishing during that period. By contrast, the WPNT **NOTED** that the results are very sensitive to the assumptions of depletion level at the end of the period and **ENCOURAGED** the author to consider applying some sensitivity analysis to these depletion levels in the future. The WPNT further **NOTED** that the depletion in intermediate years can also be assumed but there is usually a lack of such information.

99. The WPNT **NOTED** that the point estimate of the current stock status (i.e., year 2021) is very close to the middle of the Kobe plot (i.e., close to $B/B_{MSY} = 1$ and $F/F_{MSY} = 1$) and that the uncertainties associated with this status reflect a broad distribution across the four Kobe quadrants. The WPNT further **NOTED** that the stock status is determined by the Kobe quadrant which corresponds to the greatest likelihood of the stock estimate distribution and accounts for the uncertainty of the point estimate.

100. The WPNT **NOTED** that estimates of stock status from the LB-SPR method are not directly comparable to outputs from the other models as they refer to different target reference points.

101. The WPNT further **NOTED** that the dome-shaped selectivity observed in the Iranian gillnet fishery is a concern for the application of the LB-SPR method which is adapted to short-lived species, **NOTING** that longtail tuna is considered a long-lived species with fish living more than 10 years. However, the WPNT **NOTED** that the population structure of longtail tuna remains poorly understood and that a more recent study suggested that the longevity of the species may vary considerably between regions.

102. The WPNT **NOTED** paper IOTC-2023-WPNT13-15 on Assessment of Indian Ocean kawakawa (*Euthynnus affinis*) using data-limited methods, including the following abstract provided by the authors:

> *"Assessing the status of the stocks of neritic tuna species in the Indian Ocean is challenging due to the paucity of data. There is lack of reliable information on stock structure, abundance and biological parameters. Stock assessments have been conducted for kawakawa (Euthynnus affinis) from 2013 to 2015, and again in 2020 using data-limited methods. In 2020 the C-MSY method was used to assess the status of E. affinis (Fu 2020) using historical catches. This paper provides an update to the C-MSY assessment based on the most recent catch information. This assessment also explored several alternative methods including the Optimised Catch-Only method, the JABBA model (Winker et.al. 2014), and the length-based spawning potential ratio model (Hordyk et al. 2014). In addition to examining various population dynamic assumptions, these models allow for the evaluation of the usefulness of alternative data in determining the status of E. affinis".*

103. The WPNT **NOTED** the results from the CMSY method (Table 2, Fig. 2)

Table 2. Kawakawa: Key management quantities from the CMSY used in 2023.

Management Quantity	**Aggregate Indian Ocean**
Most recent catch estimate (year)	150,170 (2021)
Mean catch – most recent 5 years	156,655 (2017 – 2021)
MSY (95% CI)	154,000 (122 000 – 193 000)
Data period used in assessment	1950 – 2021
F_{MSY} (95% CI)	0.60 (0.48 – 0.74)
B_{MSY} (95% CI)	258,000 (185 – 359)
$F_{current}/F_{MSY}$ (95% CI)	0.98 (0.82 – 2.20)
$B_{current}/B_{MSY}$ (95% CI)	0.99 (0.45 – 1.20)
$B_{current}/B_0$ (95% CI)	0.50 (0.22 – 0.60)

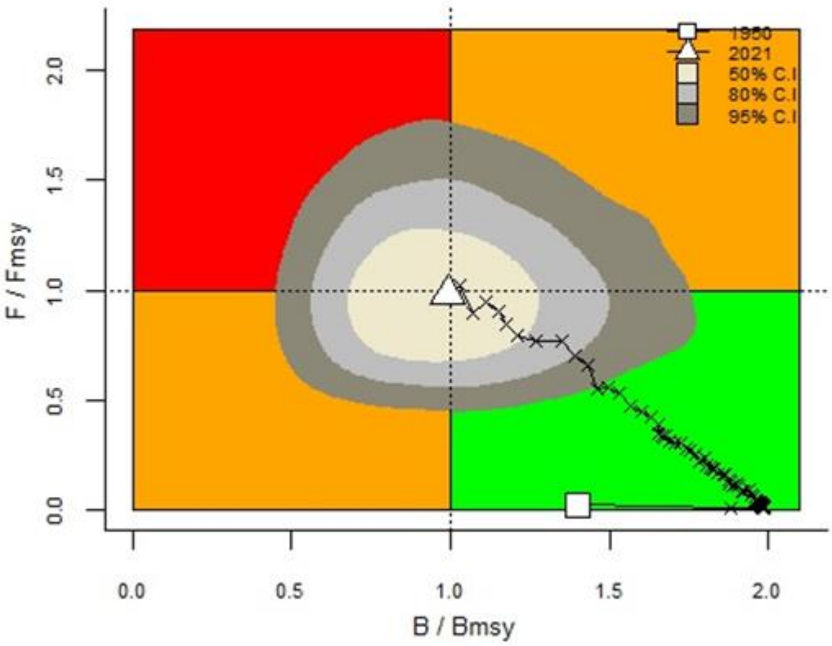

Fig. 2. Kawakawa C-MSY Indian Ocean assessment Kobe plot.

104. The WPNT **NOTED** the results of the C-MSY model applied to kawakawa that suggested that the stock is **overfished** (B2021<BMSY) but **not subject to overfishing** (F2021 < FMSY), but that the status is very close to the target. The WPNT further **NOTED** that the OCOM model is more pessimistic (overfished and subject to overfishing) while the JABBA model is more optimistic (not overfished and not subject to overfishing).

105. The WPNT **NOTED** paper IOTC-2023-WPNT13-16 on Assessment of Indian Ocean narrow-barred Spanish mackerel (*Scomberomorus commerson)* using data-limited methods, including the following abstract provided by the authors:

> *"Assessing the status of the stocks of neritic tuna species in the Indian Ocean is challenging due to the paucity of data. There is lack of reliable information on stock structure, abundance and biological parameters. Stock assessments have been conducted for narrow-barred Spanish mackerel (Scomberomorus commerson) from 2013 to 2017, and again in 2020 using data-limited methods (Zhou & Sharma, 2013, 2014; Martin & Sharma, 2015; Martin & Robinson, 2016, Martin & Fu, 2017). In 2017, the C-MSY method was used to assess the status of S. commerson using historically catches (Fu 2020). This assessment also explored several alternative methods including the Optimised Catch-Only method (Zhou et al., 2013), the JABBA model (Winker et.al. 2014), and the length-based spawning potential ratio model (Hordyk et al. 2014). In addition to examining various population dynamic assumptions, these models allow for the evaluation of the usefulness of alternative data in determining the status of S. commerson."*

106. The WPNT **NOTED** the results from the CMSY method (Table 3, Fig. 3)

Table 3. Narrow-barred Spanish mackerel: Key management quantities from the CMSY used in 2023.

Management Quantity	Aggregate Indian Ocean
Most recent catch estimate (year)	168,807 (2021)
Mean catch – most recent 5 years	160,351 (2017 – 2021
MSY (95% CI)	161,000 (132 000 – 197 000)
Data period used in assessment	1950 – 2021
F_{MSY} (95% CI)	0.60 (0.48 – 0.74)
B_{MSY} (95% CI)	271,000 (197 000 – 373 000)
$F_{current}/F_{MSY}$ (95% CI)	1.07 (0.88 – 2.38)
$B_{current}/B_{MSY}$ (95% CI)	0.98 (0.44 – 1.19)
$B_{current}/B_0$ (95% CI)	0.49 (0.22 – 0.60)

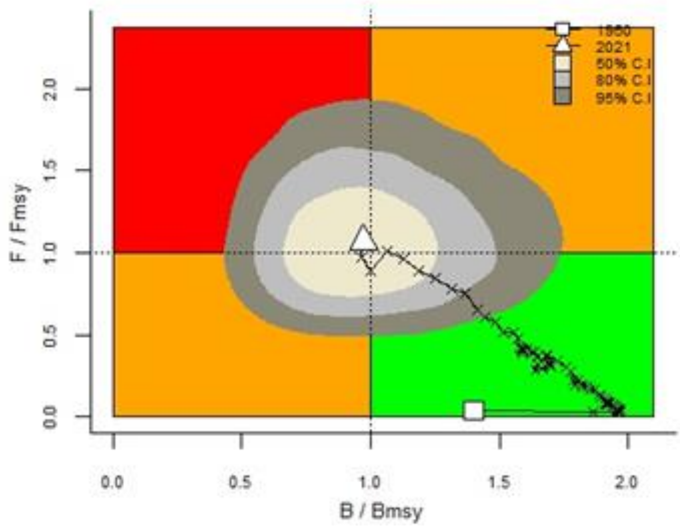

Fig. 3. Narrow-barred Spanish mackerel C-MSY Indian Ocean assessment Kobe plot.

107. The WPNT **NOTED** the results of the C-MSY model applied to narrow-barred Spanish mackerel tuna that suggested that the stock is **overfished** (B2021<BMSY) and **subject to overfishing** (F2021>FMSY), but that the status is very close to the target. The WPNT further **NOTED** that the OCOM model is more pessimistic overall (overfished and subject to overfishing) while the JABBA model is more optimistic (not overfished and not subject to overfishing).

7.2 Stock status indicators for other neritic tuna species

108. The WPNT **NOTED** paper IOTC-2023-WPNT13-19 on Preliminary analysis on the abundance indices of neritic tuna species from Indonesian fleets in the north-eastern Indian Ocean 2012, including the following abstract provided by the authors:

> *"Indonesia is one of the world's largest tuna producers, with approximately 300,000 tons/year (equal to £35 billion in value in 2018) harvested from its archipelagic waters, Economic Exclusive Zone (EEZ), and high seas. About a quarter of the catch belongs to the neritic tuna group, e.g., eastern little tuna. Neritic tuna is caught mainly by artisanal fisheries, associated with fish aggregating devices (FADs), and consumed and traded among coastal communities. However, given its importance, the available data, such as reported catches and effort, are insufficient for stock assessment models. Therefore, this study aims to give some preliminary historical trends of abundance indices of neritic tuna species from Indonesian fleets, with an attempt to separate based on association of the fleets with FADs. Key assumptions include that sets conducted in waters deeper than 3,000 m were not influenced by the presence of FADs, while above were classified as FADs-associated fisheries. Catch-per-unit-of-effort (CPUE) in free-schooling fisheries for neritic tuna varied less over time than CPUE associated with FADs. While CPUE associated with Fish Aggregating Devices (FADs) showed significant variability. Further refinement and a comprehensive approach are necessary to establish robust abundance indices for regional assessments beyond purse seine fisheries."*

109. The WPNT **NOTED** that Resolution 23/01 *On the management of anchored Fish Aggregating Devices (aFADs)* will require the registration of all of CPC's aFADs which is likely to be extremely challenging for Indonesia as there is thought to be a very high number of aFADs in Indonesian waters. The WPNT **DISCUSSED** possible approaches for trying to quantify the number of aFADs in Indonesia including: the use of VMS and AIS of vessels fishing on aFADs; using high resolution satellite imagery to identify aFADs; and working with local governments within the country to try to locate all aFADs that have been deployed.

110. The WPNT **NOTED** the intention of the author to attempt to use clustering methodologies to identify the location of aFADs based on spatial information from logbook data from purse seine vessels but **NOTED** that this work has not yet been started.

111. The WPNT further **NOTED** that there is a project based out of Bali where a satellite receiver is being used to detect IUU fishing which could be expanded to try to incorporate the identification of FADs, but it is unclear whether this project will continue after the separation of the research institute from the Indonesian fisheries management organisation. The WPNT also **NOTED** that a result of this separation between the Indonesian

research institute and the management organisation is that the research institute no longer has access to the VMS data which limits their research capabilities.

112. The WPNT **NOTED** that logbook data are checked against actual catch quantities and composition during scientific port sampling throughout Indonesia to ascertain their level of accuracy.

7.3 Development of management advice for neritic tuna species

113. The WPNT **NOTED** that the models used for the three assessed species produced stock estimates that are not drastically divergent because they shared similar dynamics and assumptions. The C-MSY model has been explored more fully and therefore is used to obtain estimates of stock status. The analysis using OCOM model is generally more pessimistic (largely due to the selection of smaller r values as final viable estimates) and that using JABBA incorporating gillnet CPUE indices is more optimistic. For the three species, the JABBA model however, was unable to estimate carrying capacity with a fair degree of certainty without additional prior constraints, indicating that the CPUE is either not informative or is conflicting with catch data for these species. However, the assessment using catch-only method is subjected to high uncertainty and is highly influenced by several prior assumptions.

114. Full management advice for each species is provided in the Executive Summaries in the Appendices.

8. Programme of Work (Research and Priorities)

8.1 Revision of the WPNT Program of Work 2024–2028

115. The WPNT **NOTED** paper IOTC-2022-WPNT12-08 on Revision of the WPNT Program of Work (2024-2028).

116. 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:

- Data mining and collation to improve stock assessments;
- 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;
- Biological information (parameters for stock assessment) including stock structure (connectivity).

117. The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2024–2028), as provided in Appendix VI.

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

118. 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 2024, by an Invited Expert:

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

9. Other Business

9.1 Election of a Chairperson and a Vice-Chairperson of the WPNT for the next biennium

Chairperson

119. The WPNT **NOTED** that the second term of the current Chairperson, Ms Ririk Sulistyaningsih (IDN) expired at the close of the WPNT13 meeting and, as per the IOTC Rules of Procedure (2014), participants are required to elect a new Chairperson of the WPNT for the next biennium.

120. **NOTING** the Rules of Procedure (2014), the WPNT **CALLED** for nominations for the position of Chairperson of the IOTC WPNT for the next biennium. Dr Farhad Kaymaram (IRN) was nominated, seconded and elected as Chairperson of the WPNT for the next biennium.

Vice-Chairperson

121. The WPNT **NOTED** that the second term of the current Vice-Chairperson, Dr Farhad Kaymaram (IRN) expired at the close of the WPNT13 meeting. As per the IOTC Rules of Procedure (2014), participants are required to elect a new Vice-Chairperson of the WPNT for the next biennium.

122. **NOTING** the Rules of Procedure (2014), the WPNT **CALLED** for nominations for the positions of Vice-Chairperson of the IOTC WPNT for the next biennium. Mr Bram Setyadji (IDN) was nominated, seconded and elected as Vice-Chairperson of the WPNT for the next biennium.

9.2 Date and place of the 14th and 15th Working Party on Neritic Tunas

123. The WPNT **REQUESTED** CPCs that may be interested in hosting the 14th and 15th Working Party on Neritic tunas to contact the Secretariat.

9.3 Review of the draft, and adoption of the Report of the 13th Working Party on Neritic Tunas

124. 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 2023:
    - 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

125. The report of the 13th Session of the Working Party on Neritic Tunas (IOTC–2023–WPNT13–R) was **ADOPTED** by correspondence.

APPENDIX I
LIST OF PARTICIPANTS

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APPENDIX II
AGENDA FOR THE 13TH WORKING PARTY ON NERITIC TUNAS

Date: 3–7 July 2023
Location: Seychelles
Venue: Eden Bleu Hotel
Time: 09:00 – 17:00 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 25th Session of the Scientific Committee (IOTC Secretariat)
   3.2. Outcomes of the 26th Session 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 WPNT12 and SC25 (IOTC Secretariat)

4. **CPUE WORKSHOP**

   4.1. CPUE standardisation materials (IOTC Secretariat)
   4.2. Hands on data analysis work (all)

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

   5.1. Review of the statistical data available for neritic tunas (IOTC Secretariat)
   5.2. Demonstration of tools for accessing IOTC statistical data (IOTC Secretariat)
   5.3. Review new information on fisheries and associated environmental data (general CPC papers)

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

   6.1. Review new information on the biology, stock structure, fisheries and associated environmental data (all)
   6.2. Data for input into stock assessments (all)

7. **STOCK ASSESSMENT UPDATES**

   7.1. Stock assessment updates (all)
   - Narrow-barred Spanish mackerel
   - Longtail tuna
   - Kawakawa

   7.2. Stock status indicators for other neritic tuna species (all)
   7.3. Development of management advice for neritic tuna species (all)

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

   8.1. Revision of the WPNT Program of Work 2024–2028 (Chair)
   8.2. Development of priorities for an Invited Expert at the next WPNT meeting

9. **OTHER BUSINESS**

9.1. Election of a Chairperson and a Vice-Chairperson of the WPNT for the next biennium
9.2. Date and place of the 14th and 15th Working Party on Neritic Tunas (Chair)
9.3. Review of the draft, and adoption of the Report of the 13th Working Party on Neritic Tunas (Chair)

APPENDIX III
LIST OF DOCUMENTS

Document	Title
IOTC–2023–WPNT13–01a	Draft: Agenda of the 13th Working Party on Neritic Tunas
IOTC–2023–WPNT13–01b	Annotated agenda of the 13th Working Party on Neritic Tunas
IOTC–2023–WPNT13–02	List of documents of the 13th Working Party on Neritic Tunas
IOTC–2023–WPNT13–03	Outcomes of the 25th Session of the Scientific Committee (IOTC Secretariat)
IOTC–2023–WPNT13–04	Outcomes of the 26th Session of the Commission (IOTC Secretariat)
IOTC–2023–WPNT13–05	Review of current Conservation and Management Measures relating to neritic tuna species (IOTC Secretariat)
IOTC–2023–WPNT13–06	Progress made on the recommendations and requests of WPNT12 and SC25 (IOTC Secretariat)
IOTC–2023–WPNT13-07	Review of the statistical data available for the neritic tuna species (IOTC Secretariat)
IOTC–2023–WPNT13–08	Revision of the WPNT Program of Work (2024–2028) (IOTC Secretariat)
IOTC-2023-WPNT13-09	Artisanal fishing gears efficiency on kingfish species *Scomberomorous commerson* (I. W. Barasa and S. Ndegwa)
IOTC-2023-WPNT13-10	Status of Frigate tuna (*Auxis thazard*) and Kawakawa (*Euthynnus affinis*) fishery in the Maldives (M. Shama)
IOTC-2023-WPNT13-11	Management measures for sustainable exploitation of Neritic tuna stocks in Iran (R. A. Naderi)
IOTC-2023-WPNT13-12	A synoptic review of the biology & population dynamic parameter studies on Narrow barred Spanish mackerel in the Indian Ocean (F. Kaymaram, S. A. Taghavi Motlagh and A. Vahabnezhad)
IOTC-2023-WPNT13-13	Catch composition and size distribution of neritic tuna caught in the Indonesian waters FMA 572 and 573(R. K. Sulistyaningsih, L. Sadiyah, F. Satria, B. Setyadji)
IOTC-2023-WPNT13-14	Assessment of Indian Ocean longtail tuna (*Thunnus tonggol*) using data-limited methods (D. Fu)
IOTC-2023-WPNT13-15	Assessment of Indian Ocean kawakawa (*Euthynnus affinis*) using data-limited methods (D. Fu)
IOTC-2023-WPNT13-16	Assessment of Indian Ocean narrow-barred Spanish mackerel (*Scomberomorus commerson*) using data-limited methods (D. Fu)
IOTC-2023-WPNT13-18	Population dynamics of Kawakawa (*Euthynnus affinis* (Cantor, 1849)) in Sri Lankan waters (K. R. Dalpathadu, D. G. Balawardhana, S. S. Haputhantri)
IOTC-2023-WPNT13-19	Preliminary analysis on the abundance indices of neritic tuna species from Indonesian fleets in the north-eastern Indian Ocean 2012-2021 (B. Setyadji, M. Spencer, L. Kell, S. Wright, S. Ferson, R. K. Sulistyaningsih)

Document	Title
IOTC-2023-WPNT13-20	Neritic Tunas and Seerfishes Fisheries from Purse Seiners in the Andaman Sea of Thailand (P. Noranarttragoon, K. Maeroh and S. Piabpabrattana)

APPENDIX IV
STATISTICS FOR NERITIC TUNAS AND SEERFISH

Extract from IOTC–2023–WPNT13–07

Historical trends (1950-2021)

The contribution of catches of neritic tunas and seerfish to total catches of IOTC species in the Indian Ocean has changed substantially over the last decades in relation with the development and expansion of coastal and industrial fisheries, e.g., following the arrival of industrial purse seine fleets to the Indian Ocean in the early-1980s which caused an increase in targeting of tropical tunas (**Fig. A 1a**). In recent years, the six species of neritic tuna and seerfish under IOTC mandate represented about one third of the total catches of IOTC species (**Fig. A 1b**).

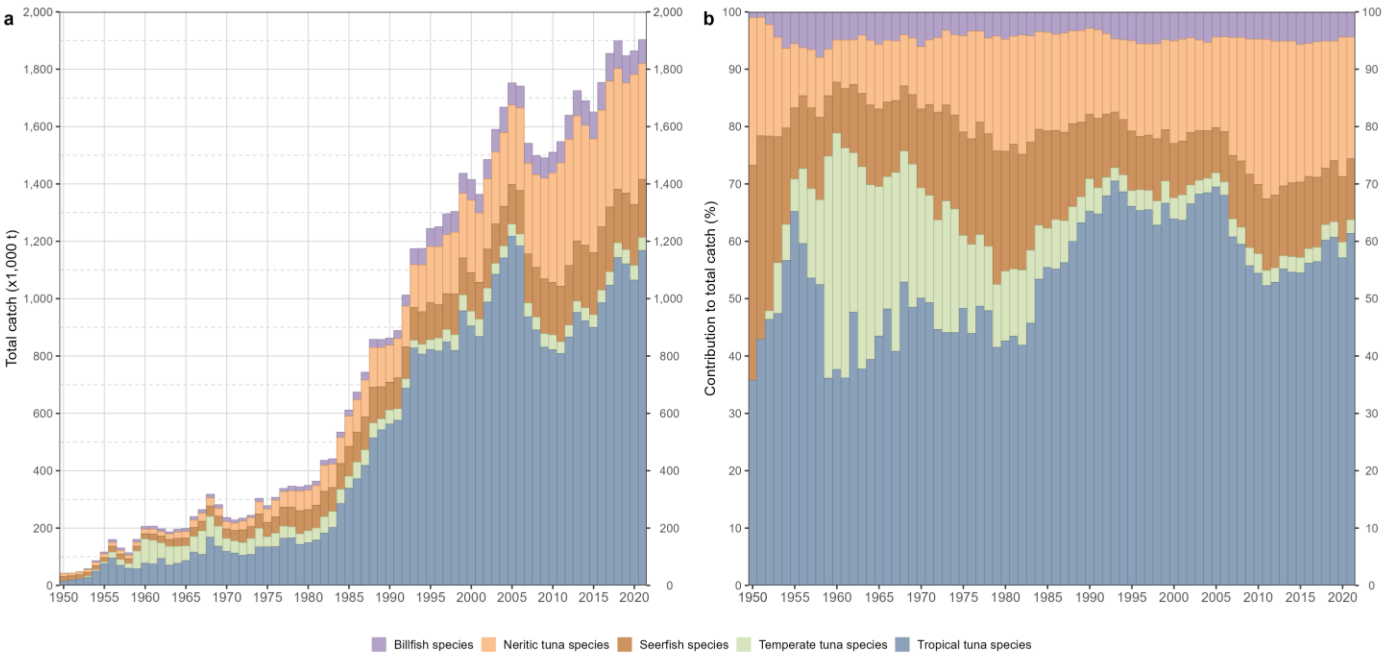

Fig. A 1: Annual time series of (a) cumulative retained catches (metric tonnes; t) and (b) contribution to the total retained catches (percentage; %) of IOTC tuna and tuna-like species by species category for the period 1950-2021

Each of the six IOTC neritic tuna and seerfish species shows an increasing trend in nominal retained catches over time until recent years (**Fig. A 2**). Following a period of steady increase for almost seven decades, the cumulative retained catch of all species reached a peak at 648,000 t in 2012, before declining down to 581,000 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. In 2020, catches re-increased to 666,000 t but showed a marked decrease of around 10% to 606,000 t in 2021 (see Recent fishery features).

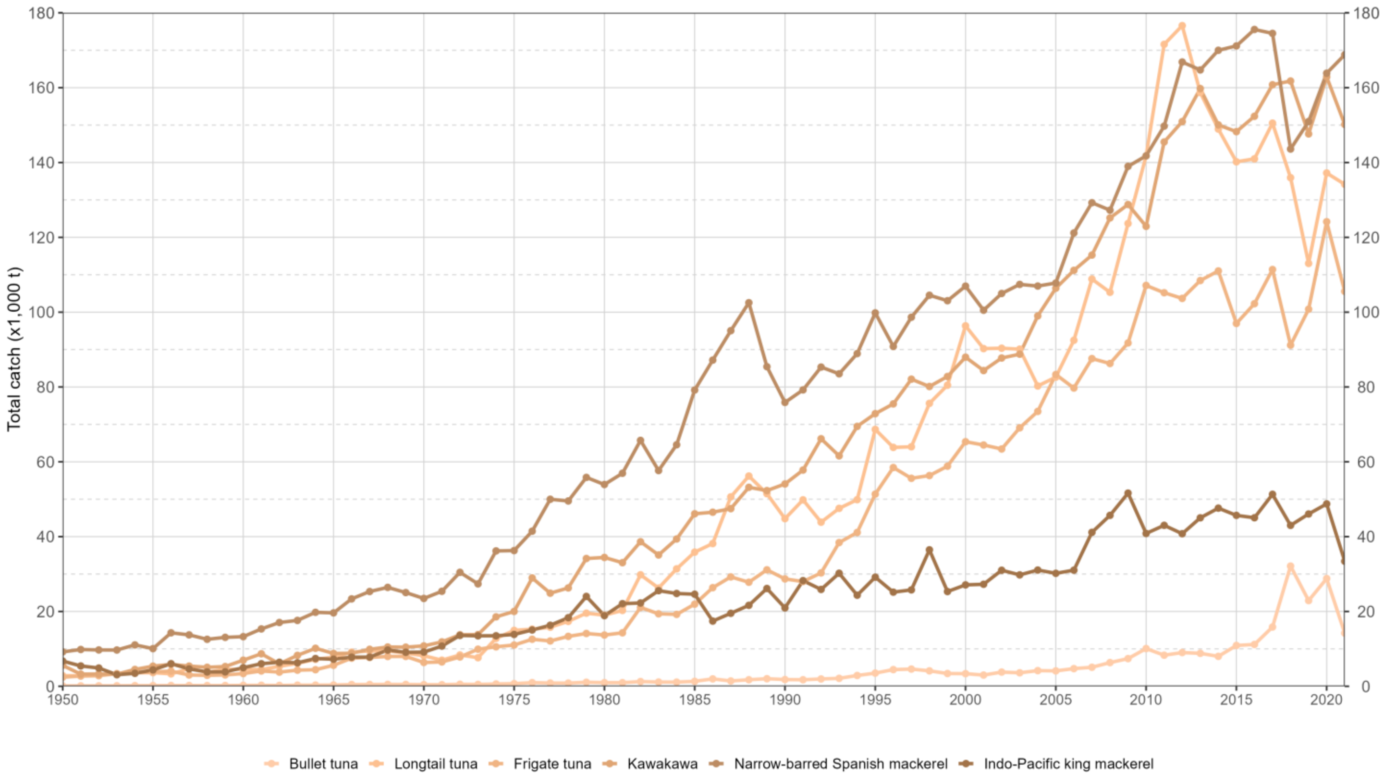

Fig. A 2: Annual time series of retained catches (metric tonnes; t) of IOTC neritic tunas and seerfish by species for the period 1950-2021

Recent fishery features (2017-2021)

Between 2017 and 2021, the mean annual retained catches of the IOTC neritic tunas and seerfish have been dominated by a few CPCs, to the point that about 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. A 3**).

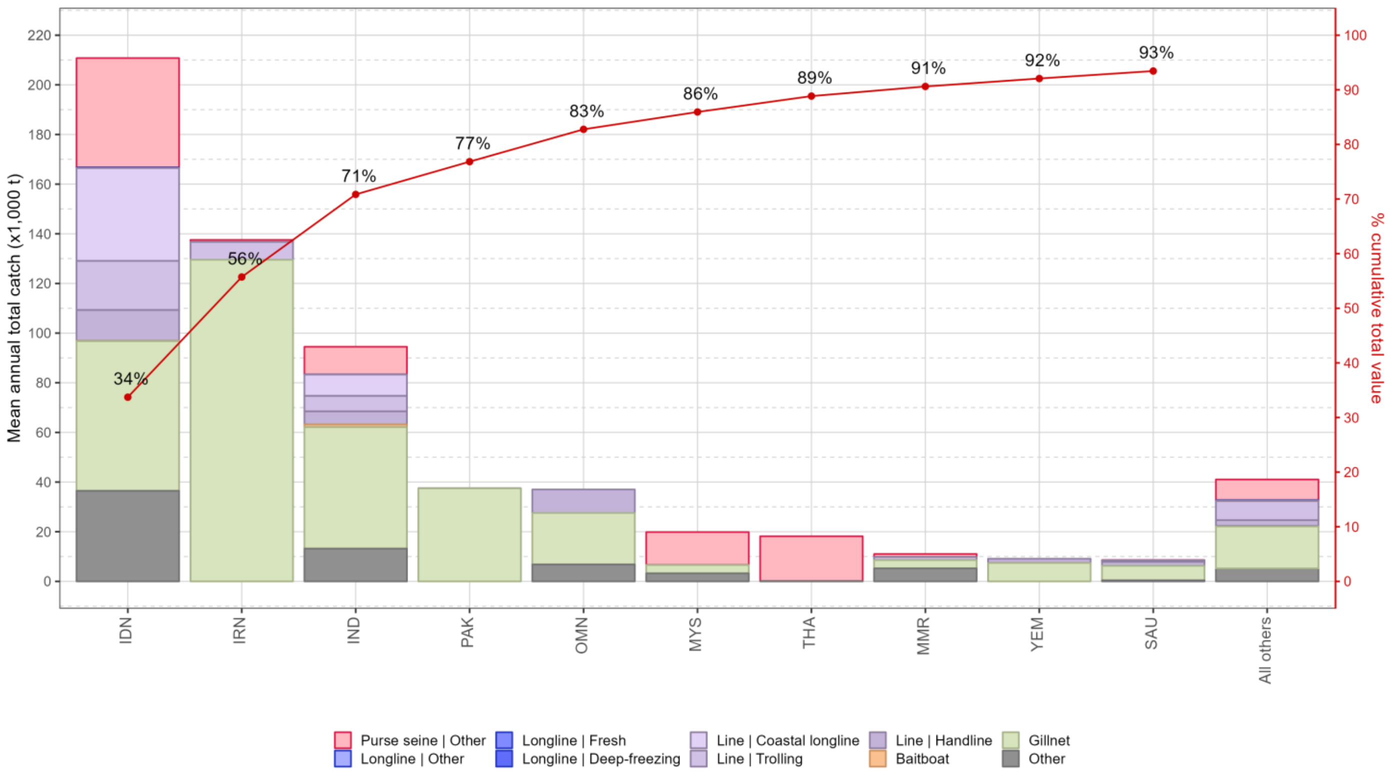

Fig. A 3: Mean annual retained catches (metric tonnes; t) of IOTC neritic tunas and seerfish by fleet and fishery between 2017 and 2021, with indication of cumulative contribution (percentage; %) of catches by fleet

Over that period the total gillnet catches showed an initial and substantial decline with some signs of recovery in the last two years, which brought the total catches of IOTC neritic and seerfish species from gillnet fisheries to 319,000 t in 2021 (**Fig. A 4**). Catches from line fisheries increased in recent years to reach 122,000 t in 2021, while purse seine catches substantially decreased to reach the same level reported in 2017 of about 80,000 t in 2021 (**Fig. A 4**).

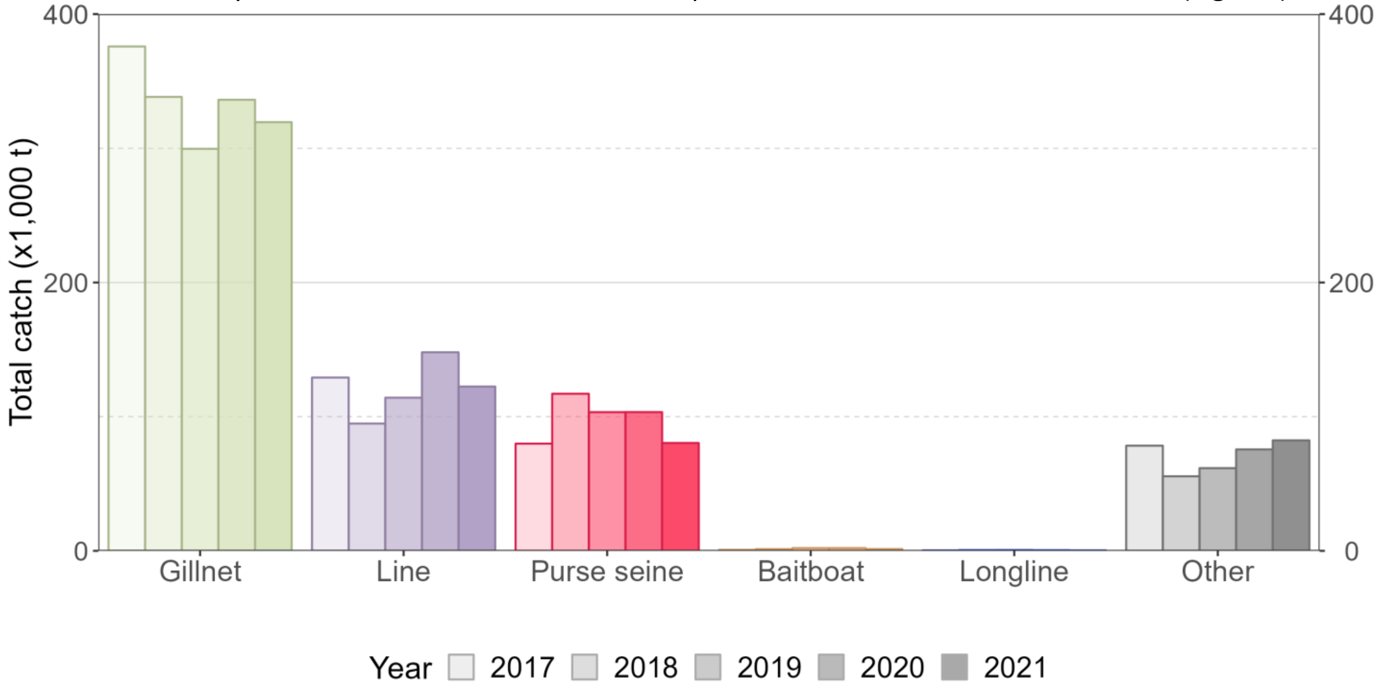

Fig. A 4: Annual trends in retained catch (metric tonnes; t) of IOTC neritic tunas and seerfish by fishery group between 2017 and 2021

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 under 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 reported 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. 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.

The specific case of bullet tuna

Bullet tuna is the least abundant neritic tuna species with catches essentially dominated by Indian and Indonesian fisheries which represent about two thirds of its total catch in the Indian Ocean in recent years. Data submitted to the Secretariat by Indonesia over the last decade show major interannual variability in catch levels as well as abrupt changes in the composition of catches by gear (**Fig. A 5**).

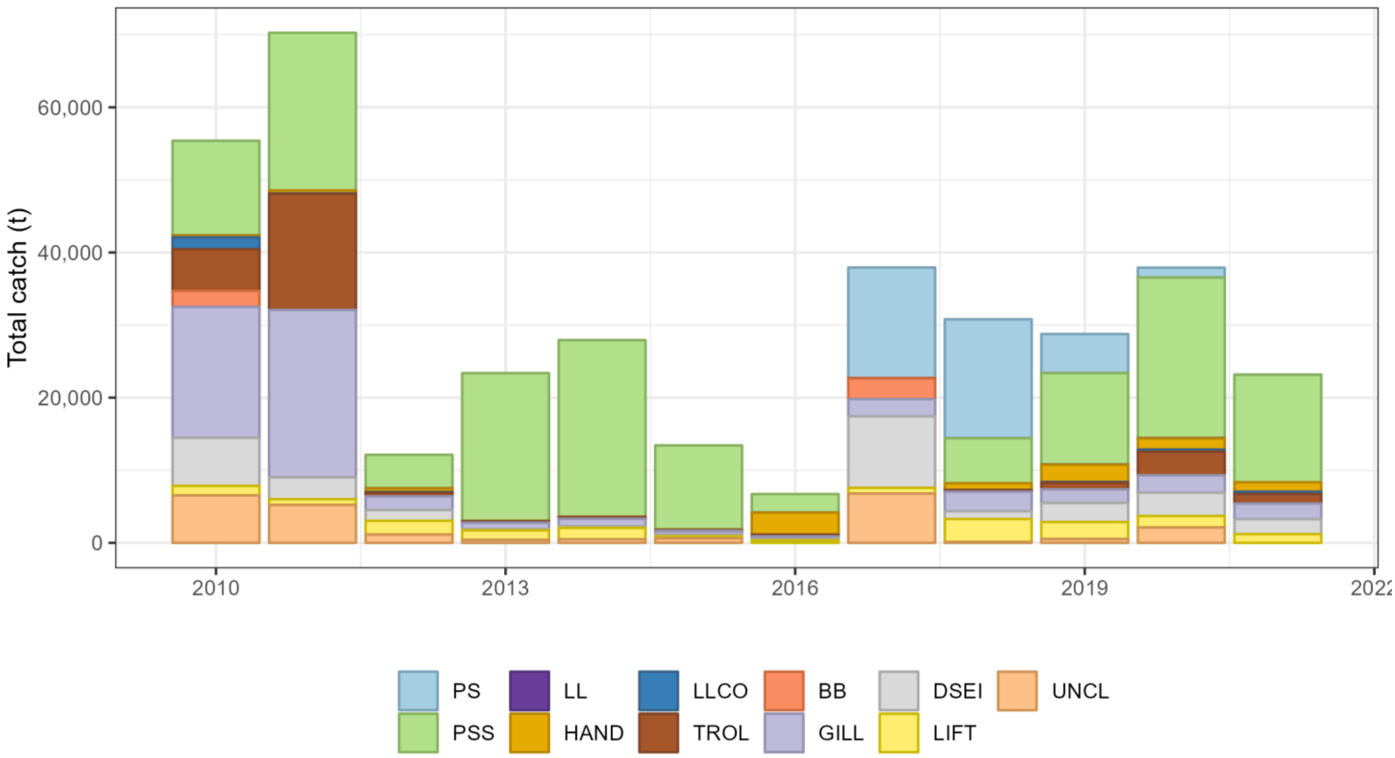

Fig. A 5: Annual time series of cumulative retained catches (metric tonnes; t) of bullet tuna by fishing gear as submitted to the IOTC Secretariat by Indonesia for the period 2010-2021. PS = industrial purse seines; PSS = coastal purse seines; LL = industrial longlines; HAND = handlines; LLCO = coastal longlines; TROL = trolling lines; BB = pole and lines; GILL = gillnets; DSEI = Danish seines; LIFT = lift nets; UNCL = Unclassified

Spatial distribution of catch and effort

Geo-referenced catch and effort data are not available at all 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, etc.) may be used over time for the same fishery. In particular, even though Indonesia and India have accounted for around half of the total catches of neritic species in the Indian Ocean in recent years 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 fully 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 an annual catch of about 95,000 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 size samples available for neritic tunas and seerfish are largely dominated by gillnet fisheries which represent 75.5% of all size data available in the IOTC database. Some size samples are also available for purse seine (1985-2021), baitboat (1983-2021), and trolling line (1983-2021) 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 retained catches. About two thirds of all samples available are for kawakawa (32.82%) and frigate tuna (32.33%). Samples for narrow-barred Spanish mackerel only represent 14.43% of the samples even though this species has been the most abundant in the catch over the last four decades, i.e., representing 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 1.4 million t 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 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 has averaged around 6.5% over the last decade.

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 was in place in Madagascar from 2017 to 2021. 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 variations in the data over the years, due to annual changes in sampling regions triggered by 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. The sampling programme ended in 2021, and Madagascar has not collected any sample since the termination of the project. • 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 collected for coastal fisheries (with support from the IOTC-OFCF pilot sampling project), albeit for a very small number of landing sites (i.e., less than 10). Catch-and-effort data have been reported by Indonesia for some industrial, semi-industrial, and coastal fisheries since 2019 (reference year 2018) but the coverage remains very low (<5% of total catches) • Kenya: Kenya has recently undertaken a Catch Assessment Survey to improve catch estimates for artisanal fisheries and with the help of the IOTC Secretariat, Kenya was able to report catch-and-effort and size data for their coastal fisheries for 2019. However, there still are inconsistencies in species between the two datasets and Kenya has stopped providing data for coastal fisheries since 2020. • 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 and Mozambique is 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. In fact, 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. Although Tanzania has introduced an e-CAS system to collect data directly through mobile phones at the landing sites, the system does not cover the entire country fishing regions and data is still collected through paper forms at Zanzibar landing sites. Overall, data from Tanzania – when reported – is thought to be very incomplete.
	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, and data for 2021 were processed using one single area as reported by the national focal points. Malaysia needs therefore to revise their data for previous years and re-submit the time series to the Secretariat.
Catch and effort, size data	(Offshore) Surface and longline fisheries: I.R. Iran and Pakistan	Non-reported 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: Only 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	All industrial purse seine fisheries	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 2003-2021. Update: 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 three data support mission in Indonesia undertaken by the Secretariat from July to March 2023, Indonesia is in the process of revising their catches using georeferenced data from their national logbooks, which could change the catch allocated to industrial fisheries.
Discards	All fisheries	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 2003–2021.

			Update: 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	All fisheries	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. Update: 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 (2024–2028)

The following is the Draft WPNT Program of Work (2024 to 2028) and is based on the specific requests of the Commission and Scientific Committee as well as topics identified during the WPNT13. 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**				
		2024	**2025**	**2026**	**2027**	**2028**
1. Data mining and collation	Collate and characterize operational level data for the main neritic tuna fisheries in the Indian Ocean to investigate their suitability to be used for developing standardised CPUE indices. The following data should be collated and made available for collaborative analysis: ➢ catch and effort by species and gear by landing site; ➢ operational data: stratify this by vessel, month, and year for the development as an indicator of CPUE over time; and ➢ operational data: collate other information on fishing techniques (i.e., area fished, gear specifics, depth, environmental condition (near shore, open ocean, etc.) and vessel size (length/horsepower)). ➢ Reconstruction of historical catch by CPCs using recovered or captured information. ➢ Re-estimation of historic catches (with consultation and consent of concerned CPCs) for assessment purposes (taking into account updated identification of uncertainties and knowledge of the history of the fisheries) ➢ (Data support missions to priority countries: India, Oman, Pakistan)					

2. Stock assessment / Stock indicators	Explore alternative assessment approaches and develop improvements where necessary based on the data available to determine stock status for longtail tuna, Spanish mackerel and kawakawa					
3. Biological information (parameters for stock assessment) including stock structure (connectivity)	Quantitative biological studies are necessary for all neritic tunas throughout their range to determine key biological parameters including age-at-maturity, and fecundity-at-age/length relationships, age-length keys, age and growth, longevity which will be fed into future stock assessments. Priorities for longtail tuna, kawakawa and Spanish mackerel. Genetic research to determine the connectivity of neritic tunas throughout their distributions (This should build on the stock structure work conducted in other previous studies)					

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

Table 2. Proposed assessment schedule for the IOTC Working Party on 2024-2028

Working Party on Neritic Tunas					
Species	**2024***	**2025****	**2026***	**2027***	**2028***
Bullet tuna	**Assessment**	Data preparation	Data preparation	**Assessment**	Data preparation
Frigate tuna	**Assessment**	Data preparation	Data preparation	**Assessment**	Data preparation
Indo-Pacific king mackerel	**Assessment**	Data preparation	Data preparation	**Assessment**	Data preparation
Kawakawa	Data preparation	Data preparation	**Assessment**	Data preparation	**Assessment**
Longtail tuna	Data preparation	Data preparation	**Assessment**	Data preparation	**Assessment**
Narrow-barred Spanish mackerel	Data preparation	Data preparation	**Assessment**	Data preparation	**Assessment**

* Including data-limited stock assessment methods.
** Including species-specific catches, CPUE, biological information and size distribution as well as identification of data gaps and discussion of improvements to the assessments (stock structure); one day may be reserved for capacity building activities.

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

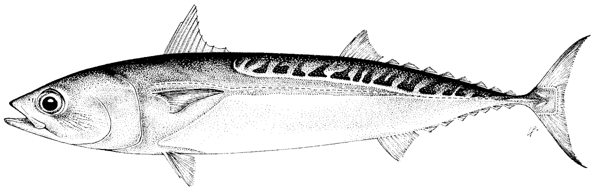

TABLE 1. Status of bullet tuna (*Auxis rochei*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch 2021[2] (t)	14,198	
	Mean annual catch (2017-2021) (t)	22,771	
	MSY (1,000 t) (80% CI)	unknown	
	F_{MSY} (80% CI)	unknown	
	B_{MSY} (1,000 t) (80% CI)	unknown	
	$F_{current}/F_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_0$ (80% CI)	unknown	

[1]Stock boundaries defined as the IOTC area of competence; [2]Proportion of catch fully or partially estimated for 2021: 50.3%; [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. No new stock assessment was conducted in 2023 and so the results are based on the results of the assessment carried out in 2021 using the data-limited techniques (CMSY and LB-SPR), however the catch data for bullet tuna are very uncertain given the high percentage of the catches that had to be estimated due to a range of reporting issues. Due to a lack of fishery data for several gears, only preliminary stock status indicators can be used. Aspects of the fisheries for bullet tuna combined with the lack of data on which to base an assessment of the stock are a cause for concern. Stock status in relation to the Commission's B_{MSY} and F_{MSY} reference points remains unknown (**Table 1**).

Outlook. Annual catches of bullet tuna have steadily increased from around 2,000 t in the early 1990s to around 13,000 t in 2015-2017. In 2018, catches sharply increased to 33,000 t – mostly due to an increase in catches reported by Indonesian industrial purse seine fisheries (**Fig. 1**). In 2019, the catches of bullet tuna decreased to less than 24,000 t despite a major increase in the number of Indonesian industrial purse seiners in operation. There is considerable uncertainty around bullet tuna catches and insufficient information to evaluate the effect that these catch levels may have on the resource. Research emphasis should be focused on improving the data collection and reporting systems in place and collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g., estimates of growth, natural mortality, maturity, etc.).

Management advice. For assessed species of neritic tunas and seerfish in the Indian Ocean (longtail tuna, kawakawa and narrow-barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both F_{MSY} and B_{MSY} were breached thereafter. Therefore, in the absence of a stock assessment of bullet tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (8,590 t). This catch advice should be maintained until an assessment of bullet tuna is available. Considering that MSY-based reference points for assessed species can change over time, the stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice.

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean stock is unknown;
- Limit reference points: the Commission has not adopted limit reference points for any of the neritic tunas under its mandate;
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods;
- Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).
- Species identification, data collection and reporting urgently need to be improved;
- There is limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2022 catches (reference year 2021), 50.3% of the total catches was either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore, the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.

Fisheries overview.

- **Main fisheries (mean annual catch 2017-2021)**: bullet tuna is caught using purse seine (58.7%), followed by line (19.3%) and gillnet (14.5%). The remaining catches taken with other gears contributed to 7.5% of the total catches in recent years (**Fig. 1**);
- **Main fleets (mean annual catch 2017-2021)**: the majority of bullet tuna catches are attributed to vessels flagged to India (33.8%) followed by Indonesia (31.2%) and Thailand (27%). The 13 other fleets catching bullet tuna contributed to 8% of the total catch in recent years (**Fig. 2**).

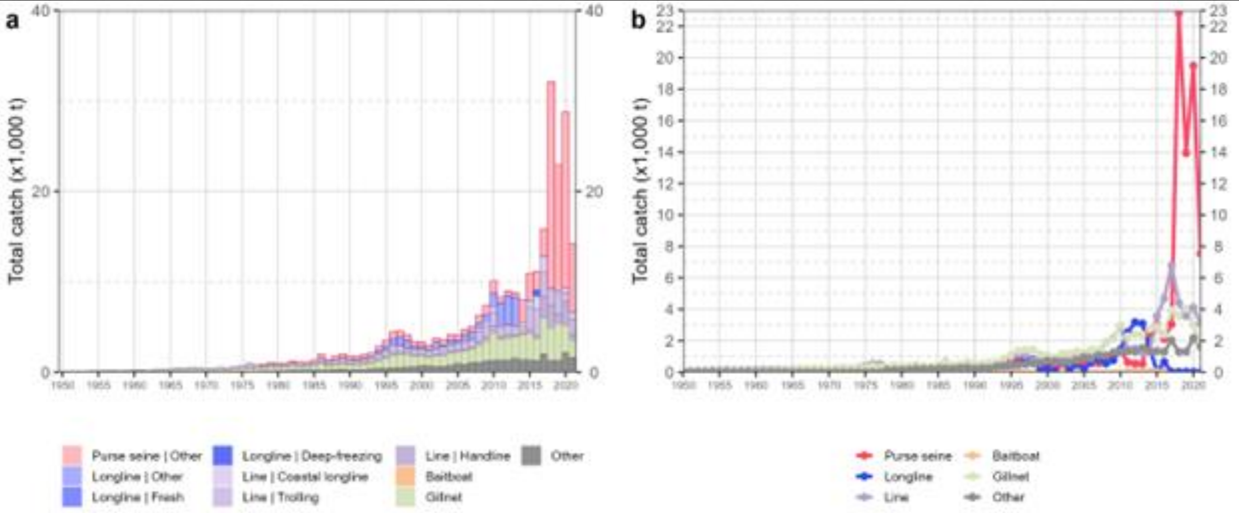

Fig. 1. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for bullet tuna during 1950-2021

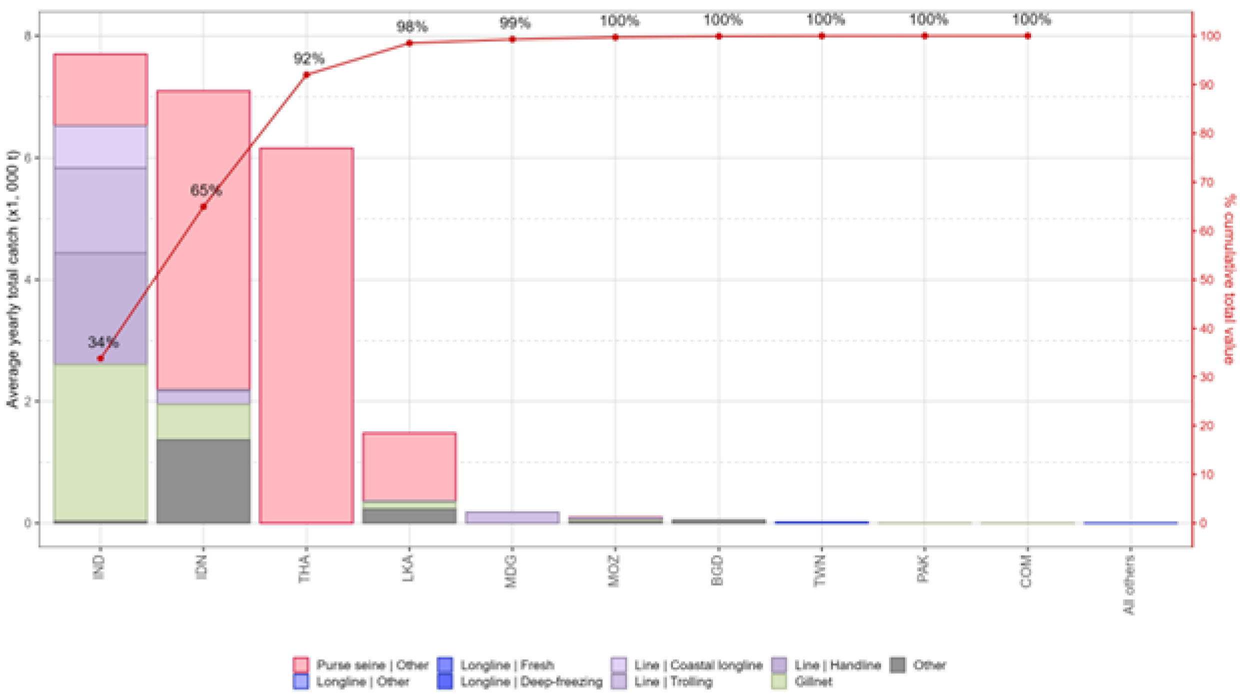

Fig. 2. Mean annual catches (t) of bullet tuna by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX VIII
EXECUTIVE SUMMARY: FRIGATE TUNA

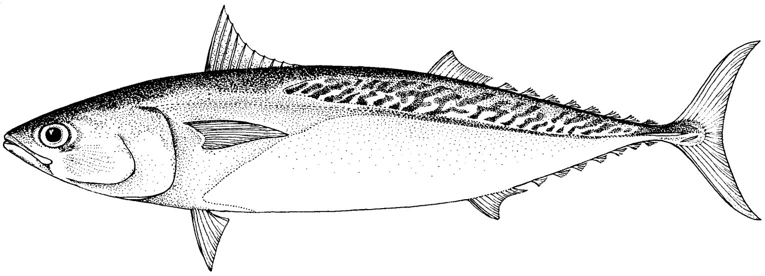

TABLE 1. Status of frigate tuna (*Auxis thazard*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch (2021) (t)[2]	105,547	
	Mean annual catch (2017-2021) (t)	106,615	
	MSY (1,000 t) (80% CI)	unknown	
	F_{MSY} (80% CI)	unknown	
	B_{MSY} (1,000 t) (80% CI)	unknown	
	$F_{current}/F_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_{MSY}$ (80% CI)	unknown	
	$B_{current}/B_0$ (80% CI)	unknown	

[1]Stock boundaries defined as the IOTC area of competence; [2]Proportion of catch fully or partially estimated for 2021: 74%; [3]Status relates to the final year data are available for assessment

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new assessment was conducted in 2023 therefore the results are based on the assessment conducted in 2021 using the data-limited techniques (CMSY and LB-SPR), however the catch data for frigate tuna are very uncertain given the high percentage of the catches that had to be estimated due to a range of reporting issues. Due to a lack of fishery data for several gears, only preliminary stock status indicators can be used. Aspects of the fisheries for frigate tuna combined with the lack of data on which to base an assessment of the stock are a cause for considerable concern. Stock status in relation to the Commission's B_{MSY} and F_{MSY} reference points remains **unknown** (**Table 1**).

Outlook. Estimated catches have increased steadily since the late-1970s, reaching around 30,000 t in the late-1980s, to between 51,000 and 58,000 t by the mid-1990s, and steadily increasing to over 90,000 t in the following ten years. Between 2010 and 2014 catches have increased to over 105,000 t, rising to the highest levels recorded, although catches have since decline marginally to between 90,000 – 102,000 t since 2014. There is insufficient information to evaluate the effect that this level of catch or a further increase in catches may have on the resource. Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g., estimates of growth, natural mortality, maturity, etc.).

Management advice. For assessed species of neritic tunas in Indian Ocean (longtail tuna, kawakawa and narrow-barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both F_{MSY} and B_{MSY} were breached thereafter. Therefore, in the absence of a stock assessment of frigate tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (101,260 t). The reference period (2009-2011) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available under the assumption that also for frigate tuna MSY was reached between 2009 and 2011. This catch advice should be maintained until an assessment of frigate tuna is available. Considering that MSY-based reference points for assessed species can change over time, the stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice.

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean stock is unknown;
- Limit reference points: the Commission has not adopted limit reference points for any of the neritic tunas under its mandate;
- Further work is needed to improve the reliability of the catch series, such as verification or estimation based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods;
- Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g., estimates of growth, natural mortality, maturity, etc.)
- Species identification, data collection and reporting urgently need to be improved;
- There is limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2022 catches (reference year 2021), 80% of the total catches were either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore, the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.

Fisheries overview.

- **Main fisheries (mean annual catch 2017-2021)**: frigate tuna is caught using gillnet (37%), followed by line (33.7%) and purse seine (14.6%). The remaining catches taken with other gears contributed to 14.8% of the total catches in recent years (**Fig. 1**);
- **Main fleets (mean annual catch 2017-2021)**: the majority of frigate tuna catches are attributed to vessels flagged to Indonesia (62.1%) followed by Pakistan (10.4%) and I. R. Iran (8.9%). The 25 other fleets catching frigate tuna contributed to 18.5% of the total catch in recent years (**Fig. 2**).

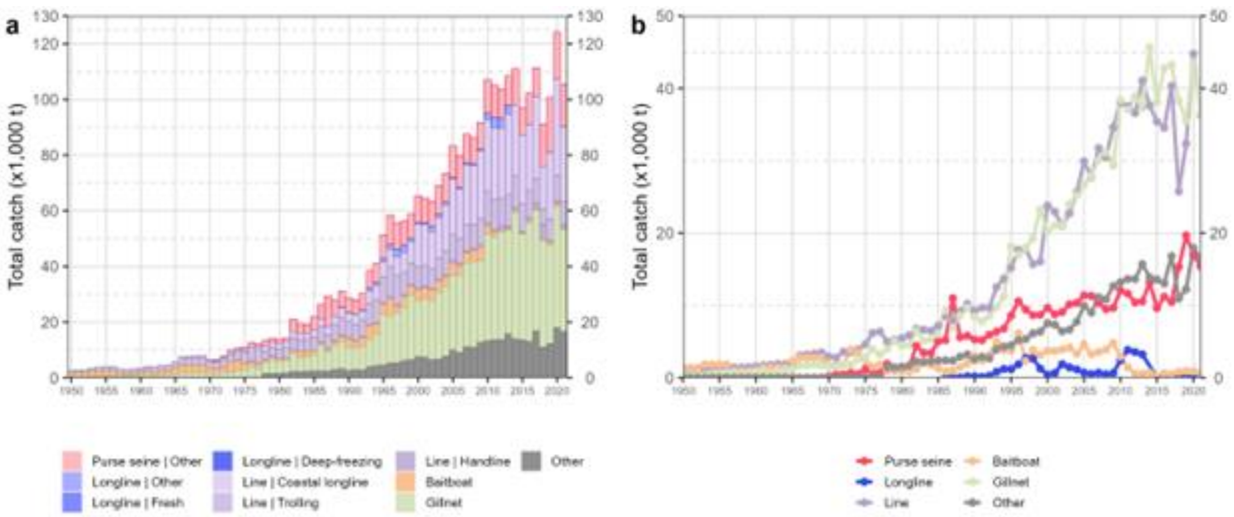

Fig. 1. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for frigate tuna during 1950-2021

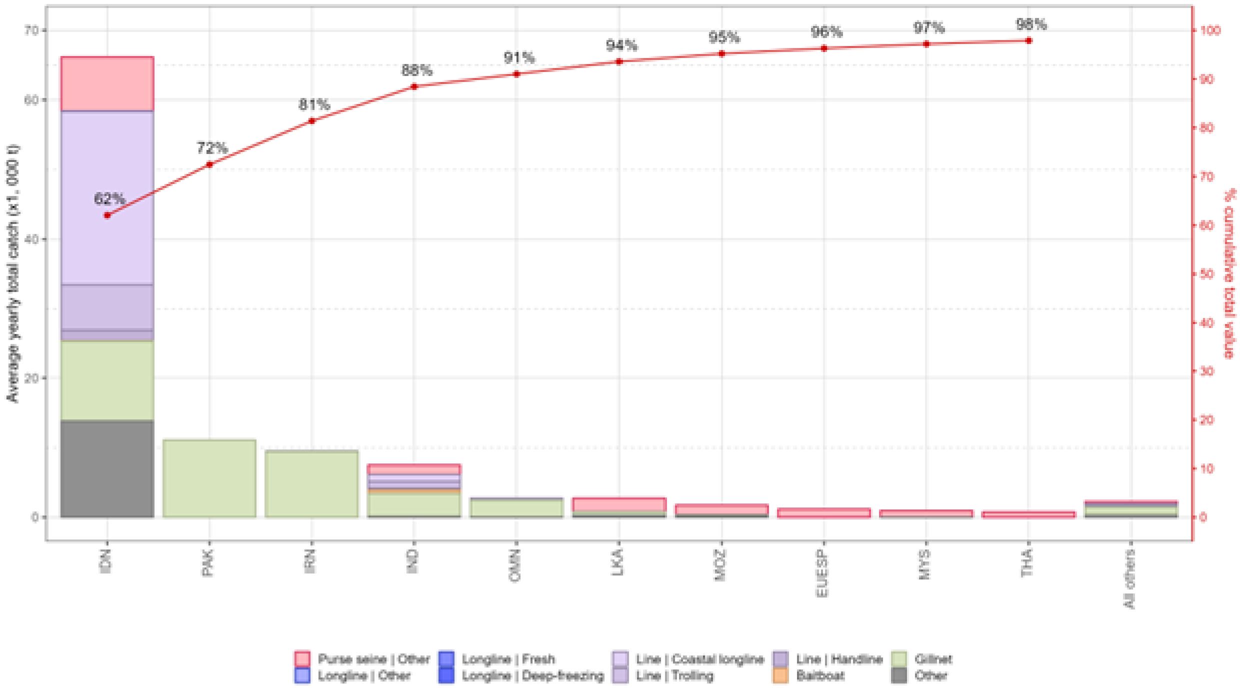

Fig. 2. Mean annual catches (t) of frigate tuna by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX IX
EXECUTIVE SUMMARY: KAWAKAWA

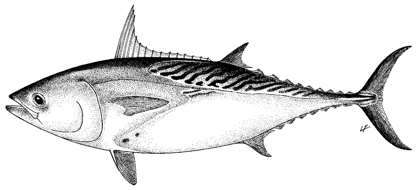

TABLE 1. Status of kawakawa (*Euthynnus affinis*) in the Indian Ocean

Area[1]	Indicators		2023 stock status determination[3]
Indian Ocean	Catch 2021[2] (t) Mean annual catch 2017-2021 (t)	150,170 156,654	**27%**
	MSY (t) (80% CI) F_{MSY} (80% CI) B_{MSY} (t) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	154,000 (122,000 – 193,000) 0.60 (0.48 – 0.74) 258,000 (185 – 359) 0.98 (0.82–2.20) 0.99 (0.45 – 1.20)	

[1]Stock boundaries defined as the IOTC area of competence; [2]Proportion of catch fully or partially estimated for 2021: 55.6%; [3]Status relates to the final year data are available for assessment.

Colour key	Stock overfished (SB_{year}/SB_{MSY}< 1)	Stock not overfished (SB_{year}/SB_{MSY}≥ 1)
Stock subject to overfishing (F_{year}/F_{MSY}> 1)	25%	23%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	27%	25%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

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

Outlook. There is considerable uncertainty about stock structure and the estimate of total catches. Due to the uncertainty associated with catch data (e.g., 55.6% of catches partially or fully estimated by the IOTC Secretariat for 2021) and the limited number of CPUE series available for fleets representing a small proportion of total catches, only data poor assessment approaches can currently be used. Aspects of the fisheries for this species, combined with the lack of data on which to base a more complex assessment (e.g., integrated models) are a cause for considerable concern. In the interim, until more traditional approaches are developed, data-poor approaches will be used to assess stock status. Continued increase in the annual catches for kawakawa is also likely to further increase the pressure on the Indian Ocean stock. Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g., estimates of growth, natural mortality, maturity, etc.).

Management Advice. The assessment models rely on catch data, which are considered to be highly uncertain. The catch in 2021 was just below the estimated MSY. The available gillnet CPUE of kawakawa showed a somewhat increasing trend although the reliability of the index as abundance indices remains unknown. Despite the substantial uncertainties, the stock is probably very close to being fished at MSY levels and that higher catches may not be sustained in the longer term. A precautionary approach to management is recommended.

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean is estimated to be 154,000 t with a range between 122,000 t and 193,000 t and so catch levels should be reduced in future to prevent the stock becoming overfished;
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, 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 55.6% of the catches (in 2023, with reference year 2021), which increases the uncertainty of the stock assessments using these data. Therefore, the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.

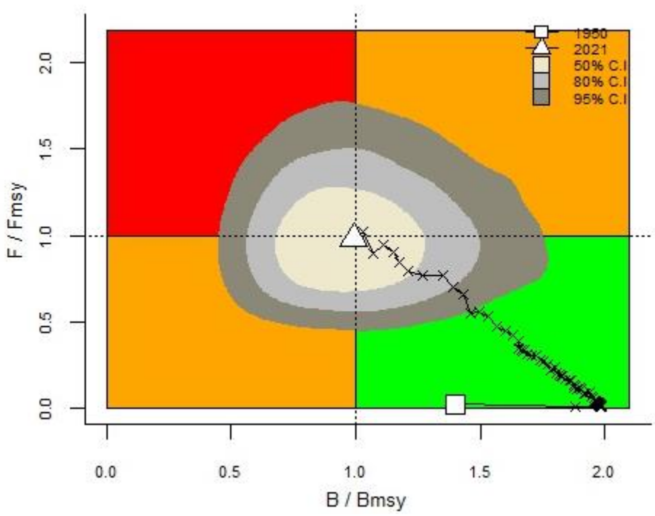

Fig. 1. C-MSY Indian Ocean assessment Kobe plot for kawakawa. The Kobe plot presents the trajectories (median) for the range of plausible model trajectories included in the formulation of the final management advice. The shaded contour lines represent 50%, 80%, and 95% confidence intervals of estimated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

Fisheries overview.

- **Main fisheries (mean annual catch 2017-2021)**: kawakawa are caught using gillnet (48.5%), followed by purse seine (30.2%) and line (16.3%). The remaining catches taken with other gears contributed to 4.9% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2017-2021)**: the majority of kawakawa catches are attributed to vessels flagged to Indonesia (31.3%) followed by I. R. Iran (23.6%) and India (19.6%). The 30 other fleets catching kawakawa contributed to 25.3% of the total catch in recent years (**Fig. 3**).

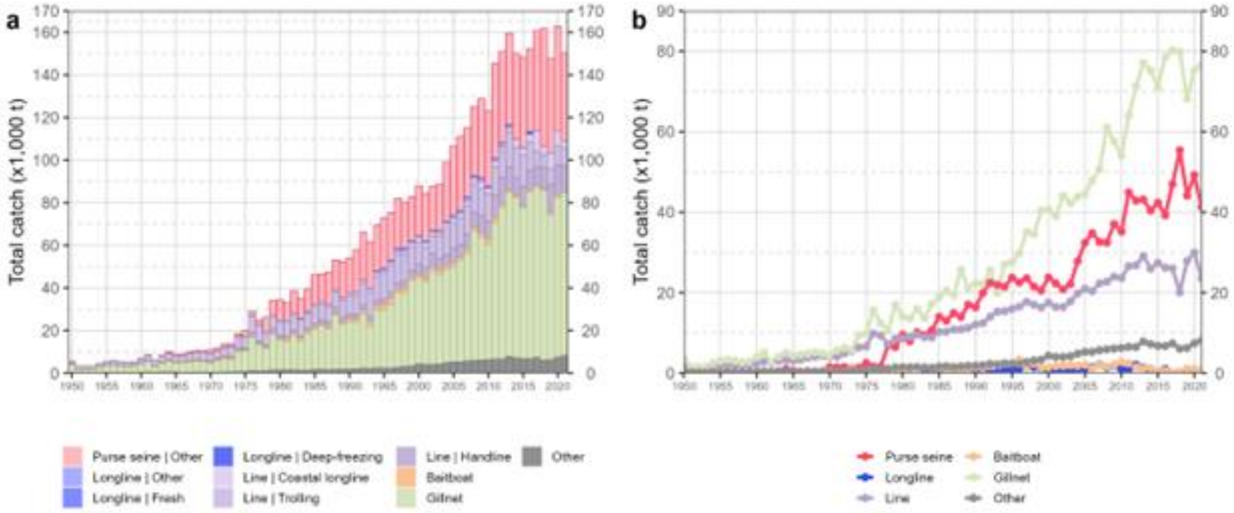

Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for kawakawa during 1950-2021

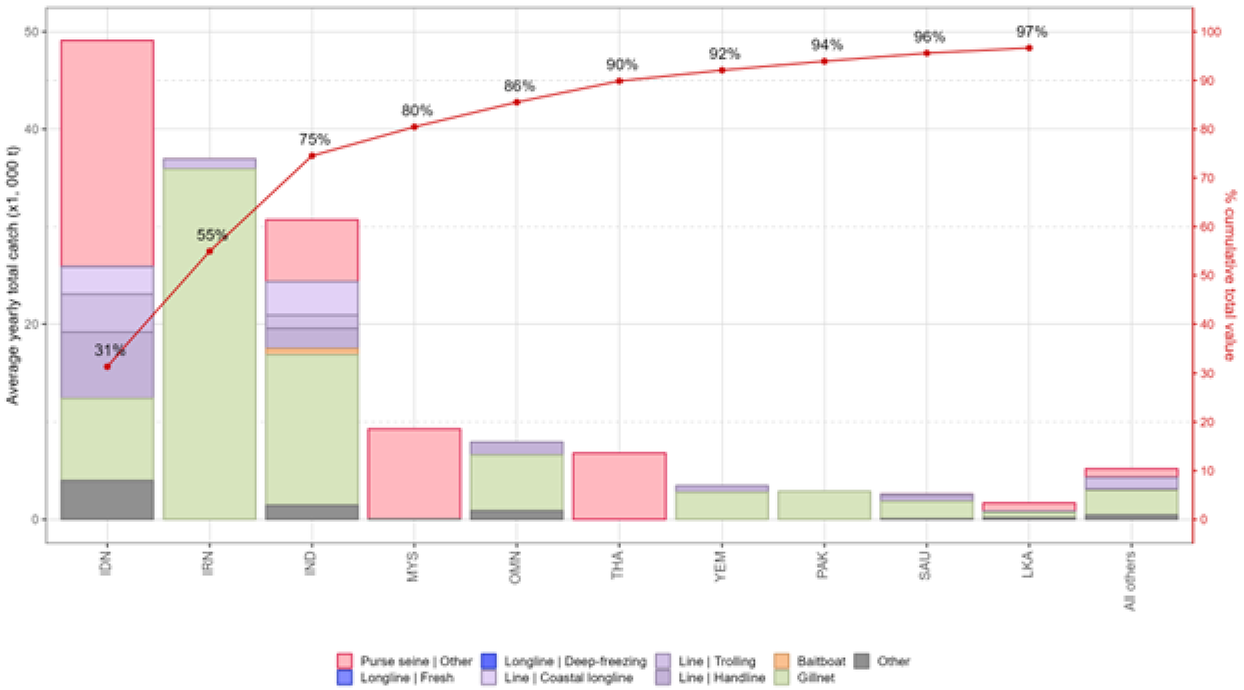

Fig 3. Mean annual catches (t) of kawakawa by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX X
EXECUTIVE SUMMARY: LONGTAIL TUNA

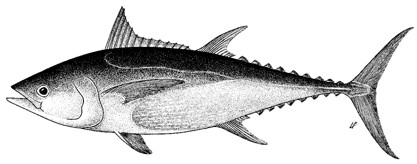

TABLE 1. Status of longtail tuna (*Thunnus tonggol*) in the Indian Ocean

Area[1]	Indicators		2023 stock status determination[3]
Indian Ocean	Catch 2021[2] (t)	134,171	34.7%
	Mean annual catch (2017-2021) (t)	134,171	
	MSY (t) (80% CI)	133,000 (108 –165)	
	F_{MSY} (80% CI)	0.31 (0.22 – 0.44)	
	B_{MSY} (t) (80% CI)	433,000 (272,000 – 690,000)	
	$F_{current}/F_{MSY}$ (80% CI)	1.05 (0.84 – 2.31)	
	$B_{current}/B_{MSY}$ (80% CI)	0.96 (0.44 – 1.19)	

[1]Stock boundaries defined as the IOTC area of competence; [2]Proportion of catch fully or partially estimated for 2021: 31.1%; [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)	34.7%	25%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	23%	17%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

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

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

Management advice. The catch in 2021 was above the estimated MSY and the exploitation rate has been increasing over the last few years, as a result of the declining abundance. Despite the substantial uncertainties, this suggests that the stock is being fished above MSY levels and that higher catches may not be sustained. A precautionary approach to management is recommended.

The following should be also noted:

- 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 2023 catches (reference year 2021) 31.1% 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.

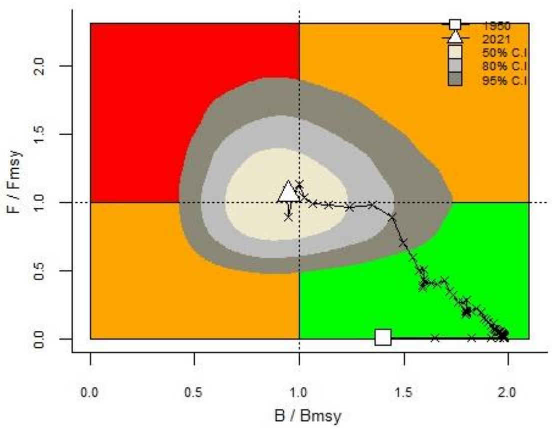

Fig. 1. Longtail tuna C-MSY Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (median) for the range of plausible model trajectories included in the formulation of the final management advice. The shaded contour lines represent 50%, 80%, and 95% confidence intervals of estimated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

Fisheries overview.

- **Main fisheries (mean annual catch 2017-2021)**: longtail tuna are caught using gillnet (67.4%), followed by line (16%) and 'other' gears (8.9%). The remaining catches taken with purse seine, longline and pole-and-line contributed to 7.7% of the total catches in recent years (**Fig. 2**).
- **Main fleets (mean annual catch 2017-2021)**: the majority of longtail tuna catches are attributed to vessels flagged to I. R. Iran (41.5%) followed by Indonesia (21%) and Sultanate of Oman (16.4%). The 20 other fleets catching longtail tuna contributed to 20.9% of the total catch in recent years (**Fig. 3**).

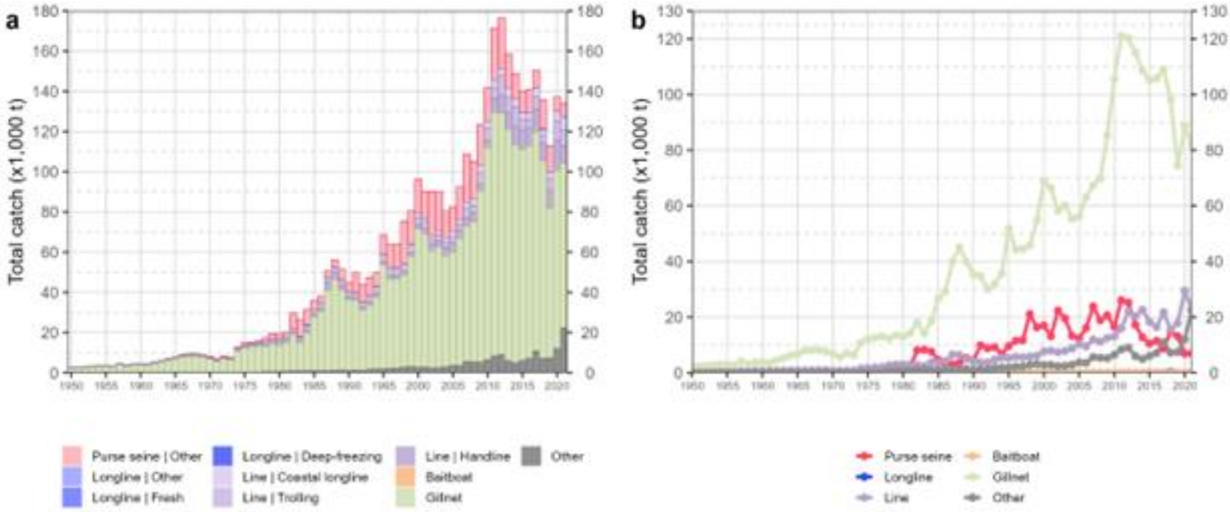

Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for longtail tuna during 1950-2021

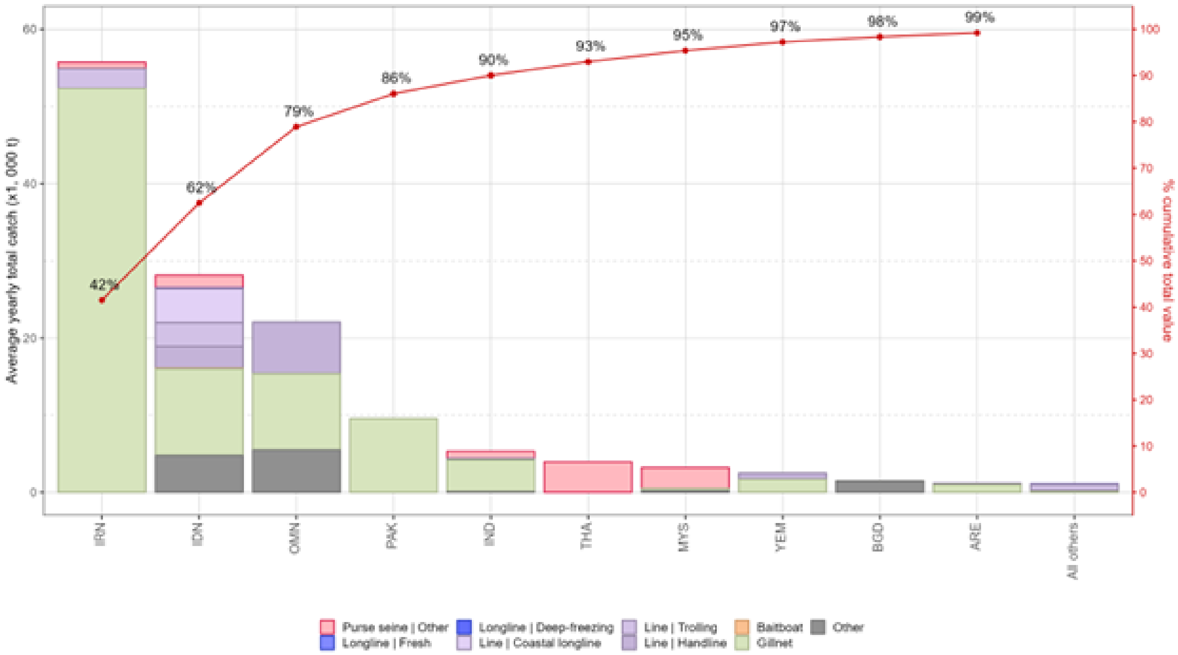

Fig. 3. Mean annual catches (t) of longtail tuna by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX XI
EXECUTIVE SUMMARY: INDO-PACIFIC KING MACKEREL

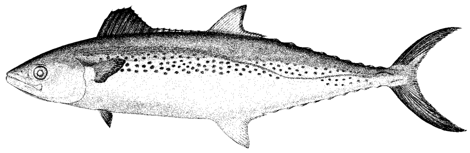

TABLE 1. Status of Indo-Pacific king mackerel (*Scomberomorus guttatus*) in the Indian Ocean

Area[1]	Indicators		2021 stock status determination[3]
Indian Ocean	Catch (2021) (t)[2]	33,418	35%
	Mean annual catch (2017-2021) (t)	44,508	
	MSY (1,000 t)	46.9 (37.7–58.4)	
	F_{MSY}	0.74 (0.56–0.99)	
	B_{MSY} (1,000 t)	63.2 (42–94)	
	$F_{current}/F_{MSY}$	0.90 (0.78–2.01)	
	$B_{current}/B_{MSY}$	1.03 (0.46–1.19)	
	$B_{current}/B_0$	0.51 (0.23–0.60)	

[1]Stock boundaries defined as the IOTC area of competence; [2]Proportion of catch fully or partially estimated for 2021: 69.6%; [3]Status relates to the final year data are available for assessment.

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

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

Outlook. Total annual catches for Indo-Pacific king mackerel have increased steadily over time, reaching a peak of 51,600 t in 2009 and have since fluctuated between around 40,000 t and 48,000 t. There is considerable uncertainty about stock structure and total catches. Aspects of the fisheries for this species, combined with the limited data on which to base a more complex assessment (e.g., integrated models), are a cause for concern. Although data-poor methods are used to provide stock status advice, further refinements to the catch-only methods and application of additional data-poor approaches may improve confidence in the results. Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g., estimates of growth, natural mortality, maturity, etc.).

Management advice. Reported catches of Indo-Pacific king mackerel in the Indian Ocean has increased considerably since the late 2000s with recent catches fluctuating around estimated MSY, although the catch in 2021 was below the estimated MSY. This suggests that the stock is close to being fished at MSY levels and that higher catches may not be sustained despite the substantial uncertainty associated with the assessment, a precautionary approach to management is recommended.

The following should be also noted:

- 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 2023 catches (reference year 2021), 69.6% of the total catches was either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore, the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.

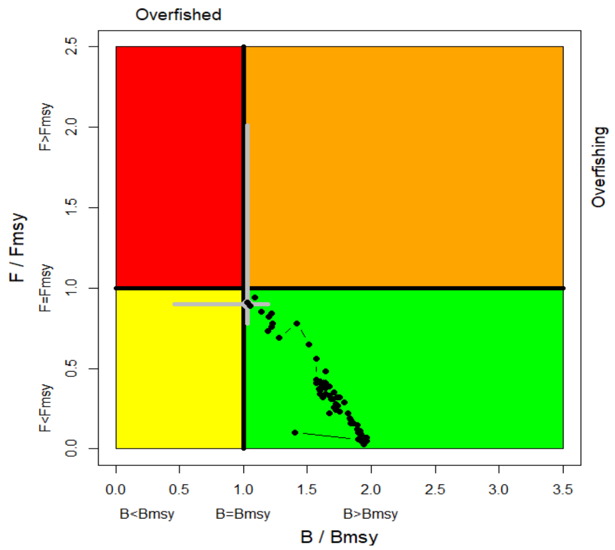

Fig. 1 Kobe plot of the CMSY assessment for the Indian Ocean spotted kingfish. The Kobe plot shows the trajectories (geometric mean) of the range of plausible model options included in the formulation of the final management advice. The grey cross represents the estimated stock status in 2021 (median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

Fisheries overview.

- **Main fisheries (mean annual catch 2017-2021)**: Indo-Pacific king mackerel are caught using gillnet (66.4%), followed by other (21.7%) and line (9.3%). The remaining catches taken with other gears contributed to 2.7% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2017-2021)**: the majority of Indo-Pacific king mackerel catches are attributed to vessels flagged to Indonesia (32.2%) followed by India (29.4%) and I. R. Iran (22.8%). The 13 other fleets catching Indo-Pacific king mackerel contributed to 15.5% of the total catch in recent years (**Fig. 3**).

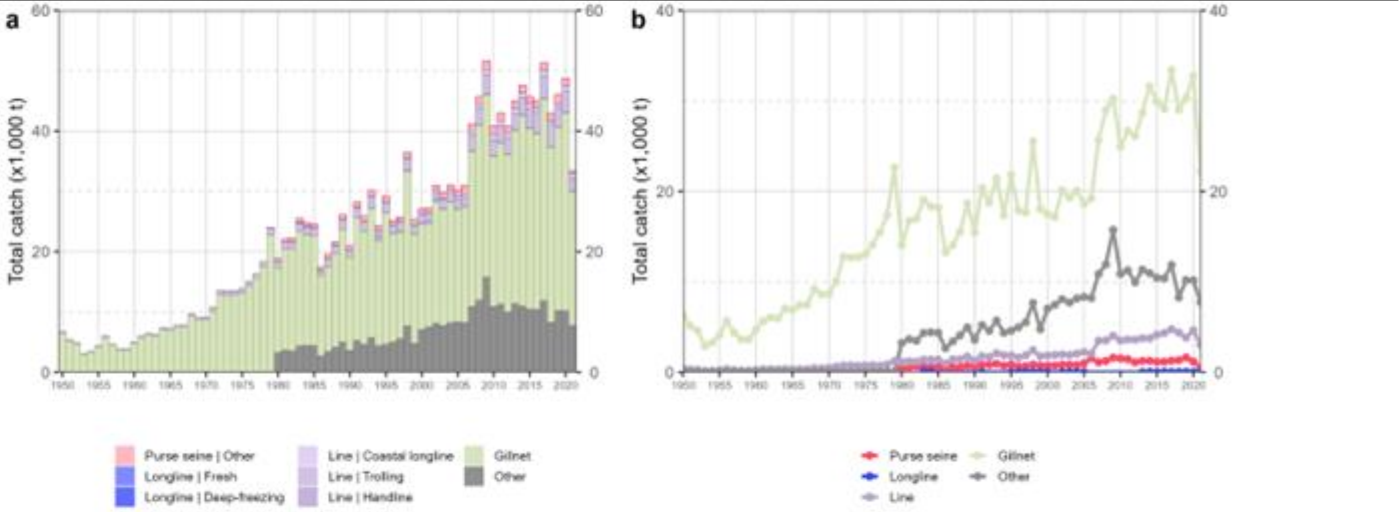

Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for Indo-Pacific king mackerel during 1950-2021

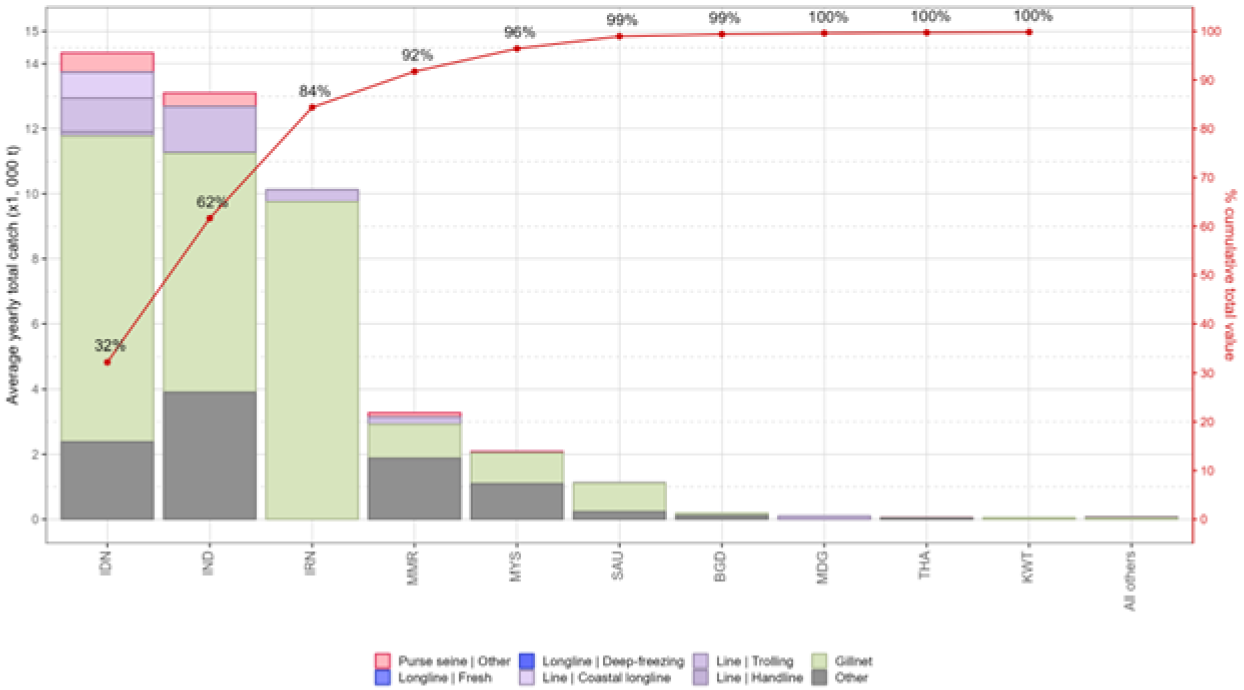

Fig. 3. Mean annual catches (t) of Indo-Pacific king mackerel by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX XII
EXECUTIVE SUMMARY: NARROW-BARRED SPANISH MACKEREL

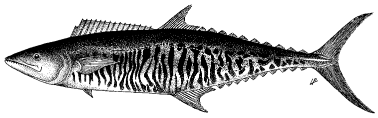

TABLE 1. Status of narrow-barred Spanish mackerel (*Scomberomorus commerson*) in the Indian Ocean

Area[1]	Indicators		2023 stock status determination[3]
Indian Ocean	Catch (2021)[2] (t) Mean annual catch (2017-2021) (t)	168,807 160,352	31%
	MSY (t) (80% CI) F_{MSY} (80% CI) B_{MSY} (t) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $B_{current}/B_{MSY}$ (80% CI)	161,000 (132,000 – 197,000) 0.60 (0.48–0.74) 271,000 (197,000 – 373,000) 1.07 (0.88 – 2.38) 0.98 (0.44 – 1.19)	

[1]Stock boundaries defined as the IOTC area of competence; [2]Proportion of catch fully or partially estimated for 2021: 69.8%; [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)	31%	28%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	21%	19%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A new assessment was conducted for narrow-barred Spanish mackerel in 2023 which examined a number of data-limited methods including C-MSY, OCOM, and JABBA models (based on data up to 2021). These models produced stock estimates that are not drastically divergent because they shared similar dynamics and assumptions. The C-MSY model has been explored more fully and therefore is used to obtain estimates of stock status. The C-MSY analysis indicates that the stock is being exploited at a rate that exceeded F_{MSY} in recent years and that the stock appears to be below B_{MSY} and above F_{MSY} (31% of plausible models runs). The analysis using OCOM model is more pessimistic and using JABBA incorporating gillnet CPUE indices is more optimistic. The JABBA model, however, is unable to estimate carrying capacity with a fair degree of certainty without additional prior constraints, indicating that the CPUE is either not informative or is conflicting with catch data. An analysis undertaken in 2013 in the Northwest Indian Ocean (Gulf of Oman) indicated that overfishing is occurring in this area and that localised depletion may also be occurring[3]. While the precise stock structure of Spanish mackerel remains unclear, recent research (IOTC-2020-SC23-11_Rev1) provides strong evidence of population structure of Spanish mackerel within the IOTC area of competence, with at least 4 genetic populations identified. This increases the uncertainty in the assessment, which currently assumes a single stock of Spanish mackerel. Based on the C-MSY assessment, the stock appears to be **overfished** and **subject to overfishing** (**Table 1**, **Fig. 1**). However, the assessment using catch-only method is subjected to high uncertainty and is highly influenced by several prior assumptions.

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

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.).

[3] IOTC-2013-WPNT03-27

Management advice. The catch in 2021 was above the estimated MSY and the available gillnet CPUE shows a somewhat increasing trend in recent years although the reliability of the index as an abundance index remains unknown. Despite the substantial uncertainties, the stock is being fished above MSY levels and higher catches may not be sustained.

The following should also be noted:

- Maximum Sustainable Yield for the Indian Ocean stock was estimated at 161,000 t (ranging between 132,000 t and 197,000 t, with catches for 2021 (168,807 t) exceeding this level;
- Limit reference points: the Commission has not adopted limit reference points for any of the neritic species under its mandate;
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods;
- Improvement in data collection and reporting is required if the stock is to be assessed using integrated stock assessment models;
- Given the increase in narrow-barred Spanish mackerel catch in the last decade, measures need to be taken to reduce catches in the Indian Ocean;
- Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions, exploring alternative approaches for estimating abundance (e.g., close-kin mark-recapture), and gaining a better understanding of stock structure and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.);
- There is a lack of information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2023 catches (reference year 2021) 69.8% 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.

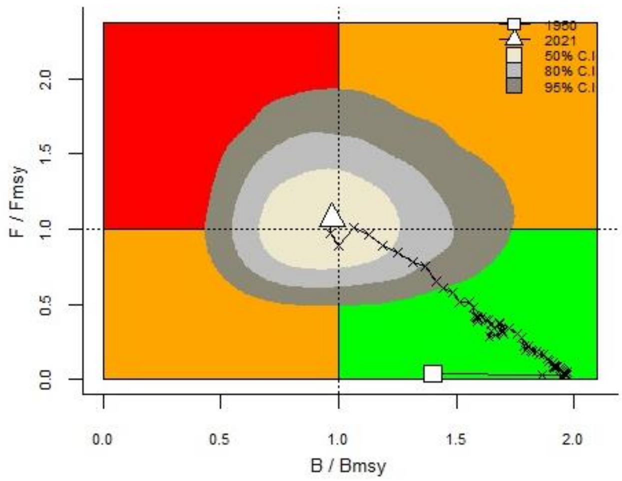

Fig. 1. Narrow-barred Spanish Mackerel OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (median) for the range of plausible model trajectories included in the formulation of the final management advice. The shaded contour lines represent 50%, 80%, and 95% confidence intervals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

Fisheries overview.

- **Main fisheries (mean annual catch 2017-2021)**: narrow-barred Spanish mackerel are caught using gillnet (59.3%), followed by line (18.9%) and other (15.9%). The remaining catches taken with other gears contributed to 5.9% of the total catches in recent years (**Fig. 2**).

- **Main fleets (mean annual catch 2017-2021)**: the majority of narrow-barred Spanish mackerel catches are attributed to vessels flagged to Indonesia (28.7%) followed by India (18.8%) and I. R. Iran (15.7%). The 27 other fleets catching narrow-barred Spanish mackerel contributed to 36.9% of the total catch in recent years (**Fig. 3**).

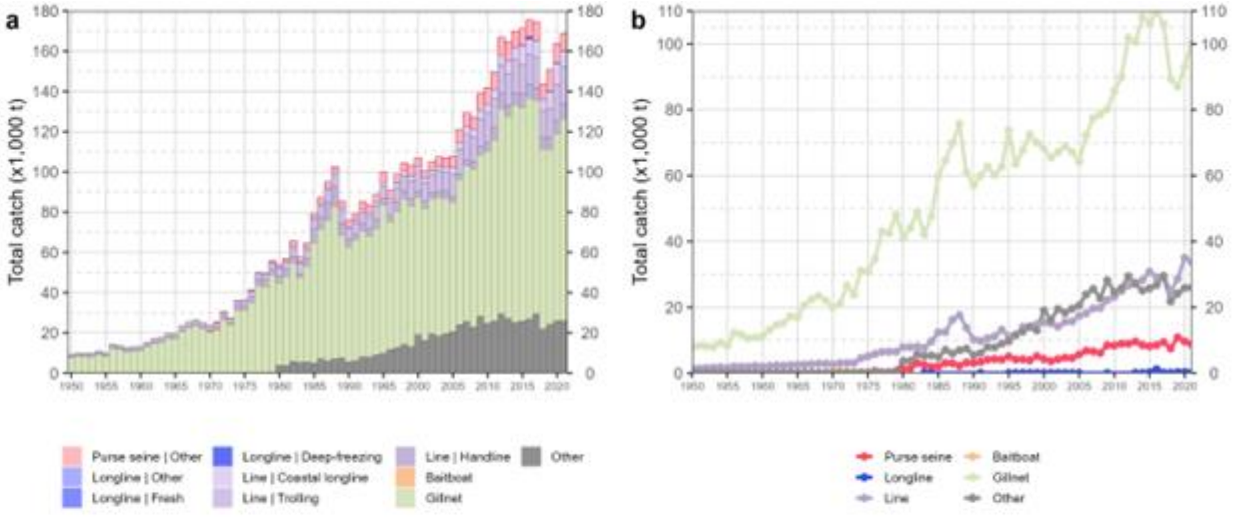

Fig. 2. Annual time series of (a) cumulative nominal catches (t) by fishery and (b) individual nominal catches (t) by fishery group for narrow-barred Spanish mackerel during 1950-2021

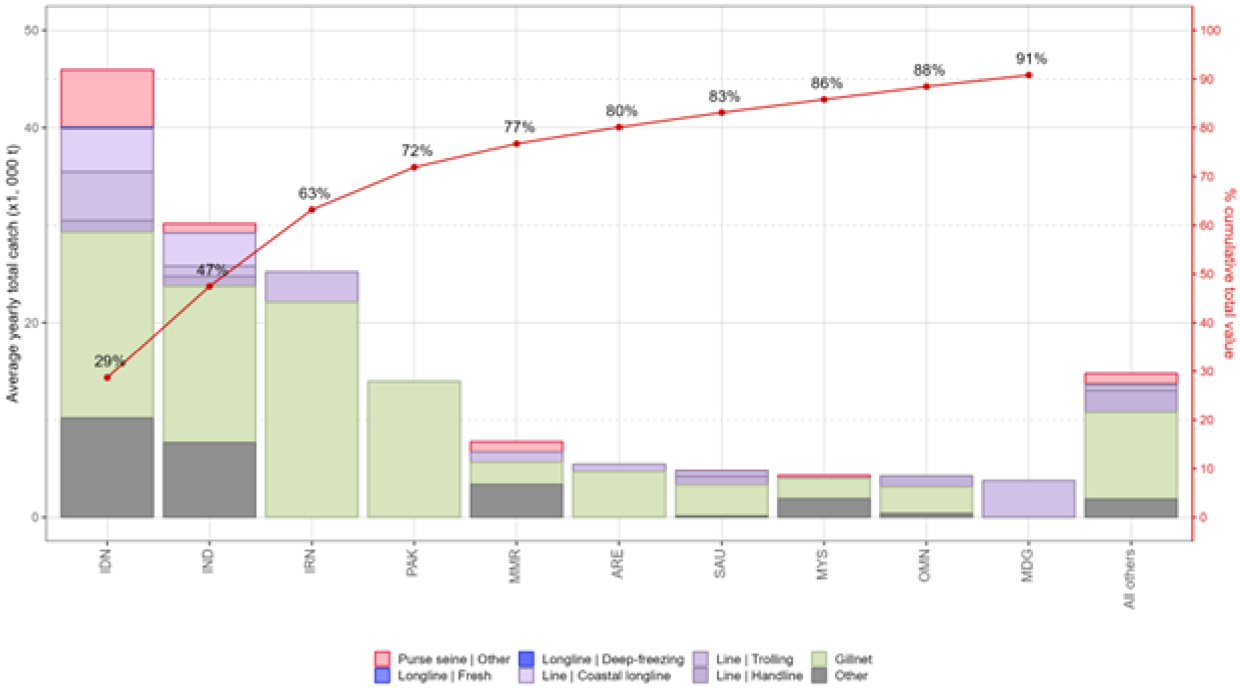

Fig. 3. Mean annual catches (t) of narrow-barred Spanish mackerel by fleet and fishery between 2017 and 2021, with indication of cumulative catches by fleet

APPENDIX XIII
CONSOLIDATED RECOMMENDATIONS OF THE 13TH SESSION OF THE WORKING PARTY ON NERITIC TUNAS

Note: Appendix references refer to the Report of the 13th Session of the Working Party on Neritic Tunas (IOTC–2023–WPNT13–R)

Progress on the Recommendations of WPNT12 and SC25

WPNT13.01 (para. 11) The WPNT **NOTED** that the current name of the working group may be misleading as two of the six species covered by the group are not classed as neritic tunas, they are in fact seerfish. The WPNT **DISCUSSED** the possibility of changing the name of the working group to clarify this with suggested options including the Working Party on: neritic tunas and seerfish; neritic tuna and tuna-like species; and neritic species. The WPNT **RECOMMENDED** that the SC discuss the necessity for a name change and the proposed options.

Review of the statistical data available for neritic tunas

WPNT13.02 (para 33) **NOTING** how issues in species identification are common for neritic tunas and seerfish in several fisheries and that this affects the accuracy of the time series of catch which are the main input for the assessment models, the WPNT **RECOMMENDED** that the SC endorse the organisation of training workshops for fish species identification.

WPNT13.03 (para 40) **ACKNOWLEDGING** that FAO, through its Coordinating Working Party on Fishery Statistics (CWP), is actively working on the standardization of effort definitions and on a proposal for standard effort units by gear type, the WPNT **RECOMMENDED** that the SC endorses the amendment of the IOTC data reporting requirements accordingly in order to reflect the results of these studies and guarantee homogeneous reporting of effort statistics in the future.

WPNT13.04 (para 44) **NOTING** the interest of size-based assessment models such as LB-SPR as an alternative or complement to catch-based approaches, the WPNT **RECOMMENDED** the SC to endorse the development of a large-scale regional sampling program focusing on the collection of size-frequency data from coastal fisheries and also including the collection of morphometric data required to develop robust conversion factors, length-length and length-weight relationships.

Revision of the WPNT Program of Work (2024–2028)

WPNT13.05 (para 116) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2024–2028), as provided in Appendix VI.

Review of the draft, and adoption of the Report of the 13th Working Party on Neritic Tunas

WPNT13.06 (para 123) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT13, 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 2023:

- 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