Food and Agriculture Organization of the United Nations

Indian Ocean Tuna Commission
Commission des Thons de l'Ocean Indien



# Report of the 11th Session of the IOTC Working Party on Neritic Tunas

Microsoft Teams Online, 5 – 9 July 2021

**DISTRIBUTION:**

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**BIBLIOGRAPHIC ENTRY**

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## ACRONYMS

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

## STANDARDISATION OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE REPORT TERMINOLOGY

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

## HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

***Level 1: From a subsidiary body of the Commission to the next level in the structure of the Commission:***

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

***Level 2: From a subsidiary body of the Commission to a CPC, the IOTC Secretariat, or other body (not the Commission) to carry out a specified task:***

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

***Level 3: General terms to be used for consistency:***

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

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

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

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## EXECUTIVE SUMMARY

The 11th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT11) was held online using the Microsoft Teams online platform from 5 - 9 July 2021. A total of 33 participants (43 in 2020, 18 in 2019 and 18 in 2018) attended the Session.

**Revision of the WPNT Program of Work (2022–2026)**

WPNT11.01 (para 86) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2022–2026), as provided in Appendix VI.

**Review of the draft, and adoption of the Report of the 11th Working Party on Neritic Tunas**

WPNT11.02 (para 92) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT11, provided at 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 2021 (Fig. 10):

- 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: 2021

**Neritic tunas and mackerel: These six species have become as important or more important as the three tropical tuna species (bigeye tuna, skipjack tuna and yellowfin tuna) to most IOTC coastal states with** a total estimated catch of 589,359t landed in 2019. 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 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Advice to the Commission |
|---|---|---|---|---|---|---|---|---|---|
| Bullet tuna<br>*Auxis rochei* | Catch 2019: 23,719 t<br>Average catch 2015–2019: 19,163 t<br>MSY (1,000 t) unknown<br>$F_{MSY}$: unknown<br>$B_{MSY}$ (1,000 t): unknown<br>$F_{current}/F_{MSY}$: unknown<br>$B_{current}/B_{MSY}$: unknown<br>$B_{current}/B_0$: unknown | | | | | | | | For assessed species of neritic tunas and seerfish in Indian Ocean (longtail tuna, kawakawa and narrow-barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both FMSY and BMSY were breached thereafter. Therefore, in the absence of a stock assessment of bullet tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (8,547 t). This catch advice should be maintained until an assessment of bullet tuna is available. Considering that MSY-based reference points for assessed species can change over time, the stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice.. Click here for a full stock status summary: Appendix VII |
| Frigate tuna<br>*Auxis thazard* | Catch 2019: 98,691 t<br>Average catch 2015–2019: 96,644 t<br>MSY (1,000 t) unknown<br>$F_{MSY}$: unknown<br>$B_{MSY}$ (1,000 t): unknown<br>$F_{current}/F_{MSY}$: unknown<br>$B_{current}/B_{MSY}$: unknown<br>$B_{current}/B_0$: unknown | | | | | | | | For assessed species of neritic tunas in Indian Ocean (longtail tuna, kawakawa and narrow-barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both FMSY and BMSY were breached thereafter. Therefore, in the absence of a stock assessment of frigate tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (101,260 t). The reference period (2009-2011) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available under the assumption that also for frigate tuna MSY was reached between 2009 and 2011. This catch advice should be maintained until an assessment of frigate tuna is available. Considering that MSY-based reference points for assessed species can change over time, the stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice. Click here for a full stock status summary: Appendix VIII |

| Stock | Indicators | Previous | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Advice to the Commission |
|---|---|---|---|---|---|---|---|---|---|
| Kawakawa<br>*Euthynnus affinis* | Catch 2019[2]: 148,828 t<br>Average catch 2015-2019 152,253 t<br><br>MSY (1,000 t) [*] 149 [124 –223]<br>$F_{MSY}$ [*] 0.44 [0.21–0.82]<br>$B_{MSY}$ (1,000 t) [*] 356 [192–765]<br>$F_{2018}/F_{MSY}$ [*] 0.98 [0.47–1.75]<br>$B_{2018}/B_{MSY}$ [*] 1.13 [0.75–1.58]<br>$B_{2013}/B_0$ [*] | | | | | | | | A new stock assessment was carried out in 2020 using data-limited assessment techniques. The OCOM model indicated that F was just FMSY (F/FMSY=0.98) and B above BMSY (B/BMSY=1.13). The estimated probability of the stock currently being in green quadrant of the Kobe plot is about 50%. The available gillnet CPUE showed a somewhat increasing trend. On the weight-of-evidence available in 2020, the stock status is assessed to be not overfished and overfishing is not occurring. However the assessment models rely on catch data, which are considered to be highly uncertain. The catch in 2019 was equal to the estimated MSY. 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<br>*Thunnus tonggol* | Catch 2019[2]: 112,867 t<br>Average catch 2015–2019: 135,070 t<br>MSY (1,000 t) (*): 129 (100–151)<br>$F_{MSY}$ (*): 0.32 (0.15–0.66)<br>$B_{MSY}$ (1,000 t) (*): 395 (129–751)<br>$F_{2018}/F_{MSY}$ (*): 1.52 (0.75–2.87)<br>$B_{2018}/B_{MSY}$ (*): 0.69 (0.45–1.21)<br>$B_{2015}/B_0$ (*): (–) | | | | | | | | A new stock assessment was carried out in 2020 using data-limited assessment techniques. The OCOM model indicated that F was above FMSY (F/FMSY=1.52) and B below BMSY (B/BMSY=0.69), with an estimated probability of 76% for the stock currently being in red quadrant of the Kobe plot. The recent catches are close to historical high levels and available gillnet CPUE showed declining catch rates, which is a cause of concern. On the weight-of-evidence available in 2020, the stock status is assessed to be overfished and overfishing is occurring. However the assessment models rely on catch data, which are considered to be highly uncertain. The catch in 2019 was below the estimated MSY but the exploitation rate has been increasing over the last few years, as a result of the declining abundance. Despite the substantial uncertainties, this suggests that the stock is very close to being fished at MSY levels and that higher catches may not be sustained. A precautionary approach to management is recommended. Click here for a full stock status summary: Appendix X |
| Indo-Pacific king mackerel<br>*Scomberomorus guttatus* | Catch 2019[2]: 45,796 t<br>Average catch 2015-2019: 45,513 t<br>MSY (1,000 t) 46.9 (37.7–58.4)<br>$F_{MSY}$: 0.74 (0.56–0.99)<br>$B_{MSY}$ (1,000 t): 63.2 (42–94)<br>$F_{current}/F_{MSY}$: 0.90 (0.78–2.01)<br>$B_{current}/B_{MSY}$: 1.03 (0.46–1.19)<br>$B_{current}/B_0$: 0.51 (0.23–0.60) | | | | | | | | A new assessment was carried out in 2020 using the data-limited techniques (CMSY and LB-SPR) . Analysis using the catch only method CMSY indicates the stock is being exploited at a rate that is below FMSY in recent years and that the stock appears to be above BMSY, although the estimates would be more pessimistic if the stock productivity is assumed to be less resilient. Based on the weight-of-evidence currently available, the stock is considered to be not overfished and not subject to overfishing. Reported catches of Indo-Pacific king mackerel in the Indian Ocean has increased considerably since the late 2000s with recent catches fluctuating around estimated MSY, although the catch in 2019 was below the estimated MSY. This suggests that the stock is very close to being fished at MSY levels and that higher catches may not be sustained despite the substantial uncertainty associated with the assessment, a precautionary approach to management is recommended. Click here for a full stock status summary: Appendix XI |
| Narrow-barred Spanish mackerel<br>*Scomberomorus commerson* | Catch 2019[2]: 159,457 t<br>Average catch 2015-2019: 171,799 t<br>MSY (1,000 t) [*]: 158 [132–187]<br>$F_{MSY}$ [*]: 0.49 [0.25–0.87]<br>$B_{MSY}$ (1,000 t) [*]: 324 [196–593]<br>$F_{2018}/F_{MSY}$ [*]: 1.24 [0.65–2.13] | | | | | | | | A new stock assessment was carried out in 2020 using data-limited assessment techniques. The OCOM model indicated that F was above FMSY (F/FMSY=1.24) and B below BMSY (B/BMSY=0.89). The estimated probability of the stock currently being in red quadrant of the Kobe plot is about 73%. On the weight-of-evidence available in 2020, the stock status is assessed to be overfished and overfishing is occurring. However |

| Stock | Indicators | Previous | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Advice to the Commission |
|---|---|---|---|---|---|---|---|---|---|
| | $B_{2018}$ $B_{MSY}$ [*]: 0.89 [0.65–2.13]<br>$B_{2018}/B_0$ [*]: | | | | | | | | the assessment models rely on catch data, which is considered to be highly uncertain. The catch in 2019 was just below the estimated MSY and the available gillnet CPUE shows a somewhat increasing trend in recent years although the reliability of the index as an abundance index remains unknown. Despite the substantial uncertainties, the stock is probably very close to being fished at MSY levels and higher catches may not be sustained. Click here for a full stock status summary: Appendix XII |

*Indicates range of plausible values

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

# 1. OPENING OF THE MEETING

1. The 11th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT11) was held online using the Microsoft Teams online platform from 5 - 9 July 2021. A total of 33 participants (43 in 2020, 18 in 2019 and 18 in 2018) attended the Session. The list of participants is provided at Appendix I. The meeting was opened by the Vice Chairperson, Dr Farhad Kaymaram from Iran, 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 WPNT11 are listed in Appendix III.

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

## *3.1 Outcomes of the 23rd Session of the Scientific Committee*

3. The WPNT **NOTED** paper IOTC–2021–WPNT11–03 which outlined the main outcomes of the 23rd Session of the Scientific Committee (SC23), specifically related to the work of the WPNT and **AGREED** to consider how best to progress these issues at the present meeting.

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

### *3.2 Outcomes of the 24th and 25th Sessions of the Commission*

5. The WPNT **NOTED** paper IOTC–2021–WPNT11–04 which outlined the main outcomes of the 24th and 25th Sessions of the Commission, specifically related to the work of the WPNT. The WPNT further **NOTED** that the 25th 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 24th Session.

6. Participants to WPNT11 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*

7. The WPNT **NOTED** paper IOTC–2021–WPNT11–05 which aimed to encourage participants at the WPNT11 to review some of the existing Conservation and Management Measures (CMM) relating to neritic tunas.

### *3.4 Progress on the Recommendations of WPNT10 and SC23*

8. The WPNT **NOTED** paper IOTC–2021–WPNT11–06 which provided an update on the progress made in implementing the recommendations from the 10th Session of the WPNT for the consideration and potential endorsement by participants.

9. 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 2021.

10. The WPNT participants were **ENCOURAGED** to review IOTC-2021-WPNT11-06 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 (WPNT12).

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

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

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

12. The WPNT **NOTED** paper IOTC–2021–WPNT11–07 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 1950–2019. A summary is provided at Appendix IVa–IVf.

13. 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, by type of dataset and fishery, which are provided in Appendix V, and **ENCOURAGED** the CPCs listed in Appendix V to make efforts to remedy the data issues identified and to report back to the WPNT at its next meeting.

14. **NOTING** that the trends in catches of all neritic tuna and seerfish species combined have been almost linearly increasing since the beginning of the time series (1950), the WPNT **ACKNOWLEDGED** that the recent decline (from 2017) is mostly explained by the decreases in reported catches from the tuna-targeting gillnet fishery of Pakistan, which have reduced operations in recent years.

15. 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% to 60% in the years between 1990 and 2019.

16. At the same time, the WPNT **NOTED** very different patterns when considering the availability of nominal catch data for each neritic tuna and seerfish species, with frigate tuna (*Auxis thazard*) ranking last in terms of data quality in recent years (2018-2019), followed by narrow-barred Spanish mackerel (*Scomberomorus commerson*), kawakawa (*Euthynnus affinis*), Indo-Pacific king mackerel (*Scomberomorus guttatus*), and finally longtail tuna (*Thunnus tonggol*) and bullet tuna (*Auxis rochei*).

17. The WPNT **NOTED** that, due to the high uncertainty in the information provided for several gears by some key fleets in 2020 (data for reference year 2019), the Secretariat had to re-estimate a consistent fraction of nominal catches reported for all neritic tuna and seerfish species, and **SUGGESTED** that relevant CPCs liaise with the Secretariat to determine whether updates to nominal catch data for their applicable fisheries can be provided for 2019 and previous years.

18. On this regard, the WPNT **ACKNOWLEDGED** that details on the disaggregation procedures and on the production of re-estimated catch series as these are applied by the IOTC Secretariat under guidance from the IOTC Scientific Committee ("*IOTC best scientific estimates*") are provided in Appendix I of the document, for both CPCs and non-CPCs, and that these include a summary of the percentage of catches that the re-estimation adds to the total yearly catches reported for the species of interest.

19. The WPNT **NOTED** that the previously identified high levels of catches of bullet tuna in 2018 were still present in 2019, albeit to a lower level, and **RECALLED** that these originate mostly from data reported by the purse seine fisheries of Indonesia, whose industrial component started to be explicitly reported only from 2017 onwards.

20. The WPNT also **ACKNOWLEDGED** that when considering the officially reported data from all fisheries (i.e., before the re-estimations endorsed by the Scientific Committee are implemented by the IOTC Secretariat) then nominal catch series of bullet tuna reported by Indonesia show even higher fluctuations in the years between 2010 and 2019, which might potentially be due to issues in data collection (e.g., species mis-identification) or data reporting (aggregation with other species such as frigate tuna) which Indonesia indicated as known issues at national level.

21. **RECALLING** that the data submitted by Indonesia indicate the presence of two distinct types of purse seine fisheries, both operating in coastal waters although using different types of vessels, the WPNT **NOTED** that data on the characteristics of the larger Indonesia-flagged purse seine vessels (above 24 m LoA) are available through the IOTC Active Vessels List, while little to no data is available for the smaller vessels, whose details might be provided through the voluntary IOTC form 2FC, and therefore **ENCOURAGED** CPCs that might routinely collect this type of information (e.g., through boat census) to consider the provision of the data to the IOTC Secretariat in the near future.

[1] Nominal catches are considered of *good quality* when their score is between 0 and 2 (see IOTC-2021-WPNT11-07) 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.

22. 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 fisheries, **ACKNOWLEDGING** that the only current reliable source of discard data for neritic tunas and seerfish comes from the submissions of scientific observer data through the IOTC ROS, and further **NOTING** that due to the current ROS data reporting protocol adopted by the EU (based on ST09 forms) the information on the status of discarded fish (dead / alive) is not known.

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

24. The WPNT **NOTED** that studies estimating the level of discards of neritic tunas for the EU industrial purse-seine fleet operating in the Indian Ocean exist, and were last presented at the IOTC Working Party on Ecosystems and Bycatch in 2018, **ACKNOWLEDGING** that the majority of these discards are thought to be occurring in the Western Indian Ocean, in particular on log-associated sets.

25. Also, the WPNT **ACKNOWLEDGED** that discarding of neritic tuna and seerfish species in coastal fisheries is thought to be uncommon, as these are often target species for the fisheries to supply the demand from canneries and local markets.

26. The WPNT **NOTED** with concern that comprehensive geo-referenced catch-and-effort data for the species and fisheries concerned are 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 with quality assurance.

27. The WPNT further **NOTED** that when such data are available, their coverage is often very small, reaching levels generally corresponding to less than 5% of total catches.

28. Additionally, the WPNT **NOTED** that little to no information on geo-referenced catch-and-effort data is available for 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 the data collection and reporting processes implemented at national level.

29. The WPNT **ACKNOWLEDGED** that one of the major issues detected with the available geo-referenced effort data from coastal and artisanal fisheries is the inconsistency in reported effort units over time, both at fleet and at gear level, and **NOTED** that this hinders the usage of this data for the determination of time series of nominal CPUE.

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

31. **NOTING** that the overall quality of the statistical data for neritic tunas and seerfish species available to the IOTC Secretariat is also affected by issues in data reporting, the WPNT **WELCOMED** with thanks the recommendation from the last Compliance Committee (CoC18) that "*the IOTC Secretariat organise a workshop for personnel in the national administrations to explain the mandatory data reporting requirements and format for data submission*", and **INVITED** CPCs with such needs to express their interest with the IOTC Secretariat.

32. Considering the importance of having accurate catch series for neritic tunas and seerfish species, the WPNT **RECALLED** that activities supporting the reconstruction and re-estimation of historical catch series for artisanal fisheries in the Indian Ocean are of high priority, and **NOTED** that a workshop focusing on the historical data submissions and current process of catch estimation for Indonesian fisheries was held in May 2021 between Indonesia and the IOTC Secretariat, and that the conclusions of the workshop will be presented at the next WPDCS.

33. The WPNT **RECALLED** that the IOTC Secretariat is available to engage with CPCs with regards to issues in data collection and reporting, and that this could take the form of webinars and data support missions as soon as the status of the global COVID19 pandemic allows.

### *4.2 Review of new information on fisheries and associated environmental data*

34. The WPNT **NOTED** paper IOTC-2021-WPNT11-09 which provided information on the fishery and stock status of neritic tunas and allied resources in the Indian coastal waters, including the following abstract provided by the authors:

"*Tunas and allied resource are exploited from coastal waters by a variety of small to medium fleets operating different varieties of gears. The catch was constituted by neritic tunas, small sized oceanic tunas like skipjacks and Spanish mackerel from shelf areas. Targeted fishery prevailed only for Spanish mackerels, whereas tunas mostly formed incidental catch in most gears. Their fishery is mostly coastal based and restricted to limited areas along the coast.*" – see document for full abstract

35. The WPNT **THANKED** the authors for their presentation and **NOTED** that the CPUE data presented would be very valuable for conducting Indian Ocean wide stock assessments so **ENCOURAGED** the authors to provide these data to the Secretariat.

36. The WPNT **NOTED** that the values of $F_{MSY}$ presented were very high compared with other estimates and suggested that this may be due to the lack of consistency with the submission of data which was used to calculate the $F_{MSY}$ value. The WPNT further **NOTED** that no biological reasoning for this high value was known.

37. The WPNT **NOTED** that the stock assessments presented were conducted on stocks within the Indian EEZ and **NOTED** that scientists from India believe these stocks to be resident within the EEZ based on landing estimates conducted across the country.

38. The WPNT further **NOTED** that connectivity studies have not been conducted between these stocks and stocks in the wider Indian Ocean. The WPNT also **NOTED** that residence times seem to be unknown, therefore if the migration rates were in fact quite high, many of the assessment model assumptions would be invalidated. The WPNT **NOTED** paper IOTC-2021-WPNT11-10 on declining Neritic Tuna Landings in Pakistan-Causes and Impact on Fishing Effort and Marketing, including the following abstract provided by the authors:

"*Neritic tuna are important component of the tuna fisheries of Pakistan It is estimated that neritic tuna alone have a share of about 43.28 % in the total landings of tuna in 2020. Of the five species of neritic tuna, longtail tuna (*Thunnus tonggol*) contributes 3, 320m, tons in 2020 and 3,242 m. tons in 2019 as compared to 11,985 m. tons in 2018. Landings of frigate tuna (*Auxis thazard thazard*) during 2020 was recorded to be 6,759 m. tons whereas it was 7,619 m. tons in 2019 and 10,986 m. tons in 2018. Kawakawa (*Euthynnus affinis*) landings in 2020 was 1,310 m. tons whereas it was 1,236 m. tons in 2019 and 4,123 m. tons in 2018. Other two species i.e. bullet tuna (*Auxis rochei*) and striped bonito (*Sarda orientalis*) contributed insignificantly in the total tuna landings of Pakistan..*" – see document for full abstract

39. The WPNT **THANKED** the authors for their work and **NOTED** that little information is available on discards of neritic tuna in Pakistan's fisheries but that overall levels of discards are thought to be low, particularly in offshore fisheries, i.e., less than 500 kg per vessel per trip as noted by crew onboard some vessels.

40. **NOTING** that the data presented here would be useful for inclusion in CPUE indices to be reviewed at the WPNT meeting in 2022 (when the meeting will focus on data preparation for all six neritic species), the WPNT **ACKNOWLEDGED** that Pakistan is currently working to develop databases for fisheries data, but that data entry and extraction is still challenging and any data for CPUE indices would need to be manually extracted from paper documents.

41. Notwithstanding the above limitations, the WPNT also **NOTED** that Pakistan intends to undertake this work in time for the next WPNT meeting.

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

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

42. The WPNT **NOTED** paper IOTC–2021–WPNT11–14 on the Length-length and Length-weight relationship of bullet tuna (*Auxis rochei*) and frigate tuna (*Auxis thazard*) from the coastal of west Sumatra, Indonesia, including the following abstract provided by the authors:

"*The length-weight relationship (LWR) and length-length relationship (LLR) have been applied for basic uses in order to make fish stocks and population assessment. The aims of this paper were to provide the baseline information of the length-length relationship and the length-weight relationship of* A. rochei *and* A. thazard *collected from the coastal of west of Sumatra. The samples were collected from several landing ports around west of Sumatra, i.e. Lampulo. Sibolga, Padang, Bengkulu, and Lampung. A total of 722 bullet tuna and 707* *frigate tuna were measured (FL and TL) and weighed during the study. The relationship between length was determined using linear regression, whereas the length-weight relationship was done by using power regression. The equation (FL-TL. FL-W, TL-W) were reliable with R2 close to 1. The bullet tuna and frigate tuna from all port samplings were hyperallometric*.".

43. The WPNT **THANKED** the authors for the presentation and **NOTED** that the values for parameter b calculated during this study were higher than previous estimates including those currently being used as the default values by the Secretariat but further **NOTED** that the R2 values were high suggesting a high degree of certainty with the results. The WPNT further **NOTED** that the default relationships used for many neritic species are very old and so it would be useful to update using newer data. The WPNT **SUGGESTED** that for future studies including data from several sampling locations, the relationships could first be established for each sampling location then combined if they are found to be similar.

44. The WPTN **NOTED** that the Secretariat is working to create a regional database of morphometric relationships for all IOTC species and **ENCOURAGED** Indonesia to contribute the data and relationships found in this study to the Secretariat database..

### *5.2 Data for input into stock assessments*

45. The WPNT **NOTED** that no papers were submitted to contribute new data for the stock assessments and so the data contained in the IOTC databases as presented in paper IOTC–2021–WPNT11–07 were used in the assessments.

## 6. Stock Assessment Updates

### *6.1 Stock Assessments*

***Indo-Pacific king mackerel***

46. The WPNT **NOTED** document IOTC-2021-WPNT11-11 on an Assessment of Indian Ocean Indo-Pacific King Mackerel (*Scomberomorus guttatus*) 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 a lack of reliable information on stock structure, abundance, and biological parameters. Stock assessments was conducted for Indo-Pacific king mackerel (Scomberomorus guttatus) in 2015, using data-limited methods (Martin & Sharma 2015). This paper provides an update to the C-MSY assessment (Froese et al. 2016) based on the most recent catch information. In addition, a length-based method for estimation of spawning potential ratio (Hordyk et al. 2014) was also applied to the available length composition data of the Indo-Pacific king mackerel from the gillnet fishery"*

47. The WPNT **CONGRATULATED** the authors for the progress made in the development of assessment models for Indo-Pacific king mackerel, including the application of the catch-only model (C-MSY) and a length-based method for estimating the spawning potential ratio (LB-SPR).

48. The WPNT **NOTED** that the results of the two models are consistent with regards to the stock status and indicate that the Indian Ocean-wide stock of Indo-Pacific king mackerel is not overfished and not subject to overfishing.

49. The WPNT **NOTED** that assuming a medium range of resilience resulted in more pessimistic stock status, i.e., the stock would be in the red Kobe quadrant compared with the green Kobe quadrant resulting from using a high range of resilience.

50. The WPNT **NOTED** that the reference quantities (e.g. $B/B_{MSY}$) estimated from the C-MSY have wide confidence bounds, and this is primarily due to the relatively wide range of the input parameters as derived from the Life History Module.

51. The WPNT **NOTED** that while the results on $B_{MSY}$ and $F_{MSY}$ significantly differ between the base case run and the sensitivity run, the values of MSY are close as they are mainly a function of the catches, **RECALLING** that the C-MSY method is sensitive to the accuracy of the time series of catches.

52. However, the WPNT **NOTED** that simulations have shown that the effect of bias in catches may not be so influential on model outcomes when such bias is consistent over time.

53. The WPNT **NOTED** that most recent catches are below 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.

54. The WPNT **NOTED** that the life history parameters used to define the prior for the growth parameter (*r*) were derived from a comprehensive review of the literature made in 2016 and available in the document IOTC-2016-WPNT06-DATA12, **ACKNOWLEDGING** that this approach is an improvement over the use of a fixed range of *r* values available from FishBase and used for sensitivity runs by assuming Indo-Pacific king mackerel is described by medium resilience, i.e., *r* in the range 0.2-0.8.

55. The WPNT **NOTED** that the prior distribution for *r* was derived from a Life History Module based on the Euler-Lotka equation (https://github.com/cttedwards/bdm) and that such approach might be more adapted to shark species and large marine mammals than teleosts, and **ENCOURAGED** the authors to explore alternative methods in the future to elicit the prior for *r*.

56. The WPNT **NOTED** that some small changes occurred between 2015 and 2021 in the historical nominal catches of Indo-Pacific king mackerel and that such changes are common and due to updates provided by some CPCs as well as corrections made to the data managed at the Secretariat.

57. The WPNT **NOTED** that the optimized catch-only model (OCOM; Zhou et al. 2017), which is based on a more rigorous approach to define the priors for *r* and carrying capacity (*K*), has been found to generally perform better than C-MSY and **ENCOURAGED** the authors to apply OCOM in addition to C-MSY in future studies to better account for the sensitivity of the results to the initial conditions, **NOTING** that both models are now part of a R package that includes most data-limited methods (https://rdrr.io/github/cfree14/datalimited2/).

58. The WPNT **ACKNOWLEDGED** the interest of using other data-poor approaches in addition to catch-based models and **NOTED** that the LB-SPR method was applied to Indo-Pacific king mackerel for demonstration purpose in absence of a sufficient size data set that would be representative of all Indian Ocean fisheries.

59. The WPNT **NOTED** that the LB-SPR could be applied to the fishery/gear groups that have representative size samples, and that the method works better for size compositions from fisheries that target the adult portion of the stock.

60. The WPNT **EXPRESSED** some concern about the use of the LB-SPR approach to Indian Ocean neritic tuna and tuna-like species regarding (i) the assumption of constant recruitment over time, (ii) the definition of reference points, and (iii) the seasonal and multi-gear nature of the fisheries combined with the migratory character of seer fish which may affect the representativeness of the size data available and eventually the results of the model.

61. The WPNT **NOTED** that neritic tunas and seerfish are thought to be relatively resident within coastal areas although little information on movements are available for these species, **SUGGESTING** that this may be of less concern when applying the method to these species as compared to tropical tunas and billfish that are more migratory.

62. The WPNT **ENCOURAGED** the authors to explore the sensitivity of the results and some possible caveats by applying the method to the size data available for a specific gear during consecutive years or from different gears in the same year.

63. Overall, the WPNT **AGREED** that the LB-SPR approach may have some merit for some neritic species when some good size data are or become available (e.g. longtail tuna) but that it should come as a second option to compare the stock status results with those found using catch-based models

64. The WPNT **RECALLED** that the key input for conducting stock assessments with catch-based methods is the time series of catches and **URGED** all CPCs to make the best effort to collect and report catch data following IOTC Resolutions 15/01 and 15/02 and in agreement with IOTC reporting guidelines and standards.

***Frigate tuna***

65. The WPNT **NOTED** document IOTC-2021-WPNT11-12 on an Assessment of Indian Ocean Frigate tuna (*Auxis thazard*) 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 a lack of reliable information on stock structure, abundance, and biological parameters. There has been no formal stock assessment conducted for frigate tuna (Auxis thazard). This paper provides an assessment for frigate tuna using data-limited techniques, namely the C-MSY approach (Froese et al.*

*2016) based on the most recent catch information, and a length-based method for estimation of spawning potential ratio (Hordyk et al. 2014) based on the available length composition data from the line fishery".*

66. The WPNT **NOTED** that the life history parameters used to define the prior for the growth parameter (*r*) were derived from the literature review made in 2016 (IOTC-2016-WPNT06-DATA133) and a sensitivity C-MSY model run was also made over the use of a fixed range of *r* values available from FishBase assuming medium resilience (i.e., *r* in the range 0.2-0.8 for frigate tuna)

67. The WPNT **NOTED** that the two exploratory assessments conducted for frigate tuna with C-MSY and LB-SPR both suggested that the stock is not overfished and is not subject to overfishing.

68. The WPNT **NOTED** with concern that the overall quality of the total catches of frigate tuna is very low as a large part of the historical catches have been fully re-estimated and less than 30% of the total catches have been fully or partially reported to the Secretariat in recent years, with all catches from Indonesian coastal fisheries being estimated based on methodology that mostly relies on data collected in the 2000s.

69. The WPNT **NOTED** that although the additional LB-SPR analysis using the recent length composition data from the line fishery provided a similar estimate of depletion for frigate tuna to the C-MSY model, the results from the C-MSY and LB-SPR methods are not directly comparable, as the latter is based on a per-recruit analysis, not a full population model.

***Bullet tuna***

70. The WPNT **NOTED** document IOTC-2021-WPNT11-13 on an Assessment of Indian Ocean Bullet tuna (*Auxis rochei*) 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 a lack of reliable information on stock structure, abundance, and biological parameters. There has been no formal stock assessment conducted for bullet tuna (Auxis rochei). using data-limited methods (Martin & Sharma 2015). This paper provides an assessment for bullet tuna using data-limited techniques, namely the C-MSY approach (Froese et al. 2016) based on the most recent catch information, and a length-based method for estimation of spawning potential ratio (Hordyk et al. 2014) based on the available length composition data from the line fishery".*

71. The WPNT **NOTED** that the two exploratory assessments conducted for bullet tuna with C-MSY and LB-SPR both suggested that the stock would be subject to overfishing and overfished in 2019.

72. As for Indo-Pacific king mackerel and frigate tuna, the WPNT **NOTED** that the stock status estimated with C-MSY was found to be in worse state when assuming a medium range of resilience.

73. The WPNT **NOTED** that the LB-SPR approach was based on length samples collected from the gillnet fishery for 2016 and 2017 that were assumed to have been collected in a consistent way and be of reasonable quality.

74. The WPNT **NOTED** that the selectivity of gillnet might be dome-shaped, which is not recommended for the LB-SPR approach, but that this may have a small impact on the results as the species is described by a high M/K ratio.

75. The WPNT **NOTED** that the stock status estimated for 2019 (i.e. overfished and subject to overfishing) was mainly driven by the dramatic increase in catches of bullet tuna which doubled from about 15,000 t in 2017 to about 33,000 t in 2018.

76. The WPNT **NOTED** that bullet tuna has been mostly caught by India and Indonesia since the 1950s and that there are major uncertainties associated with the catches of the coastal fisheries of these two CPCs which have been estimated for most years following a procedure developed in the early 2010s in collaboration with the CPCs and endorsed by the SC.

77. The WPNT further **NOTED** that the sharp increase in catches of bullet tuna observed in 2018 is due to the catches of about 16,500 t reported for the industrial component of the Indonesian purse seine fishery for this year while this fishery only reported about 2,000 t of bullet tuna in 2017, **NOTING** that this more than sevenfold increase cannot be fully explained by the increase in the number of large purse seiners (>24 m) reported by Indonesia through the Active Vessel List from 31 in 2017 to 65 in 2018.

78. The WPNT **NOTED** a suggestion for possible inclusion of the fishing effort in the catch-only model to add another dimension to increase the power of the model for estimating stock productivity. This is equivalent to

an extension of the catch-only model to a full biomass dynamic model fitting to the CPUE index. The WPNT **NOTED** an analysis done during the 2020 WPNT meeting which examined models that have Incorporated CPUE indices developed from Iranian gillnet fishery for a number of neritic tuna species. The development of standardised CPUE indices from main neritic tuna fisheries are currently considered a top priority in the WPNT Program of Work.

### *6.2 Capacity Building demonstration on neritic tuna assessments using a data poor method*

79. The WPNT **NOTED** that a step-by-step demonstration of the catch-only method using the actual data will be provided via a video tutorial by the SC Chair, which shall be made available on the WPNT meeting website to allow participants to gain hands-on experience of running the model. The WPNT **ENCOURAGED** the scientists who will attend the WPNT12 next year to bring their own datasets to conduct analyses on their own data.

### *6.3 Stock status indicators for other neritic tuna species*

80. The WPNT extensively discussed the assessment models presented and **NOTED** that these models are generally consistent in their estimates of stock status despite different assumptions on underlying dynamics and datasets being used. The WPNT further **NOTED** that the catch-only model has provided a more defensible approach in addressing the uncertainty of key parameters and is able to provide an estimate of MSY that is relatively robust to input parameters. Therefore, the WPNT **AGREED** that the results of the catch-only model should be used for providing management advice.

81. The WPNT however **NOTED** that the catch-only method requires an accurate and complete time series of historical catches, and that although the estimates of some stock indicators are not sensitive to constant bias in the catch data, estimates of stock status and management quantities can be severely biased if there are temporal trends in the catch errors. The WPNT carefully examined and discussed the quality of catch data for the three neritic tuna species being assessed, and concluded that the currently available catch data for the Indo-Pacific king mackerel appears to be of sufficient quality, whereas the catch data for frigate and bullet tuna are more uncertain given the high percentage of the catches that had to be estimated due to a range of reporting issues. As such, the WPNT **AGREED** that the catch-only model should be used to quantify the stock status of Indo-Pacific king mackerel only, and the status of frigate tuna and bullet tuna remain undetermined.

82. The WPNT **NOTED** that the application of LB-SPR to the three neritic tuna species demonstrates the potential of using length-based approach to estimate useful biological reference points (e.g. SPR), by utilizing life history parameters and historical length samples, although the robustness of the method to underlying assumptions (e.g. constant recruitment) needs to be further investigated. The WPNT **AGREED** that LB-SPR would be a useful supplement to the catch-only method to provide a cost-effective tool for assessing the status of IOTC neritic tuna stocks in the future.

### *6.4 Development of management advice for neritic tuna species*

83. The WPNT **ADOPTED** the management advice developed for Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix XI, frigate tuna (*Auxis thazard*) - Appendix VIII, and bullet tuna (*Auxis rochei*) – Appendix VII as provided in the draft resource stock status summary (the stock status of frigate tuna and bullet tuna remained to be undermined), and **REQUESTED** that the IOTC Secretariat update the draft stock status summary for the three species with the latest 2019 catch data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration.

## 7. Program of Work (Research and Priorities)

### *7.1 Revision of the WPNT Program of Work 2022–2026*

84. The WPNT **NOTED** paper IOTC-2021-WPNT11-08 on Revision of the WPNT Program of Work (2022-2026).

85. 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:

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

86. The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2022–2026), as provided in Appendix VI.

### *7.2 Development of priorities for an Invited Expert at the next WPNT meeting*

87. The WPNT **NOTED** that due to the postponement of stock assessments for the remaining three neritic tuna species, these would be addressed in 2021. Therefore, 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 2021, by an Invited Expert:

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

## 8. OTHER BUSINESS

### *8.1 Election of a Chairperson and a Vice-Chairperson of the WPNT for the next biennium*

***Chairperson***

88. The WPNT **NOTED** that the first term of the current Chairperson, Ms Ririk Sulistyaningsih (Indonesia) expired at the close of the WPNT11 meeting and, as per the IOTC Rules of Procedure (2014), participants are required to elected a new Chairperson of the WPNT for the next biennium.

89. NOTING the Rules of Procedure (2014), the WPNT **CALLED** for nominations for the position of Chairperson of the IOTC WPNT for the next biennium. Ms Sulistyaningsih was nominated, seconded and re-elected as Chairperson of the WPNT for the next biennium.

***Vice-Chairperson***

90. The WPNT **NOTED** that the first term of the current Vice-Chairperson, Dr Farhad Kaymaram (Iran) expired at the close of the WPNT11 meeting and, as per the IOTC Rules of Procedure (2014), participants are required to elected a new Vice-Chairperson of the WPNT for the next biennium.

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

### *8.2 Review of the draft, and adoption of the Report of the 11th Working Party on Neritic Tunas*

92. The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT11, 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 2021 (10):
    - Bullet tuna (*Auxis rochei*) – Appendix VII
    - Frigate tuna (*Auxis thazard*) – Appendix VIII
    - Kawakawa (*Euthynnus affinis*) – Appendix IX
    - Longtail tuna (*Thunnus tonggol*) – Appendix X
    - Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix XI
    - Narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix XII

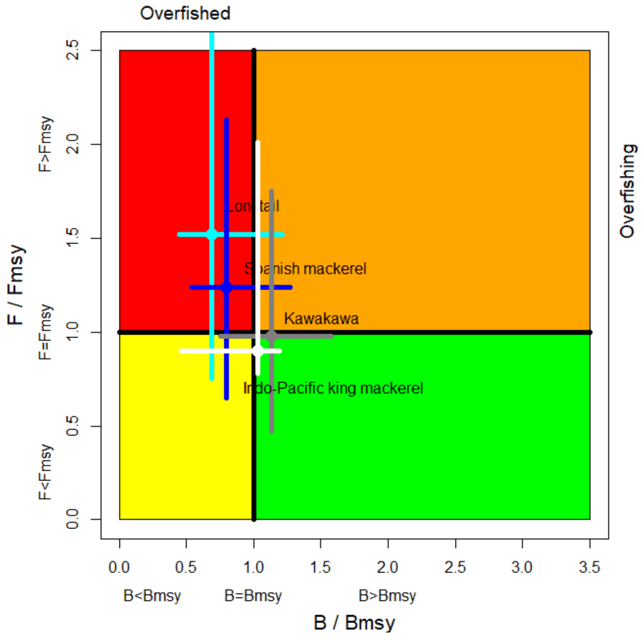


**Fig. 10.** Combined Kobe plot for longtail tuna (2018), narrow-barred Spanish mackerel (2018), kawakawa (2018) and Indo-Pacific king mackerel (2019), showing the estimates of stock size (B) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs.

93. The report of the 11th Session of the Working Party on Neritic Tunas (IOTC–2021–WPNT11–R) was **ADOPTED** by correspondence.

# APPENDIX I
# LIST OF PARTICIPANTS

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# APPENDIX II
## AGENDA FOR THE 11TH WORKING PARTY ON NERITIC TUNAS

**Date:** 5–9 July 2021
**Location:** Online
**Venue:** NA
**Time:** 12:00 – 16:00 daily (Seychelles time)
**Chair**: Ms Ririk Sulistyaningsih; **Vice-Chair**: Dr Farhad Kaymaram

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

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

3. **THE IOTC PROCESS: OUTCOMES, UPDATES AND PROGRESS**
   - 3.1 Outcomes of the 23rd Session of the Scientific Committee (IOTC Secretariat)
   - 3.2 Outcomes of the 24th and 25th Sessions of the Commission (IOTC Secretariat)
   - 3.3 Review of Conservation and Management Measures relevant to neritic tunas (IOTC Secretariat)
   - 3.4 Progress on the recommendations of WPNT10 (IOTC Secretariat)

4. **NEW INFORMATION ON FISHERIES AND ASSOCIATED ENVIRONMENTAL DATA FOR NERITIC TUNAS**
   - 4.1 Review of the statistical data available for neritic tunas (IOTC Secretariat)
   - 4.2 Review new information on fisheries and associated environmental data (general CPC papers)

5. **NERITIC TUNA SPECIES – REVIEW OF NEW INFORMATION ON STOCK STATUS**
   - 5.1 Review new information on the biology, stock structure, fisheries and associated environmental data (all)
   - 5.2 Data for input into stock assessments (all)

6. **STOCK ASSESSMENT UPDATES**
   - 6.1 Stock Assessments
     - Indo-Pacific king mackerel (*Scomberomorus guttatus*)
     - Frigate tuna (*Auxis thazard*)
     - Bullet tuna (*Auxis rochei*)
   - 6.2 Capacity Building demonstration on neritic tuna assessments using a data poor method (SC Chair)
   - 6.3 Stock status indicators for other neritic tuna species (all)
   - 6.4 Development of management advice for neritic tuna species (all)

7. **PROGRAM OF WORK (RESEARCH AND PRIORITES)**
   - 7.1 Revision of the WPNT Program of Work 2022–2026 (Chair)
   - 7.2 Development of priorities for an Invited Expert at the next WPNT meeting

8. **OTHER BUSINESS**
   - 8.1 Election of a Chairperson and a Vice-Chairperson of the WPNT for the next biennium (Secretariat)
   - 8.2 Review of the draft, and adoption of the Report of the 11th Working Party on Neritic Tunas (Chair)

# APPENDIX III

## LIST OF DOCUMENTS

| Document | Title |
|---|---|
| IOTC–2021–WPNT11–01a | Draft: Agenda of the 11th Working Party on Neritic Tunas |
| IOTC–2021–WPNT11–01b | Annotated agenda of the 11th Working Party on Neritic Tunas |
| IOTC–2021–WPNT11–02 | List of documents of the 11th Working Party on Neritic Tunas |
| IOTC–2021–WPNT11–03 | Outcomes of the 23rd Session of the Scientific Committee (IOTC Secretariat) |
| IOTC–2021–WPNT11–04 | Outcomes of the 24th Session of the Commission (IOTC Secretariat) |
| IOTC–2021–WPNT11–05 | Review of current Conservation and Management Measures relating to neritic tuna species (IOTC Secretariat) |
| IOTC–2021–WPNT11–06 | Progress made on the recommendations and requests of WPNT10 and SC23 (IOTC Secretariat) |
| IOTC–2021–WPNT11-07 | Review of the statistical data available for the neritic tuna species (IOTC Secretariat) |
| IOTC–2021–WPNT11–08 | Revision of the WPNT Program of Work (2022–2026) (IOTC Secretariat) |
| IOTC–2021–WPNT11–09 | Fishery and stock status of neritic tunas and allied resources in the Indian coastal waters (Abdussamad E M, Prathibha R, Margaret A M R, Jayasankar J, Mini K G, Ghosh S, Rajesh K M, Anulekshmi C, Surya S, Azeez P A, and Vinodhkumar R) |
| IOTC–2021–WPNT11–10 | Declining Neritic Tuna Landings in Pakistan-Causes and Impact on Fishing Effort and Marketing (Moazzam M) |
| IOTC–2021–WPNT11–11 | Assessment of Indian Ocean Indo-Pacific King Mackerel (*Scomberomorus guttatus*) using data-limited methods (Fu D) |
| IOTC–2021–WPNT11–12 | Assessment of Indian Ocean Frigate tuna (*Auxis thazard*) using data-limited methods (Fu D) |
| IOTC–2021–WPNT11–13 | Assessment of Indian Ocean Bullet tuna (*Auxis rochei*) using data-limited methods (Fu D) |
| IOTC–2021–WPNT11–14 | Length-length and Length-weight relationship of bullet tuna (*Auxis rochei*) and frigate tuna (*Auxis thazard*) from the coastal of west Sumatra, Indonesia (Tampubolon PA, Sulistyaningsih RK, Agustina M) |
| IOTC–2021–WPNT11–INF01 | Stock and Risk Assessments of Kawakawa (*Euthynnus affinis*) and Longtail Tuna (*Thunnus tonggol*) Resources in the Southeast Asian Waters Using ASPIC |

# APPENDIX IV
## STATISTICS FOR NERITIC TUNAS AND SEERFISH

*Extract from IOTC–2021–WPNT11–07*

- The total nominal catches of the IOTC neritic tuna and seerfish species showed a major increase over the last decades, from less than 30,000 t per year in the 1950s to more than 620,000 t per year in the 2010s. Neritic species are caught mainly using drifting gillnets and purse seine nets in coastal waters – although some species are also caught using troll lines, hand lines, coastal longlines or other gears both in coastal waters and on the high seas (**Fig. A1**).
- Following a period of steady increase in catches for almost seven decades and a maximum nominal catch at about 637,000 t in 2016, the cumulative catches of the six IOTC neritic tuna and seerfish have started to show a decline in recent years (**Fig. A1**). This decrease which concerns longtail tuna, and frigate tuna and narrow-barred Spanish mackerel to a lesser extent, is essentially driven by the reduction of the catches of Pakistani gillnetters since 2017, in relation with an extended fishing closure, volatility in sale price and reduced demand from the Iranian market, and poor environmental conditions that prevailed in 2019
- In recent years (2015-2019), total nominal catches of the IOTC neritic tuna and seerfish species were about 620,000 t per year, with gillnet, line, and purse seine fisheries contributing to 57%, 18%, and 14% of all catches, respectively.
- Between 2015 and 2019, the mean annual catches of the IOTC neritic tunas and seerfish have been dominated by a few CPCs, to the point that almost 70% of all catches was accounted for by three distinct fleets: Indonesia and India which are characterized by a large diversity of coastal gears and fisheries and I.R. Iran where gillnet represents the very large majority of the catches (**Fig. A2**).
- The total amount of neritic tuna and seerfish species discarded at sea remains unknown for most fisheries and time periods despite the obligation to report these data as per IOTC Res. 15/02. Overall, discarding is considered to be limited in coastal fisheries targeting neritic tunas and seerfish where there is a demand from canneries and local markets. By contrast, discarding has been found to be common in industrial fisheries that target tropical tunas and billfish but the bycatch volumes, which are seldom recorded in the logbooks nor monitored in ports, are suspected to be small.
- For most of the major fisheries reporting catches of neritic species in the Indian Ocean except for I. R. Iran, catch-and-effort data are not available or only available for a very limited time frame. In particular, Indonesia and India have accounted for around half of the total catches of neritic species in the Indian Ocean in recent years while little information is available on the distribution of catch and effort for all their fisheries.

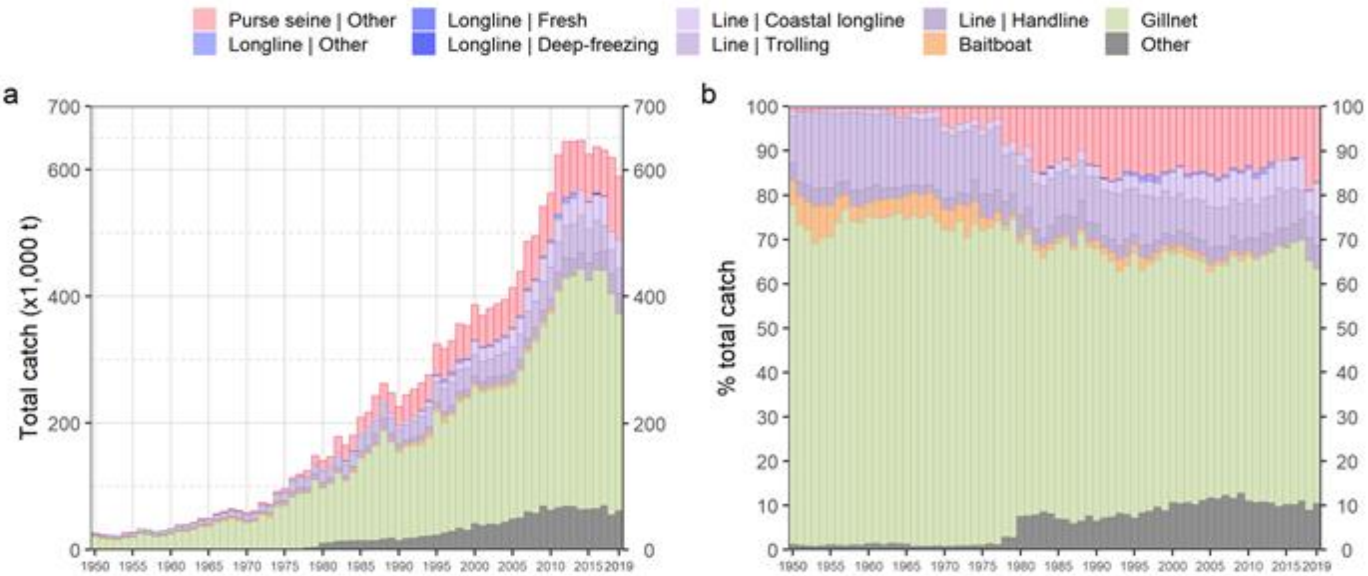


**Fig. A1.** Annual time series of cumulative nominal absolute (a) and relative (b) catches of IOTC neritic tunas and seerfish in metric tons (t) by fishery for the period 1950-2019

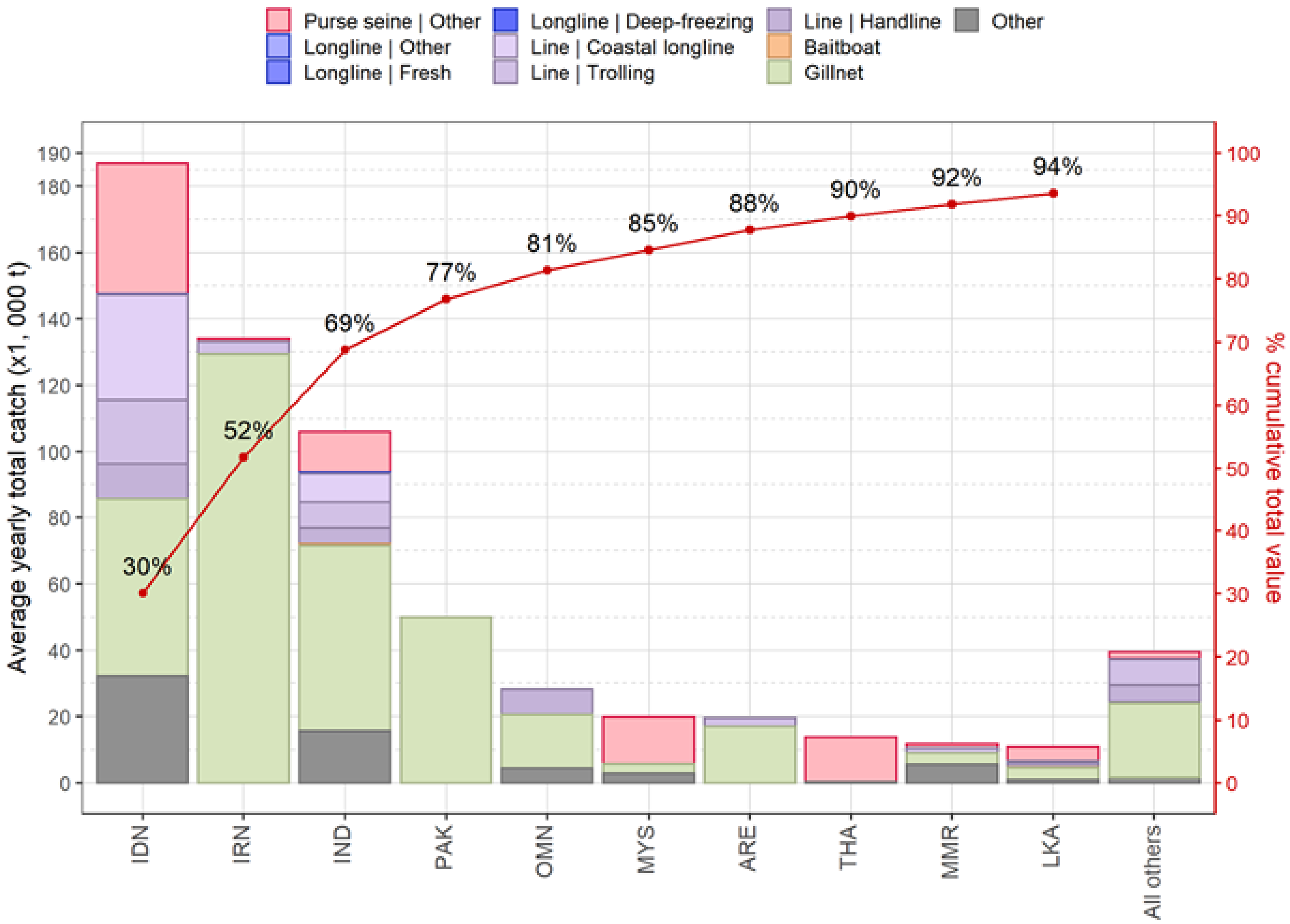


**Fig. A2**. Mean annual catches of the IOTC neritic tunas and seerfish by fleet and fishery in metric tons (t) between 2015 and 2019, with indication of cumulative catches by fleet

# APPENDIX IVA
# MAIN STATISTICS FOR BULLET TUNA (*AUXIS ROCHEI*)

- The total nominal catches of bullet tuna showed a major increase over the last seven decades, from less than 1,000 t per year prior to the 1970s to about 15,000 t per year in the 2010s. Bullet tuna are mainly caught using purse seine nets, drifting gillnets, and troll lines, mostly in coastal waters (**Fig. A3**).
- In recent years (2015-2019), total nominal catches of bullet tuna were about 19,000 t per year, with purse seine, line, and gillnet fisheries contributing to about 49%, 26%, and 17% of all catches, respectively (**Fig. A3**).
- Between 2015 and 2019, the mean annual catches of bullet tuna have been dominated by a few CPCs, to the point that about 75% of all catches was accounted for by two distinct fleets: India (41%) and Indonesia (34%) which are characterized by a large diversity of fisheries (**Fig. A4**).
- There are large uncertainties associated with the nominal catches of bullet tuna. A substantial part of the nominal catches is derived from alternative sources of catch data for the CPCs and non-members of the IOTC that do not report data to the Secretariat. In addition, a re-estimation process is performed for the artisanal fisheries of India and Indonesia which are considered to be of low quality and reported in some cases with gear aggregates (**Fig. A5**).
- In recent years, the development of the industrial purse seine fishery of Indonesia targeting neritic tuna resulted in an increase of reported catches of bullet tuna that showed a sharp increase from a few hundred tons to more than 16,000 t between 2017 and 2018, and a decrease to about 5,600 t in 2019. However, the accuracy of the catch data for this fishery is questionable with regards to the outstanding issues in the data collection and reporting systems in place (e.g. misidentification of tuna species) which is evidenced by the massive volatility of catch statistics by species reported by Indonesia.

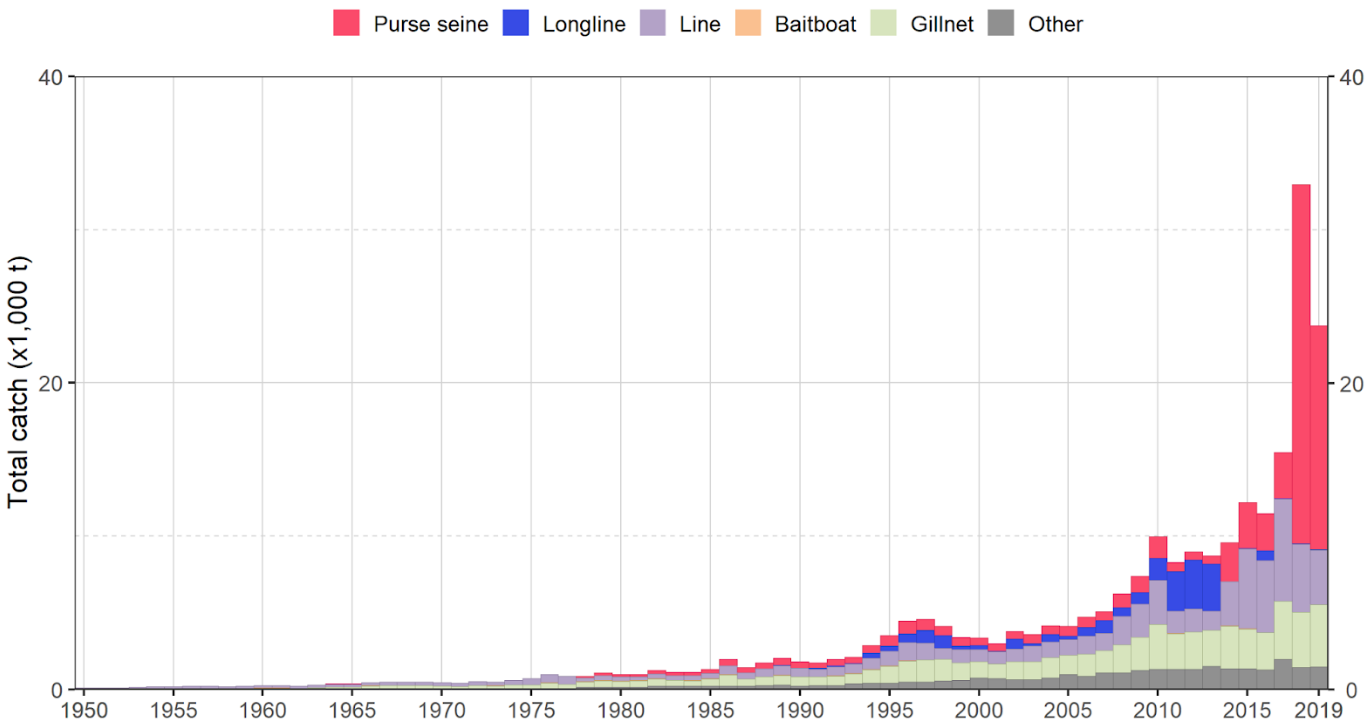


**Fig. A3**. Annual time series of cumulative nominal catches of bullet tuna in metric tons (t) by fishery group for the period 1950-2019

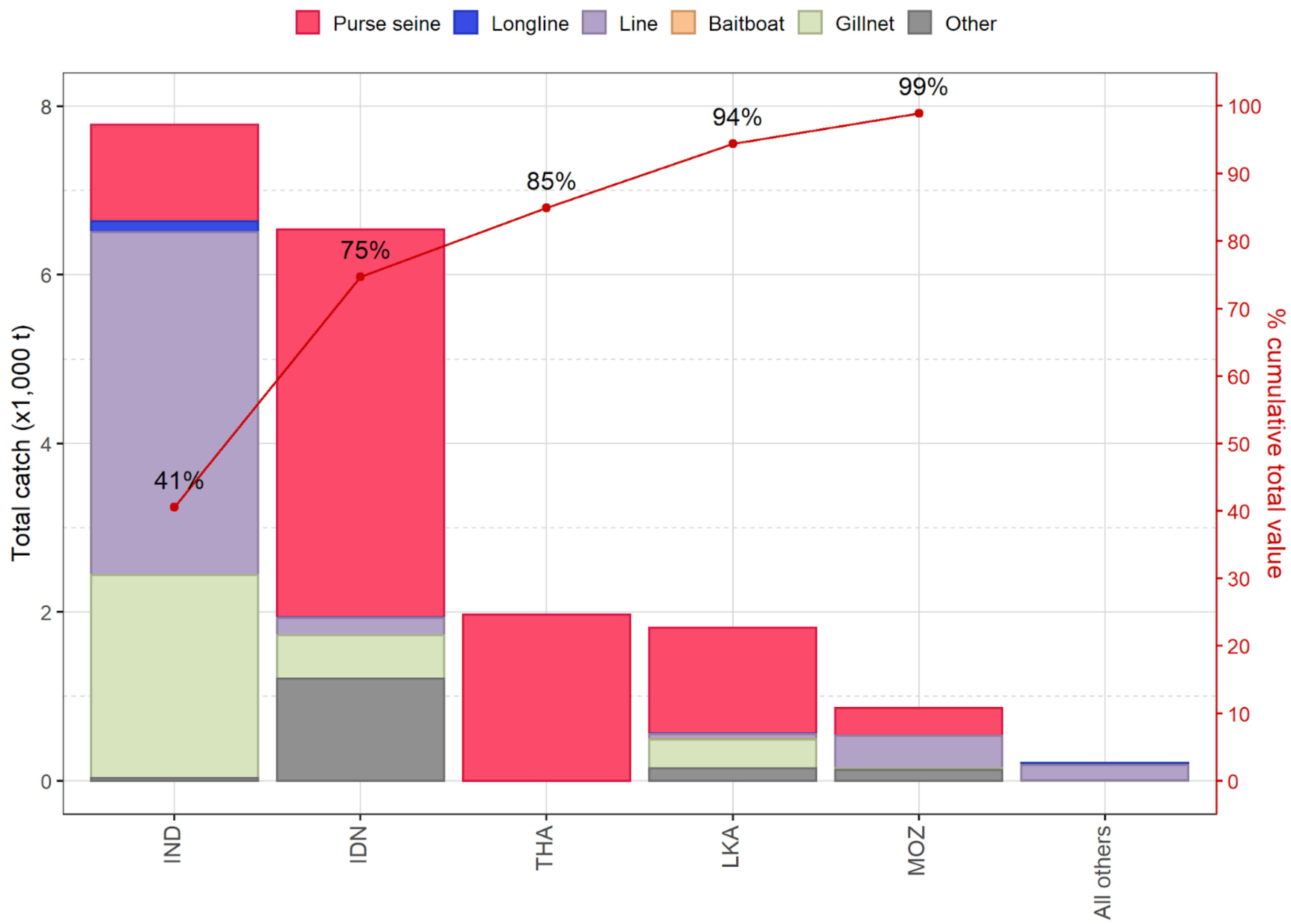


**Fig. A4**. Mean annual nominal catches of bullet tuna by fleet and fishery in metric tons (t) between 2015 and 2019, with indication of cumulative catches by fleet

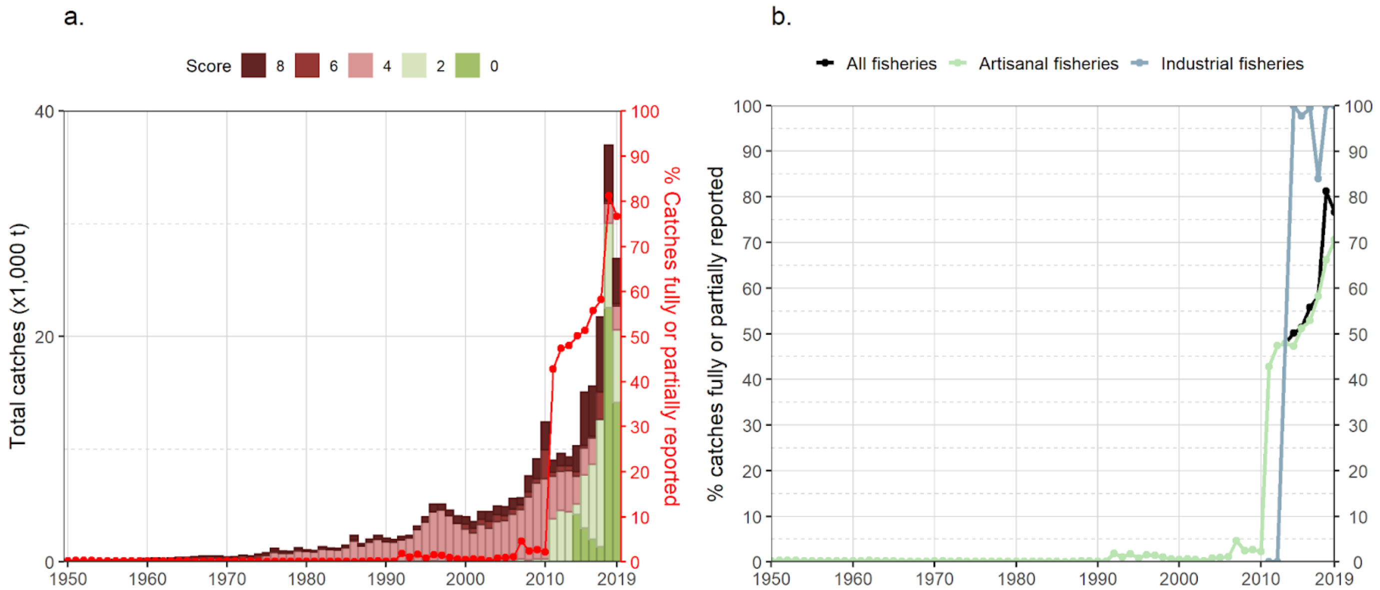


**Fig. A5**. Annual nominal catches of bullet tuna in metric tons (t) estimated by quality score (barplot) and percentage of nominal catch fully/partially reported to the IOTC Secretariat (lines with dots) for all fisheries (a) and by type of fishery (b), in the period 1950–2019

# APPENDIX IVB
# MAIN STATISTICS FOR FRIGATE TUNA (*AUXIS THAZARD*)

- The total nominal catches of frigate tuna showed a major increase over the last seven decades, from less than 10,000 t per year prior to the mid-1970s to about 100,000 t per year in the 2010s. Frigate tuna are mainly caught using coastal longline, troll lines and gillnets, and purse seine nets to a lesser extent (**Fig. A6**).
- In recent years (2015-2019), total nominal catches of frigate tuna were larger than 95,000 t per year, with gillnet and coastal longline fisheries contributing to 40% and 23% of all catches, respectively (**Fig. A6**).
- Between 2015 and 2019, the mean annual catches of frigate tuna have been dominated by a few CPCs, to the point that more than 80% of all catches was accounted for by three distinct fleets: Indonesia (60%), Pakistan (13%), and I. R. Iran (10%) (**Fig. A7**).
- There are large uncertainties associated with the nominal catches of frigate tuna. A substantial part of the nominal catches is derived from alternative sources of catch data for the CPCs and non-members of the IOTC that do not report data to the Secretariat. In addition, a re-estimation process is performed for the artisanal fisheries of Indonesia and India which are considered to be of low quality and reported in some cases with gear aggregates.
- Although the quality of data reporting has improved over the last decade, the proportion of total catches fully or partially reported to the Secretariat was still less than 40% in recent years, a large part of the total retained catches being derived from ratios of catch proportions fixed for all coastal Indonesian fisheries and derived from data collected during 2003-2011 (**Fig. A8**).

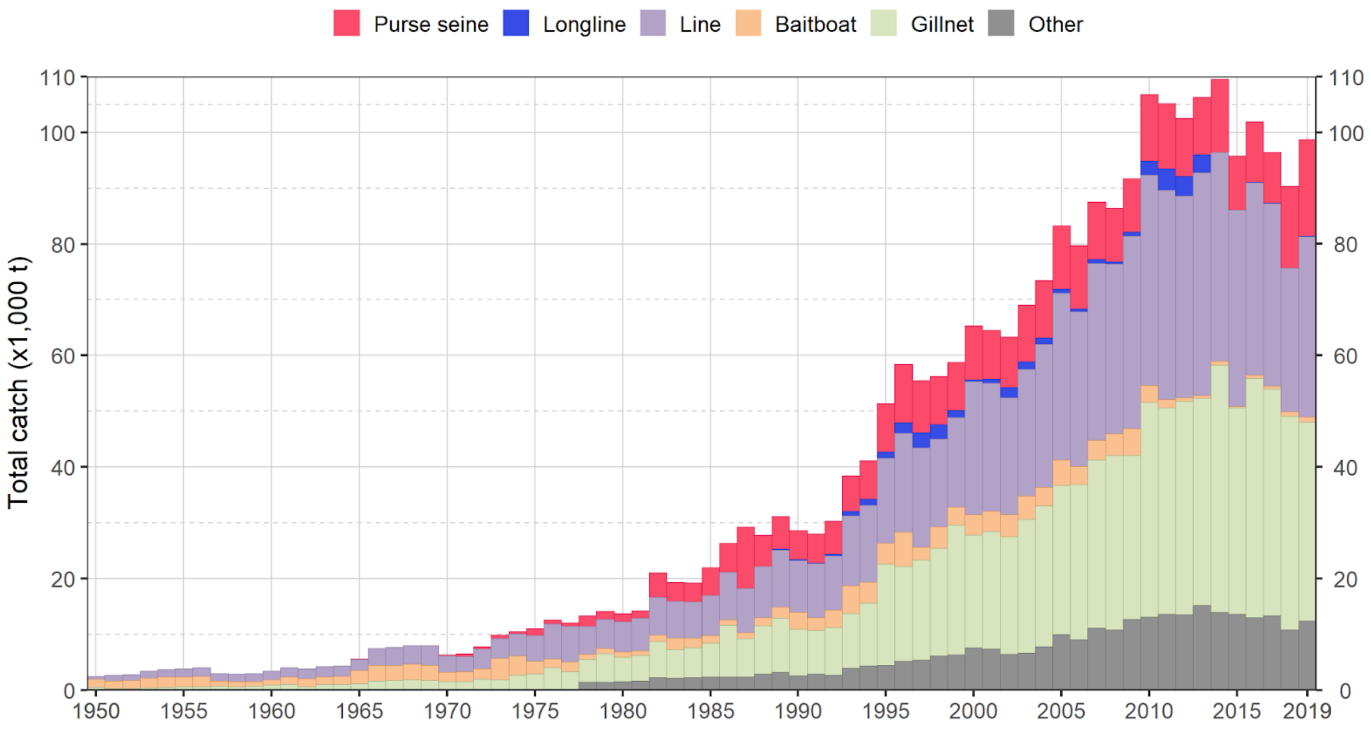


**Fig. A6**. Annual time series of cumulative nominal catches of frigate tuna in metric tons (t) by fishery group for the period 1950-2019

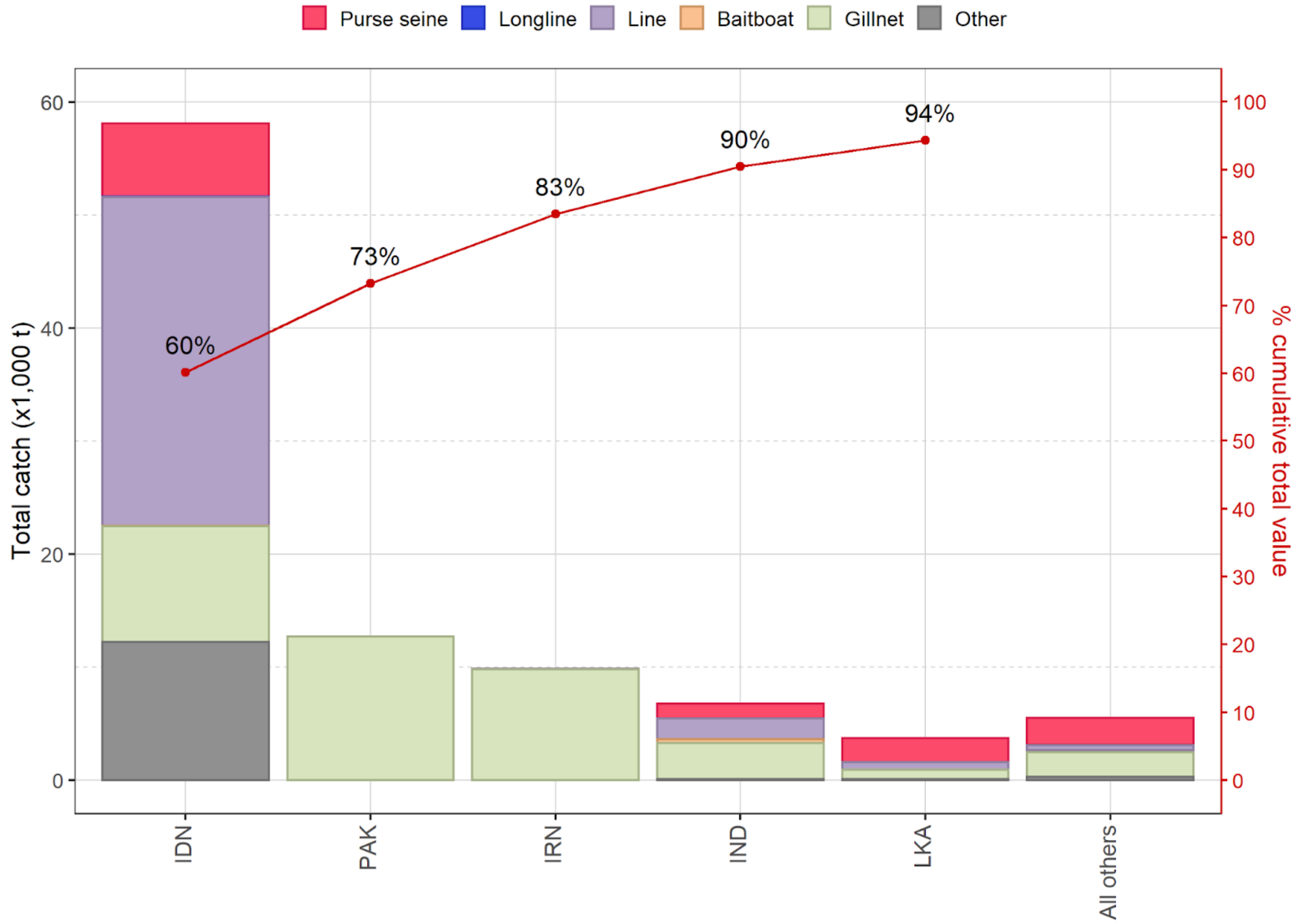


**Fig. A7**. Mean annual nominal catches of frigate tuna by fleet and fishery in metric tons (t) between 2015 and 2019, with indication of cumulative catches by fleet

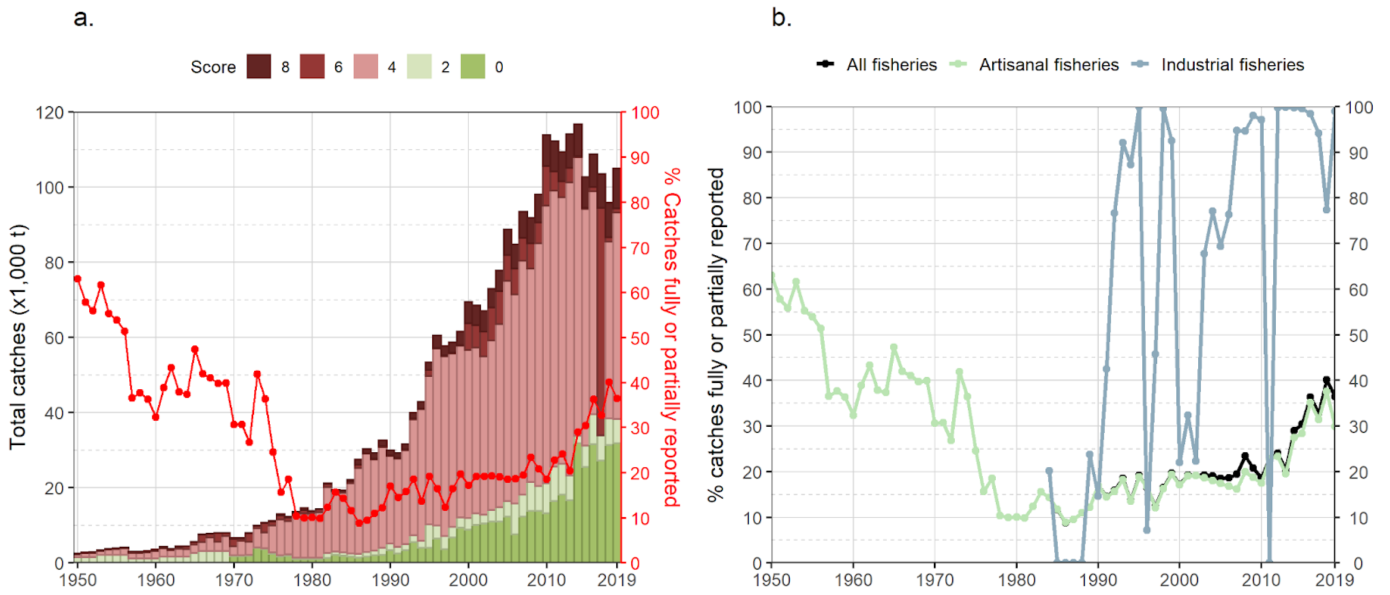


**Fig. A8**. Annual nominal catches of frigate tuna in metric tons (t) estimated by quality score (barplot) and percentage of nominal catch fully/partially reported to the IOTC Secretariat (lines with dots) for all fisheries (a) and by type of fishery (b), in the period 1950–2019

## APPENDIX IVC
## MAIN STATISTICS FOR INDO-PACIFIC KING MACKEREL (*SCOMBEROMORUS GUTTATUS*)

- The total nominal catches of Indo-Pacific king mackerel showed a major increase over the last seven decades, from less than 10,000 t per year prior to the mid-1970s to about 45,000 t per year in the 2010s. Indo-Pacific king mackerel are mainly caught using coastal longline, troll lines and gillnets, and purse seine nets to a lesser extent (**Fig. A9**).
- In recent years (2015-2019), total nominal catches of Indo-Pacific king mackerel were larger than 45,000 t per year, with gillnet contributing to two-thirds of all catches (**Fig. A9**).
- Between 2015 and 2019, the mean annual catches of Indo-Pacific king mackerel have been dominated by a few CPCs, to the point that more than 80% of all catches was accounted for by three distinct fleets: India (37%), Indonesia (28%), and I. R. Iran (19%) (**Fig. A10**).
- There are large uncertainties associated with the nominal catches of Indo-Pacific king mackerel. A substantial part of the nominal catches is derived from alternative sources of catch data for the CPCs and non-members of the IOTC that do not report data to the Secretariat. In addition, a re-estimation process is performed for the artisanal fisheries of India and Indonesia which are considered to be of low quality and reported in some cases with gear aggregates.
- Although the quality of data reporting has improved over the last decade, the proportion of total catches fully or partially reported to the Secretariat was still less than 65% in recent years, a part of the total retained catches being derived from ratios of catch proportions fixed for all coastal Indonesian fisheries and derived from data collected during 2003-2011 (**Fig. A11**).

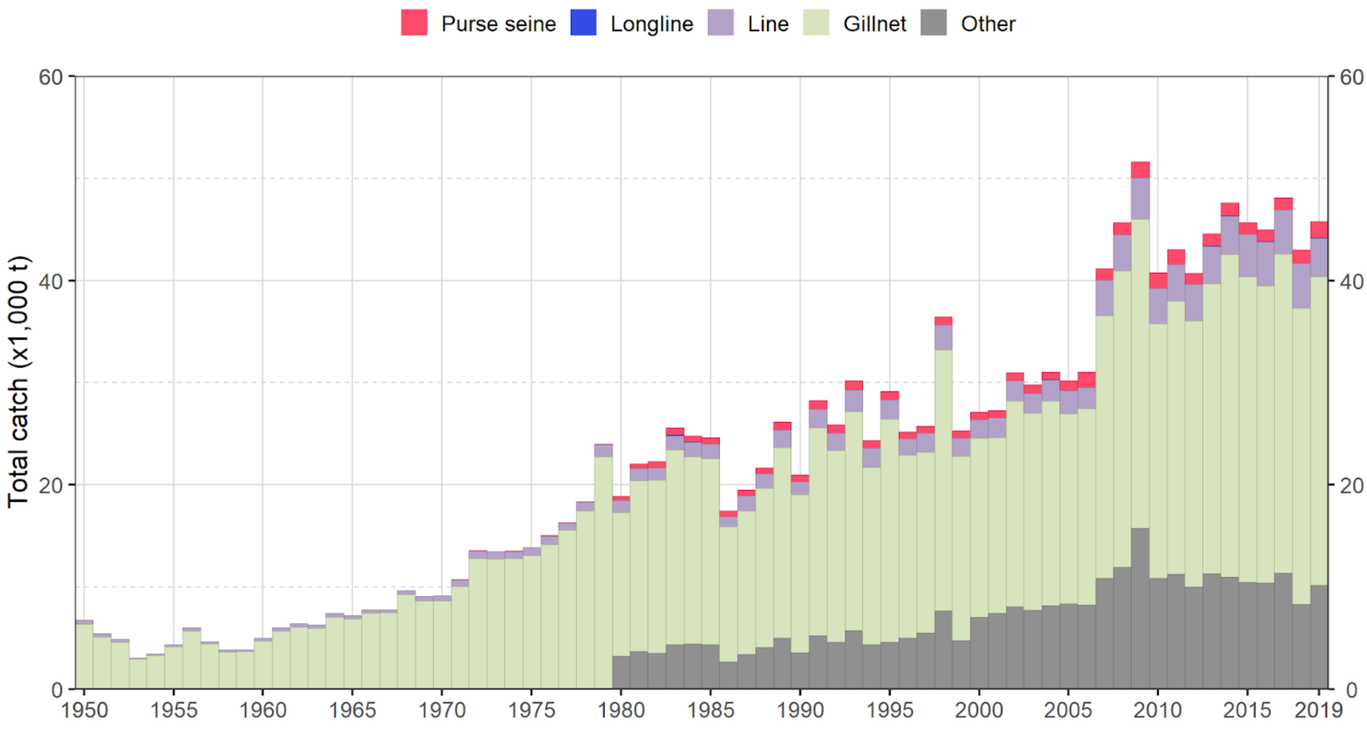


**Fig. A9**. Annual time series of cumulative nominal catches of Indo-Pacific king mackerel in metric tons (t) by fishery group for the period 1950-2019

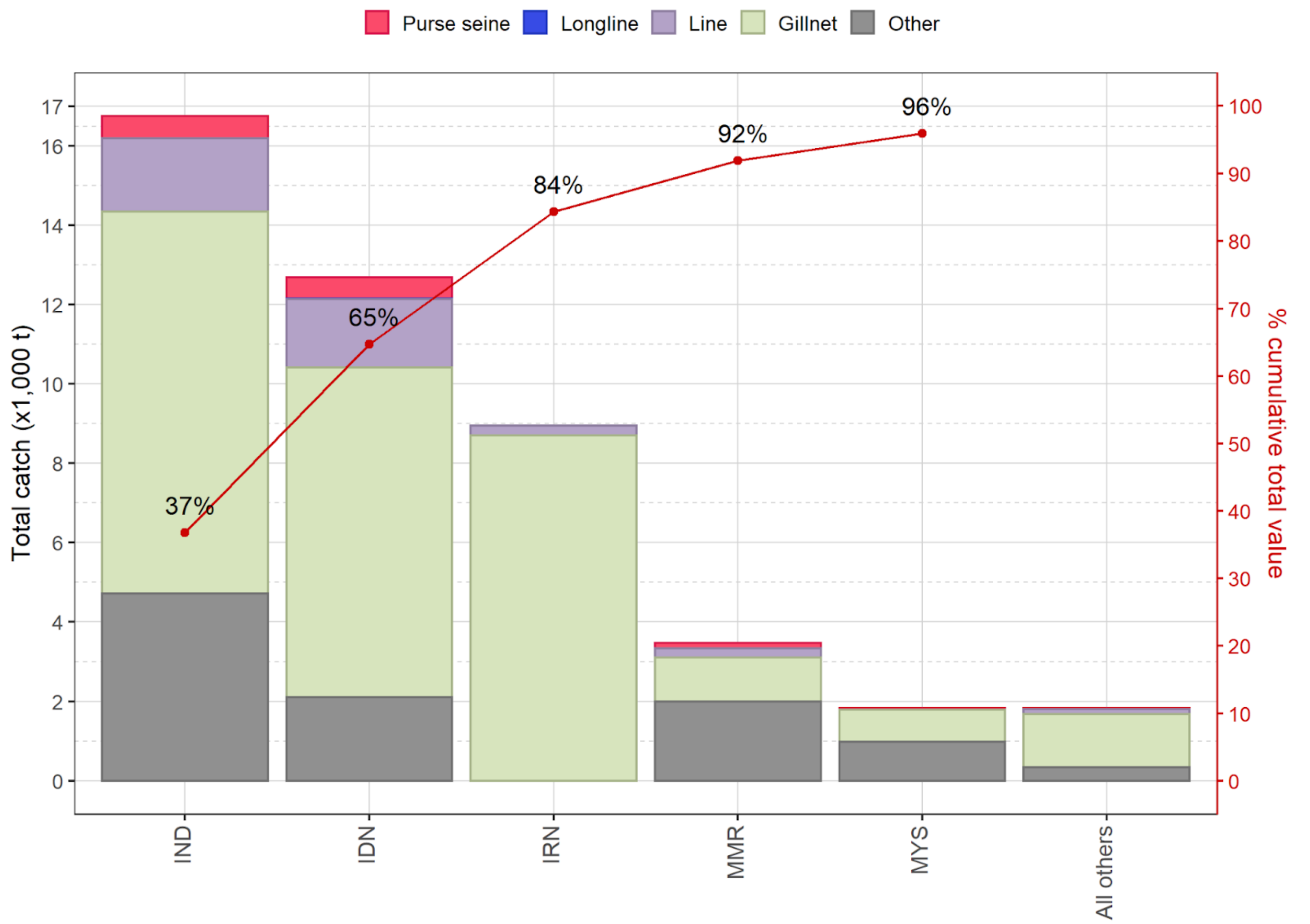


**Fig. A10**. Mean annual nominal catches of Indo-Pacific king mackerel by fleet and fishery in metric tons (t) between 2015 and 2019, with indication of cumulative catches by fleet

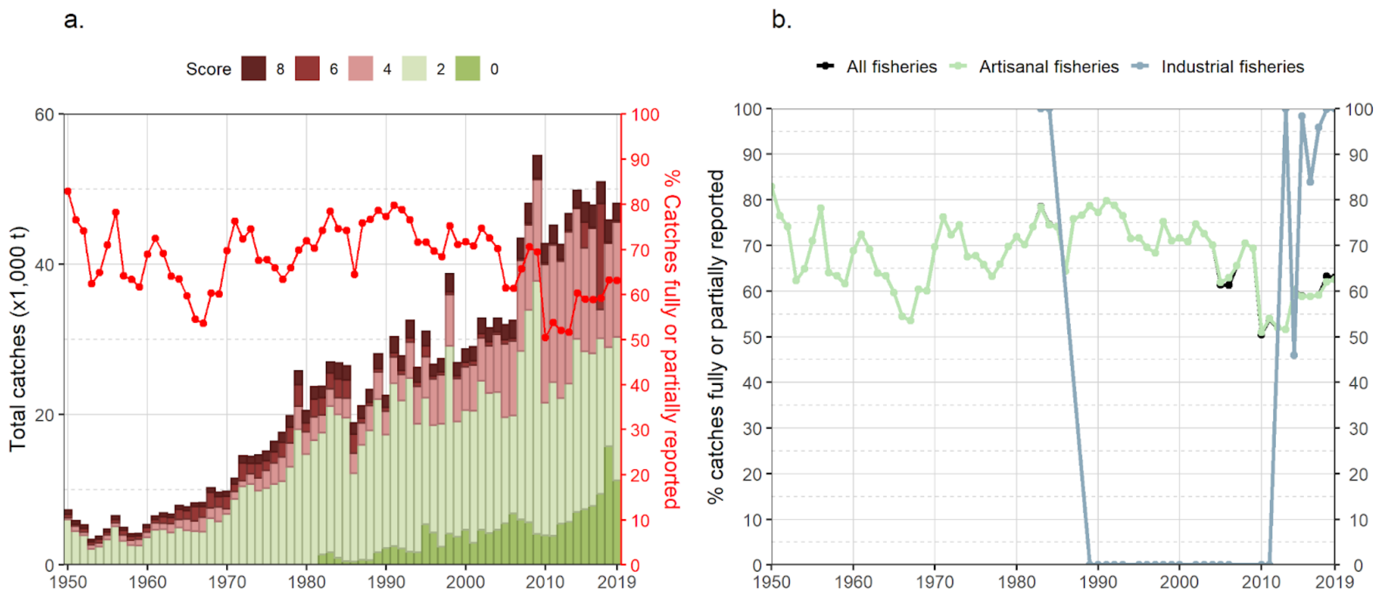


**Fig. A11**. Annual nominal catches of Indo-Pacific king mackerel in metric tons (t) estimated by quality score (barplot) and percentage of nominal catch fully/partially reported to the IOTC Secretariat (lines with dots) for all fisheries (a) and by type of fishery (b), in the period 1950–2019

# APPENDIX V

## MAIN ISSUES IDENTIFIED RELATING TO THE STATISTICS OF NERITIC TUNAS

| Data type(s) | Fisheries | Issue | Progress |
|---|---|---|---|
| Nominal catch, catch-and-effort, size data | Coastal fisheries of Madagascar, Myanmar, and Yemen | Non-reporting countries<br>Catches of neritic tunas and seerfish for these fisheries have been entirely estimated by the IOTC Secretariat in recent years – however the quality of estimates is thought to be poor due to a lack of reliable information on the fisheries operating in these countries | • Madagascar: a new sampling programme has been put in place in Madagascar since 2017. The country submitted nominal catch, catch and effort and size data for the years 2017 and 2018. However, the sampling level is very low and the data does not cover all fishing regions: for this reason, the information is still pending incorporation in the IOTC database as it cannot be adequately raised by the Secretariat<br>• Myanmar (non-reporting, non-IOTC member): catch data for some years are based on estimates published by SEAFDEC and FAO<br>• 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<br>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:<br>• Nominal catches may have been partially allocated by gear and species by the IOTC Secretariat, where necessary.<br>• 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<br>• Indonesia: catch-and-effort and size data have been reported for coastal fisheries – albeit for a very small number of landing sites (i.e., less than 10) covered by the IOTC-OFCF pilot sampling project. Catch-and-effort data have been reported by Indonesia for several semi-industrial and coastal fisheries since 2019 (reference year 2018) but the coverage is very low (<5%)<br>• Kenya: Kenya has recently undertaken a Catch Assessment Survey to improve catch estimates for artisanal fisheries. With the help of IOTC Secretariat, Kenya reported catch-and-effort and size data for the coastal fisheries. However, there are inconsistencies in the species between the two datasets.<br>• 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.<br>• Oman: no size data have been submitted, although it is understood that some data have been collected. Biological information for some neritic species is known to have been collected in the past by national research institutions and could potentially be shared with the IOTC Secretariat. |

| | | | |
|---|---|---|---|
| | | | • Tanzania: following a compliance mission held in 2019 and liaison between a compliance expert and Tanzanian liaison officers, Tanzania managed to report catch-and-effort data for the different artisanal fisheries for the year 2019, although some key information is still missing. It is also still important to confirm if catches for Zanzibar are included in the reported data. |
| | Coastal fisheries of Indonesia, Malaysia, and Thailand | Reliability of catch estimates<br>A number of 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.<br>• Malaysia (catch-and-effort): issues regarding the reliability of catch-and-effort reported in recent years have been raised by the IOTC Secretariat and, to date, remain unresolved (e.g., large fluctuations in the nominal CPUE, and inconsistencies between different units of effort recorded in recent years). Data submitted for 2019 included two fishing regions, however Malaysia was unable to break down the catch and effort data by region. In 2020, the data were processed using one of the grid squares. Malaysia needs to revise the data for previous years and re-submit the time series. |
| Catch and effort, size data | (Offshore) Surface and longline fisheries: I.R. Iran and Pakistan | Non-reporting or partially-reported data<br>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.<br><br>• Pakistan – drifting gillnets: Update: In 2018 Pakistan began reporting 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 2003-2017.<br><br>Update: reporting coverage of the Regional Observer Scheme 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. |
| 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 purse seine fisheries during 2003–17.<br><br>Update: No update, although as reporting coverage of the Regional Observer Scheme 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.<br><br>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 (2022–2026)

The following is the Draft WPNT Program of Work (2022 to 2026) and is based on the specific requests of the Commission and Scientific Committee as well as topics identified during the WPNT10. 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** | | | | |
|---|---|---|---|---|---|---|
| | | **2022** | **2023** | **2024** | **2025** | **2026** |
| 1. CPUE standardisation | Develop standardised CPUE series for the main fisheries for longtail, kawakawa, Indo-Pacific King mackerel and Spanish mackerel in the Indian Ocean, with the aim of developing CPUE series for stock assessment purposes. | | | | | |
| | ➢ Sri Lanka (priority species: Frigate tuna, Kawakawa, bullet tuna) | | | | | |
| | ➢ Indonesia (priority species: Kawakawa, Bullet tuna, Frigate tuna) | | | | | |
| | ➢ Pakistan (priority species: Longtail tuna, Kawakawa, narrow-barred Spanish mackerel) | | | | | |
| | ➢ Iran gillnet CPUEs for all species | | | | | |
| | ➢ India available CPUEs to be provided to next assessment session | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Capacity building support for CPCs to develop standardised CPUEs for their fisheries | | | | | |
| 2. Stock assessment / Stock indicators | Explore alternative assessment approaches and develop improvements where necessary based on the data available to determine stock status for longtail tuna, kawakawa and Spanish mackerel | | | | | |
| | • The Weight-of-Evidence approach should be used to determine stock status, by building layers of partial evidence, such as CPUE indices combined with catch data, life-history parameters and yield-per recruit metrics, as well as the use of data poor assessment approaches (eg. CMSY, OCOM, LB-SPR, Risk based methods).<br>• Exploration of priors and how these can be quantifiably and transparently developed<br>• Take into consideration the outputs of genetic studies to investigate stock structure and regional differences in populations<br><br>Improve the presentation of management advice from different assessment approaches to better represent the uncertainty and improve communication between scientists and managers in the IOTC. | | | | | |
| 3. Data mining and collation | Collate and characterize operational level data for the main neritic tuna fisheries in the Indian Ocean to investigate their suitability to be used for developing standardised CPUE indices.<br>The following data should be collated and made available for collaborative analysis:<br>1) catch and effort by species and gear by landing site;<br>2) operational data: stratify this by vessel, month, and year for the development as an indicator of CPUE over time; and<br>3) operational data: collate other information on fishing techniques (i.e. area fished, gear specifics, depth, environmental condition (near shore, open ocean, etc.) and vessel size (length/horsepower)).<br>4) Reconstruction of historical catch by CPCs using recovered or captured information.<br>5) Re-estimation of historic catches (with consultation and consent of concerned CPCs) for assessment purposes (taking into account updated identification of uncertainties and knowledge of the history of the fisheries)<br><br>• (Data support missions to priority countries: India, Oman, Pakistan) | | | | | |

| Other Future Research Requirements | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4. Biological information (parameters for stock assessment) | Quantitative biological studies are necessary for all neritic tunas throughout their range to determine key biological parameters including age-at-maturity, and fecundity-at-age/length relationships, age-length keys, age and growth, longevity which will be fed into future stock assessments. Priorities for Bullet and Frigate tunas as well as Indo-Pacific King Mackerel. | | | | | | |
| 5. Social economic study | ➢ Undertake quantitative studies on socio-economic aspects of all neritic tunas throughout their range, to determine and explore other sources of data, such as but not limited to trade data from individual countries, nominal catch or other catch data on neritic tuna, information on important and significance of neritic for food security (animal protein), nutrition, contribution to national GDP. (priority countries, Indonesia, Iran, India, Malaysia, Thailand, Pakistan)<br>➢ Identify and utilise other sources of information, by engaging with other bodies such as SEAFDEC, SEAFO, RECOFI, BOBLME, SWIOFC, IOC, among others.<br>➢ Integrate or evaluate market support and recognition for neritic tuna (sub-regional markets) with a focus on data acquisition<br>➢ Explore alternate sources of data collection, including the rapid use of citizen science based approaches which are reliable and verified by the SC.<br>➢ Assess/scope/explore the significance and importance of neritic species for food security, nutrition and contribution to national GDP.<br>➢ 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.<br>➢ 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 2022-2026

| ***Working Party on Neritic Tunas*** | | | | | |
|---|---|---|---|---|---|
| **Species** | **2022**** | **2023*** | **2024*** | **2025**** | **2026*** |
| Bullet tuna | Data preparation | Data preparation | **Assessment** | Data preparation | Data preparation |
| Frigate tuna | Data preparation | Data preparation | **Assessment** | Data preparation | Data preparation |
| Indo-Pacific king mackerel | Data preparation | Data preparation | **Assessment** | Data preparation | Data preparation |
| Kawakawa | Data preparation | **Assessment** | Data preparation | Data preparation | **Assessment** |
| Longtail tuna | Data preparation | **Assessment** | Data preparation | Data preparation | **Assessment** |
| Narrow-barred Spanish mackerel | Data preparation | **Assessment** | Data preparation | 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

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi

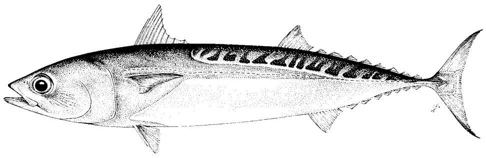

**TABLE 1.** Bullet tuna: Status of bullet tuna (*Auxis rochei*) in the Indian Ocean.

| Area[1] | Indicators | | 2021 stock status determination |
|---|---|---|---|
| Indian Ocean | Catch 2019[2] (t)<br>Average catch 2015–2019 (t) | 23,719<br>19,163 | |
| | MSY (1,000 t) (80% CI):<br>$F_{MSY}$ (80% CI):<br>$B_{MSY}$ (1,000 t) (80% CI):<br>$F_{current}/F_{MSY}$ (80% CI):<br>$B_{current}/B_{MSY}$ (80% CI):<br>$B_{current}/B_0$ (80% CI): | unknown<br>unknown<br>unknown<br>unknown<br>unknown<br>unknown | |

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2019: 40%

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

## INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** A new assessment was carried out in 2021 using the data-limited techniques (CMSY and LB-SPR), however the catch data for bullet tuna are very uncertain given the high percentage of the catches that had to be estimated due to a range of reporting issues. Due to a lack of fishery data for several gears, only preliminary stock status indicators can be used. Aspects of the fisheries for bullet tuna combined with the lack of data on which to base an assessment of the stock are a cause for concern. Stock status in relation to the Commission's $B_{MSY}$ and $F_{MSY}$ reference points remains unknown (**Table 1**).

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

***Management advice.*** For assessed species of neritic tunas and seerfish in the Indian Ocean (longtail tuna, kawakawa and narrow-barred Spanish mackerel), the MSY was estimated to have been reached between 2009 and 2011 and both $F_{MSY}$ and $B_{MSY}$ were breached thereafter. Therefore, in the absence of a stock assessment of bullet tuna a limit to the catches should be considered by the Commission, by ensuring that future catches do not exceed the average catches estimated between 2009 and 2011 (8,547 t). This catch advice should be maintained until an assessment of bullet tuna is available. Considering that MSY-based reference points for assessed species can change over time, the stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice.

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean stock is unknown.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).
- Species identification, data collection and reporting urgently need to be improved.
- There is limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2020 catches (reference year 2019), 40% of the total catches was either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore, the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2015-2019)**: bullet tuna is mainly caught using purse seine (~49%), handlines and trolling (~26%), and gillnets (~17%) (**Fig. 1**).
- **Main fleets (average catches 2015-2019)**: Catches are highly concentrated: in recent years over 90% of catches in the Indian Ocean have been accounted for by fisheries in India, Indonesia, Thailand, and Sri Lanka.

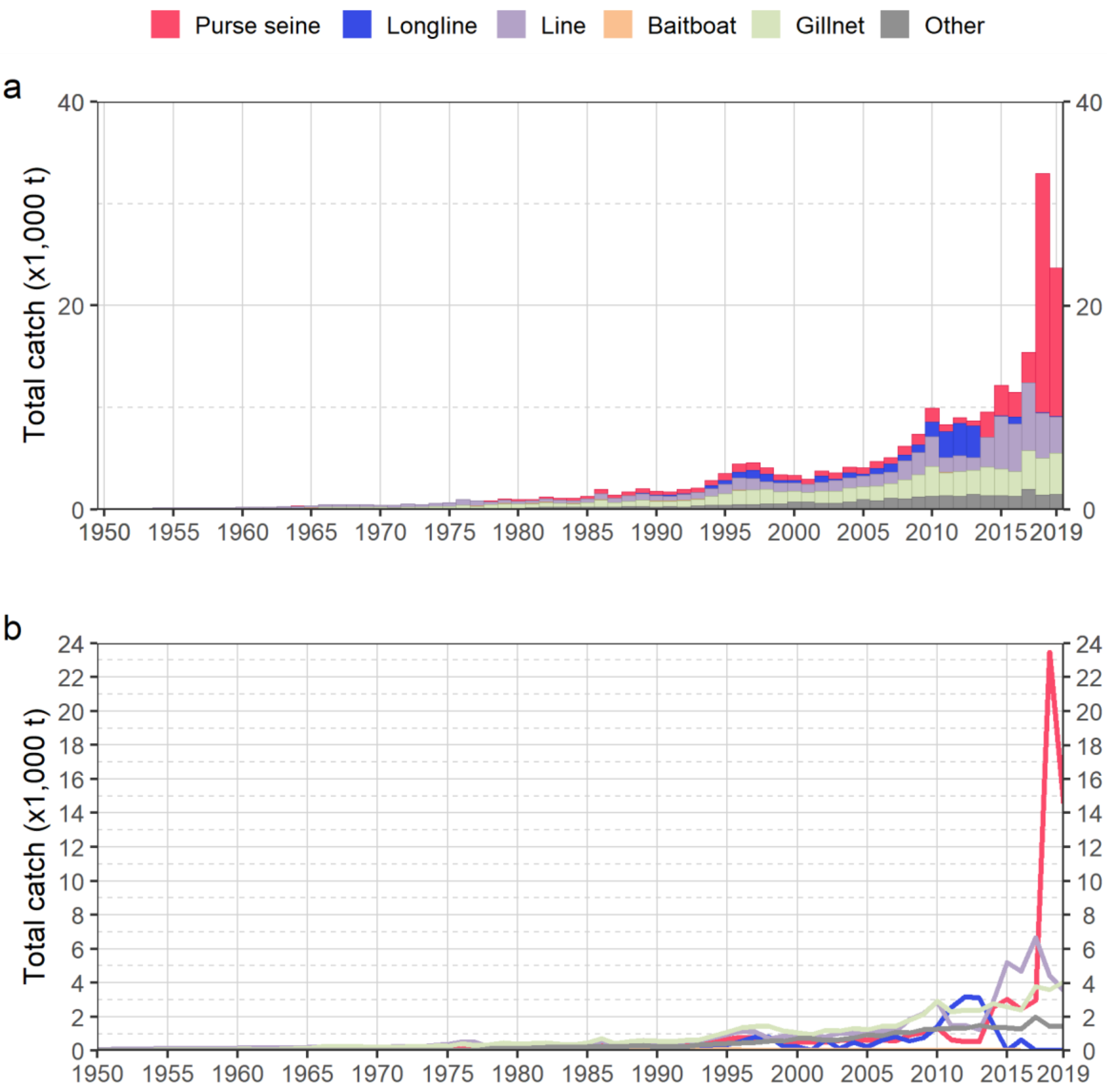


**Fig. 1.** Annual time series of (a) cumulative and (b) individual nominal catches (t) by gear group for bullet tuna during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all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

# APPENDIX VIII
## EXECUTIVE SUMMARY: FRIGATE TUNA

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi

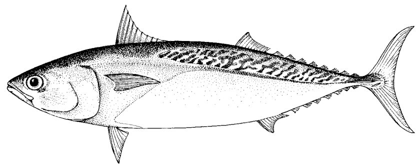

**TABLE 1**. Frigate tuna: Status of frigate tuna (*Auxis thazard*) in the Indian Ocean.

| Area[1] | Indicators | | 2021 stock status determination |
|---|---|---|---|
| Indian Ocean | Catch 2019[2] (t)<br>Average catch 2015–2019 (t) | 98,691<br>96,644 | |
| | MSY (1,000 t) (80% CI):<br>$F_{MSY}$ (80% CI):<br>$B_{MSY}$ (1,000 t) (80% CI):<br>$F_{current}/F_{MSY}$ (80% CI):<br>$B_{current}/B_{MSY}$ (80% CI):<br>$B_{current}/B_0$ (80% CI): | unknown<br>unknown<br>unknown<br>unknown<br>unknown<br>unknown | |

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2019: 68%

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

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** A new assessment was carried out in 2021 using the data-limited techniques (CMSY and LB-SPR), however the catch data for frigate tuna are very uncertain given the high percentage of the catches that had to be estimated due to a range of reporting issues. Due to a lack of fishery data for several gears, only preliminary stock status indicators can be used. Aspects of the fisheries for frigate tuna combined with the lack of data on which to base an assessment of the stock are a cause for considerable concern. Stock status in relation to the Commission's $B_{MSY}$ and $F_{MSY}$ reference points remains **unknown** (**Table 1**).

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

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

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean stock is unknown.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.
- Further work is needed to improve the reliability of the catch series, such as verification or estimation based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).
- Species identification, data collection and reporting urgently need to be improved.
- There is limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2020 catches (reference year 2019), 40% of the total catches were either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore, the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2015-2019)**: frigate tuna is mainly caught using gillnets (~40%), coastal longline and trolling, handlines and trolling (~33%), and to a lesser extent coastal purse seine nets. The species is also a bycatch for industrial purse seine vessels and the target of some ring net fisheries.
- **Main fleets (average catches 2015-2019)**: Catches of frigate tuna are highly concentrated: Indonesia accounts for around 60% of the catches, while 90% of catches are accounted for by four countries (Indonesia, Pakistan, I.R. Iran and India).

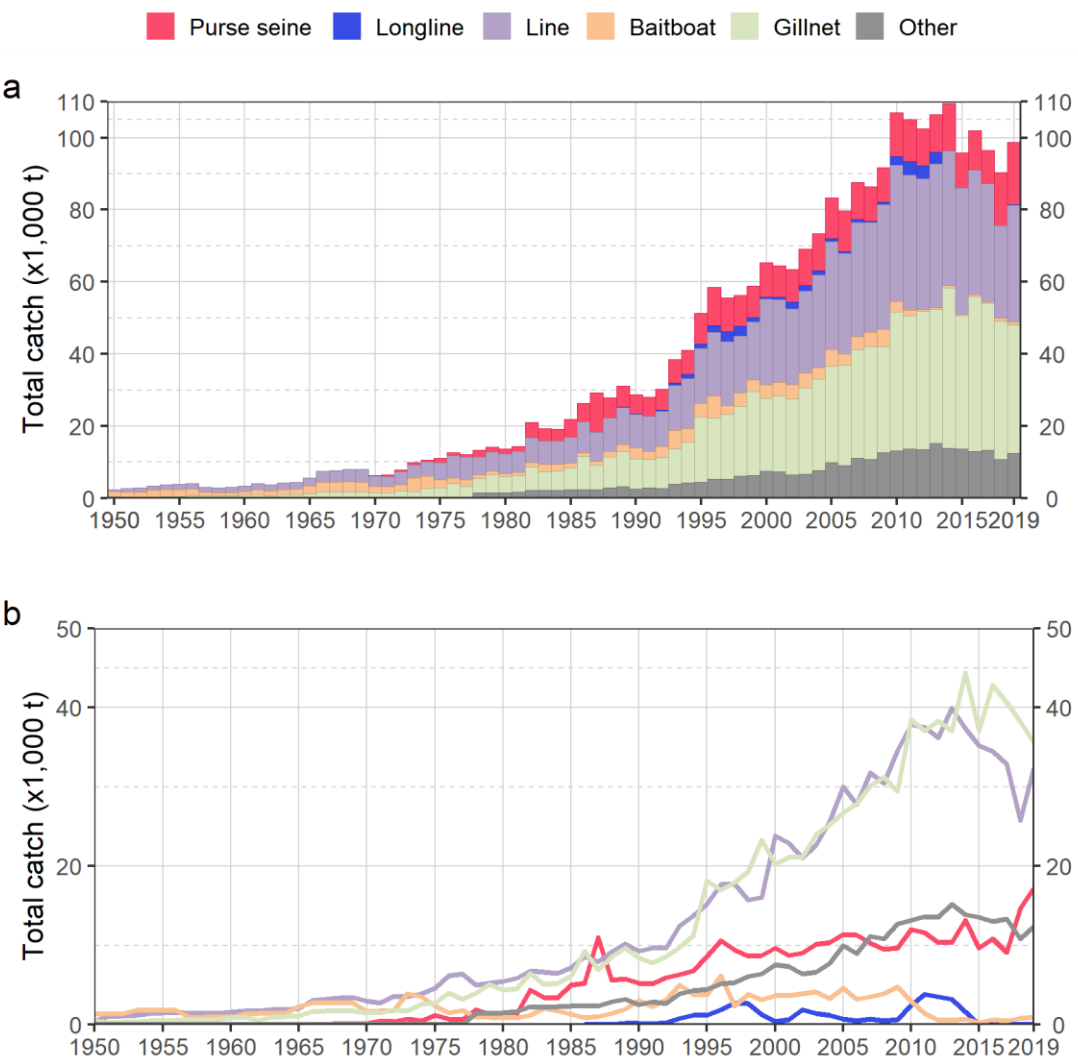

**Fig. 1.** Annual time series of (a) cumulative and (b) individual nominal catches (t) by gear group for frigate tuna during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all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

## APPENDIX IX
## EXECUTIVE SUMMARY: KAWAKAWA

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi

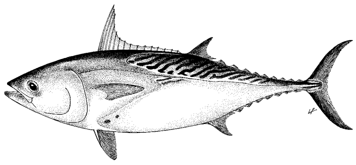

**TABLE 1.** Kawakawa: Status of kawakawa (*Euthynnus affinis*) in the Indian Ocean.

| Area[1] | Indicators | | 2021 stock status determination |
|---|---|---|---|
| Indian Ocean | Catch 2019[2] (t)<br>Average catch 2015-2019 (t) | 148,828<br>152,253 | **50%** |
| | MSY (t) (80% CI)<br>$F_{MSY}$ (80% CI)<br>$B_{MSY}$ (t) (80% CI)<br>$F_{current}/F_{MSY}$ (80% CI)<br>$B_{current}/B_{MSY}$ (80% CI) | 148,825 (124,114 – 222,505)<br>0.44 (0.21–0.82)<br>355,670 (192,080 – 764,530)<br>0.98 (0.85–1.11)<br>1.13 (0.75–1.58) | |

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2019: 53%

| Colour key | Stock overfished($B_{year}/B_{MSY}$< 1) | Stock not overfished ($B_{year}/B_{MSY}$≥ 1) |
|---|---|---|
| Stock subject to overfishing($F_{year}/F_{MSY}$> 1) | 35% | 15% |
| Stock not subject to overfishing ($F_{year}/F_{MSY}$≤ 1) | 0% | 50% |
| Not assessed/Uncertain | | |

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** No new stock assessment was conducted for kawakawa in 2021 and so the results are based on the assessment carried out in 2020 using data-limited assessment techniques. The OCOM model indicated that the fishing mortality F was very close to $F_{MSY}$ ($F/F_{MSY}$=0.98) and the B above $B_{MSY}$ ($B/B_{MSY}$=1.13). The estimated probability of the stock currently being in green quadrant of the Kobe plot is about 50%. Due to the quality of the data being used, the simple modelling approach employed in 2020, and the large increase in kawakawa catches over the last decade (**Fig. 1**), measures need to be taken in order to reduce the level of catches which have surpassed the estimated MSY levels for all years since 2011. Based on the weight-of-evidence available, the kawakawa stock for the Indian Ocean is classified as **not overfished** and **not subject to overfishing** (**Table 1**, **Fig. 2**).

***Outlook.*** There is considerable uncertainty about stock structure and the estimate of total catches. Due to the uncertainty associated with catch data (e.g., 53% of catches partially or fully estimated by the IOTC Secretariat in 2019) and the limited number of CPUE series available for fleets representing a small proportion of total catches, only data poor assessment approaches can currently be used. Aspects of the fisheries for this species, combined with the lack of data on which to base a more complex assessment (e.g. integrated models) are a cause for considerable concern. In the interim, until more traditional approaches are developed, data-poor approaches will be used to assess stock status. Continued increase in the annual catches for kawakawa is also likely to further increase the pressure on the Indian Ocean stock. Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).

***Management Advice***. The assessment models rely on catch data, which are considered to be highly uncertain. The catch in 2019 was equal to the estimated MSY. The available gillnet CPUE of kawakawa showed a somewhat increasing trend although the reliability of the index as abundance indices remains unknown. Despite the substantial uncertainties, the stock is probably very close to being fished at MSY levels and that higher catches may not be sustained in the longer term. A precautionary approach to management is recommended.

The following should be also noted:

- The Maximum Sustainable Yield estimate for the Indian Ocean is estimated to be 148,825 t with a range between 124,114 and 222,505 t and so catch levels should be reduced in future to prevent the stock becoming overfished.
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Improvement in data collection and reporting is required if the stock is to be assessed using integrated stock assessment models.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.
- Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).
- Given the limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status, the IOTC Secretariat was required to estimate 53% of the catches (in 2020, with reference year 2019), which increases the uncertainty of the stock assessments using these data. Therefore, the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2015-2019)**: kawakawa are caught mainly by gillnets (~49%), purse seiners (including coastal ones, ~29%) and handlines and trolling (~16%) (**Fig. 1**).
- **Main fleets (average catches 2015-2019)**: Catches are highly concentrated: Indonesia, I.R. Iran, and India account for ~73% of all catches in recent years.

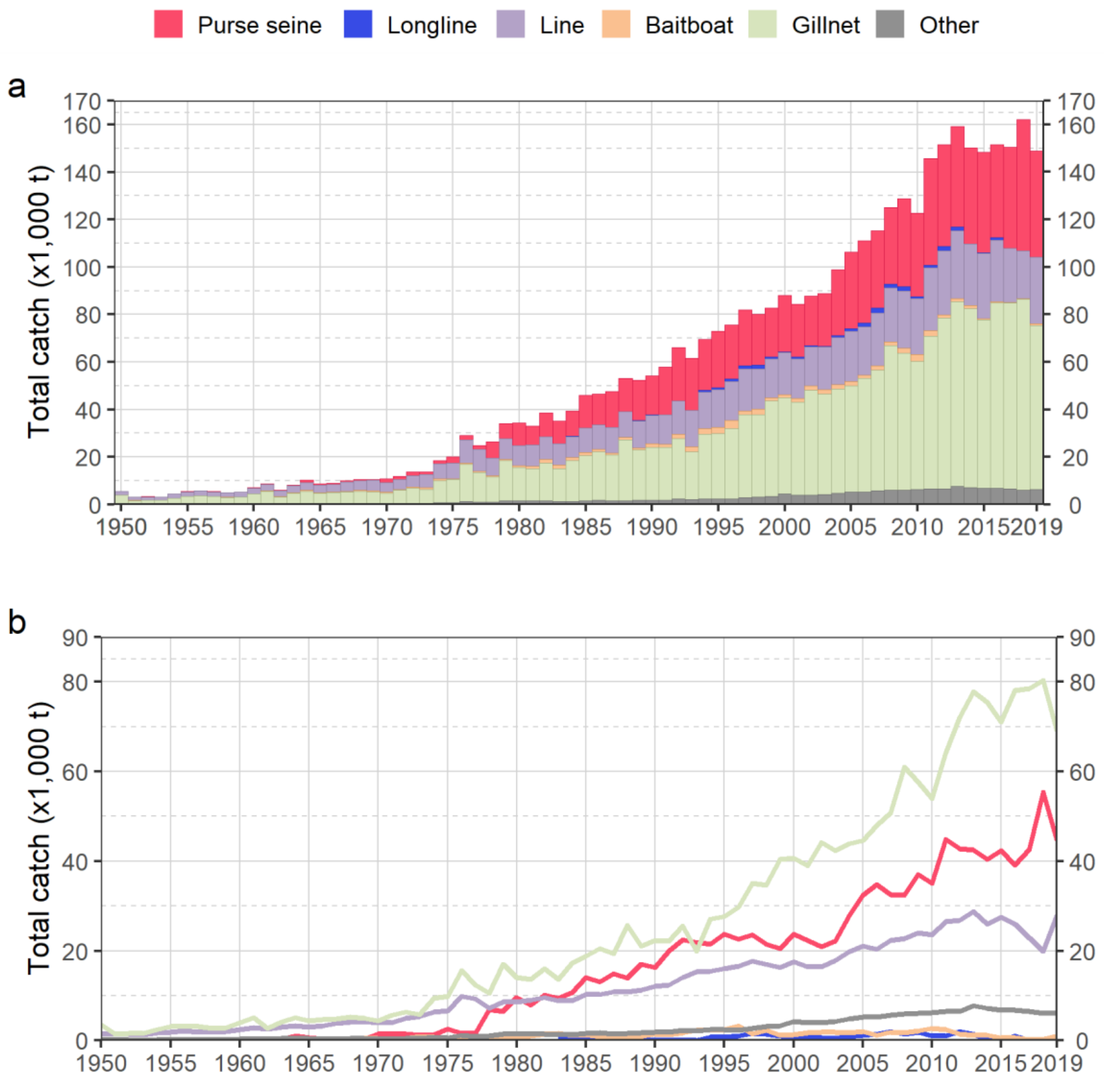


**Fig. 1.** Annual time series of (a) cumulative and (b) individual nominal catches (t) by gear group for kawakawa during 1950-2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all remaining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

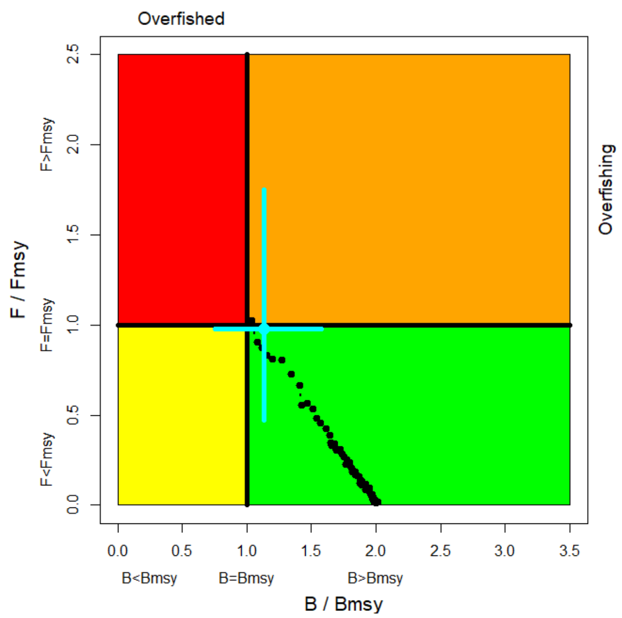


**Fig. 2.** OCOM Indian Ocean assessment Kobe plot for kawakawa. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018 (median and 80%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

## APPENDIX X
## EXECUTIVE SUMMARY: LONGTAIL TUNA

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi

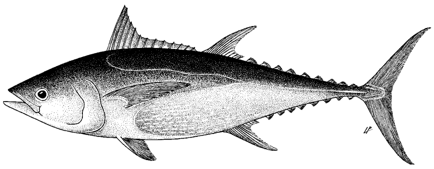

**TABLE 1.** Longtail tuna: Status of longtail tuna (*Thunnus tonggol*) in the Indian Ocean.

| Area[1] | Indicators | | 2020 stock status determination |
|---|---|---|---|
| Indian Ocean | Catch 2019[2] (t) | 112,867 | **76%** |
| | Average catch 2015–2019 (t) | 135,070 | |
| | MSY (t) (80% CI) | 128,750 (99,902 – 151,357) | |
| | $F_{MSY}$ (80% CI) | 0.32 (0.15 – 0.66) | |
| | $B_{MSY}$ (t) (80% CI) | 395,460 (129,240 – 751,316) | |
| | $F_{current}/F_{MSY}$ (80% CI) | 1.52 (0.751 – 2.87) | |
| | $B_{current}/B_{MSY}$ (80% CI) | 0.69 (0.45 – 1.21) | |

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catches estimated or partially estimated by IOTC Secretariat in 2019: 28%

| **Colour key** | Stock overfished($B_{year}/B_{MSY}$< 1) | Stock not overfished ($B_{year}/B_{MSY}$≥ 1) |
|---|---|---|
| Stock subject to overfishing($F_{year}/F_{MSY}$> 1) | 76% | 2% |
| Stock not subject to overfishing ($F_{year}/F_{MSY}$≤ 1) | 2% | 20% |
| Not assessed/Uncertain | | |

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** No new assessment was conducted for longtail tuna in 2021 and so the results are based on the assessment carried out in 2020 using the Optimised Catch-Only Method (OCOM). Analysis using the OCOM indicates that the stock is being exploited at a rate that exceeded $F_{MSY}$ in recent years and that the stock appears to be below $B_{MSY}$ and above $F_{MSY}$ (76% of plausible models runs) (**Fig. 2**). Catches were above MSY between 2010 and 2018 but steadily declined from 2012 to were less than 113,000 t in 2019, below the estimated MSY (**Fig. 1**). The $F_{2018}/F_{MSY}$ ratio is slightly higher than previous estimates. The estimate of the $B_{2018}/B_{MSY}$ ratio (0.69) was lower than in previous years, reflecting declining abundance. An assessment using a biomass dynamic model incorporating gillnet CPUE indices was also undertaken in 2020 and results were consistent with OCOM in terms of status. Therefore, based on the weight-of-evidence currently available, the stock is considered to be both **overfished** and **subject to overfishing** (**Table 1**; **Fig. 2**).

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

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

The following should be also noted:

- The Maximum Sustainable Yield estimate of around 128,750 t was exceeded between 2011 and 2018. Limits to catches are warranted to recover the stock to the $B_{MSY}$ level.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.

- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Improvements in data collection and reporting are required if the stock is to be assessed using integrated stock assessment models.
- Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets (I.R. Iran, Indonesia, Pakistan, Sultanate of Oman and India), size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).
- There is limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2020 catches (reference year 2019) 30% of the total catches were either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore, the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gear (average catches 2015-2019)**: Longtail tuna are caught mainly using gillnets (~73% of catches) and, to a lesser extent, coastal purse seine nets (~7%) and handline and trolling (~10%) (**Fig. 1**).
- **Main fleets (average catches 2015-2019)**: 42% of the catches of longtail in the Indian Ocean are accounted for by I.R. Iran, followed by Indonesia (~19%), Sultanate of Oman (~12%), and Pakistan (~11%).

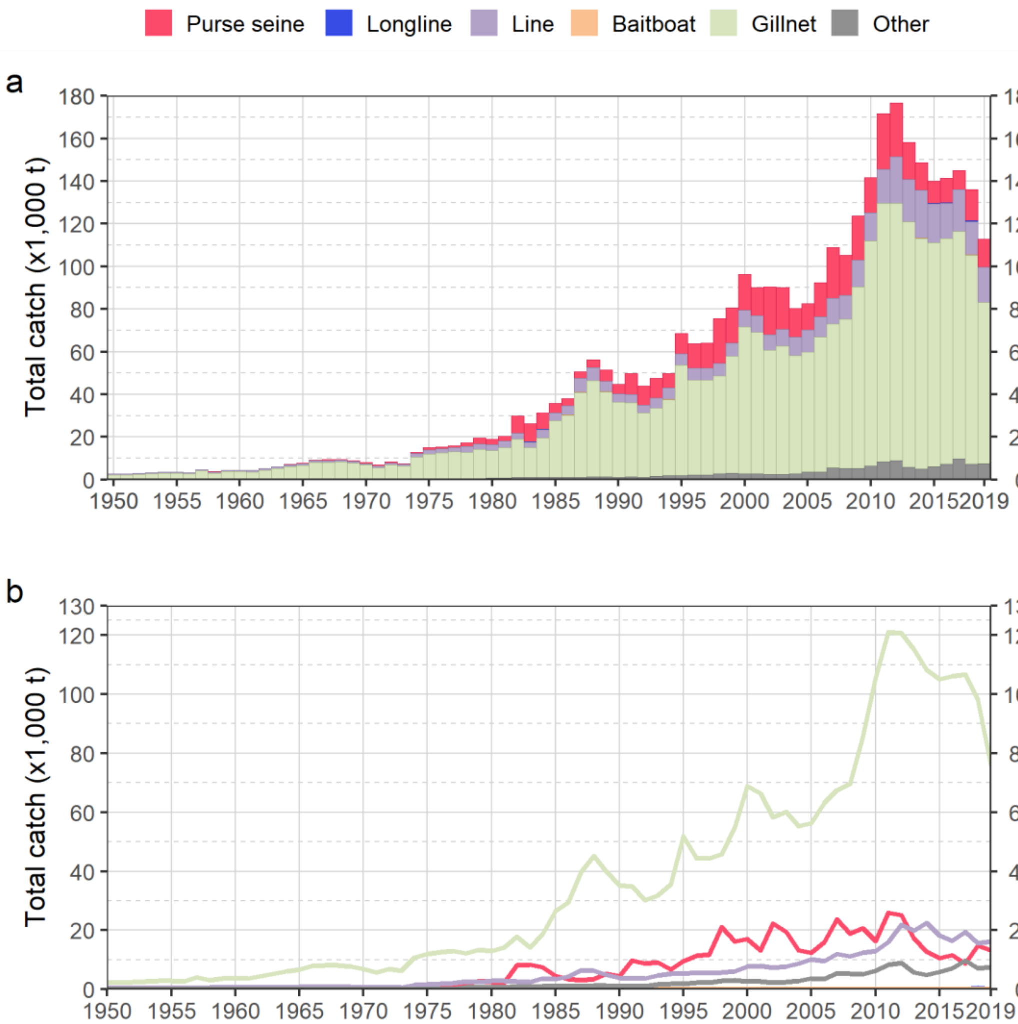


**Fig. 1.** Annual time series of (a) cumulative and (b) individual nominal catches (t) by gear group for longtail tuna during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet; Other: all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

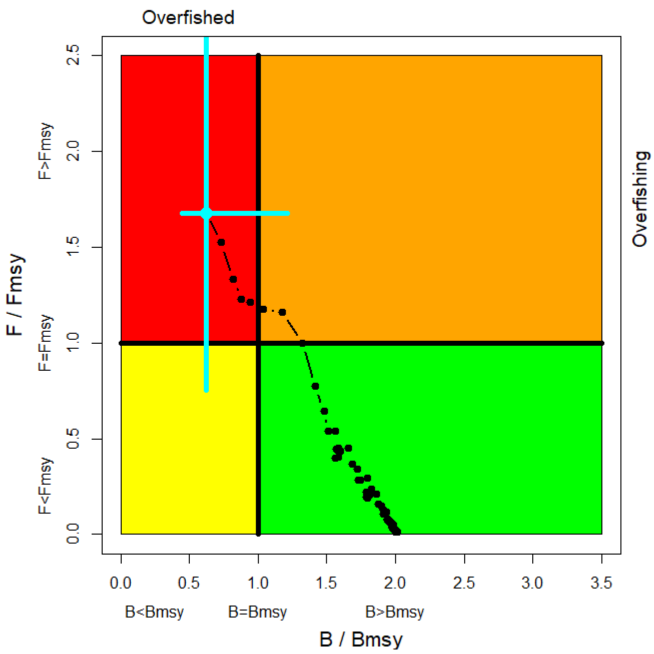


**Fig. 2.** Longtail tuna OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018 (median and 80%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

# APPENDIX XI
## EXECUTIVE SUMMARY: INDO-PACIFIC KING MACKEREL

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi

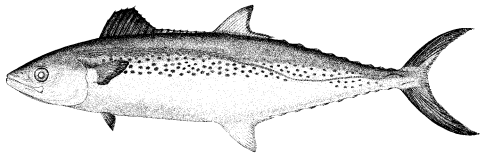

**TABLE 1.** Indo-Pacific king mackerel: Status of Indo-Pacific king mackerel (*Scomberomorus guttatus*) in the Indian Ocean.

| Area[1] | Indicators | | 2021 stock status determination |
|---|---|---|---|
| Indian Ocean | Catch 2019[2] (t)<br>Average catch 2015-2019 (t) | 45,79645,513 | 35% |
| | MSY (1,000 t)<br>$F_{MSY}$<br>$B_{MSY}$ (1,000 t)<br>$F_{current}/F_{MSY}$<br>$B_{current}/B_{MSY}$<br>$B_{current}/B_0$ | 46.9 (37.7–58.4)<br>0.74 (0.56–0.99)<br>63.2 (42–94)<br>0.90 (0.78–2.01)<br>1.03 (0.46–1.19)<br>0.51 (0.23–0.60) | |

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

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

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** A new assessment was carried out in 2021 using the data-limited techniques (CMSY and LB-SPR) . Analysis using the catch only method CMSY indicates the stock is being exploited at a rate that is below $F_{MSY}$ in recent years and that the stock appears to be above $B_{MSY}$, although the estimates would be more pessimistic if the stock productivity is assumed to be less resilient. The analysis using the length-based approach (LB-SPR) was also undertaken in 2021 and the results are not conflicting with CMSY in terms of status. The catch-only model has provided a more defensible approach in addressing the uncertainty of key parameters and the currently available catch data for the Indo-Pacific king mackerel appear to be of sufficient quality. Based on the weight-of-evidence currently available, the stock is considered to be not overfished and not subject to overfishing (Table 1; Fig. 2).

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

***Management advice.*** Reported catches of Indo-Pacific king mackerel in the Indian Ocean has increased considerably since the late 2000s with recent catches fluctuating around estimated MSY, although the catch in 2019 was below the estimated MSY. This suggests that the stock is very close to being fished at MSY levels and that higher catches may not be sustained despite the substantial uncertainty associated with the assessment, a precautionary approach to management is recommended.

The following should be also noted:

- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.
- Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Data collection and reporting urgently needed to be improved, given the limited information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2020 catches (reference year 2019) 75% of the total catches was either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore, the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gears (average catches 2015-2019)**: Indo-Pacific King mackerel are caught mainly by gillnets (~66%), however significant numbers are also caught by trawling (~18%) and trolling (7%) (**Fig. 1**).
- **Main fleets (average catches 2015-2019)**: Almost two-thirds of catches are accounted for by fisheries in India and Indonesia; with important catches also reported by I.R. Iran (~19%).

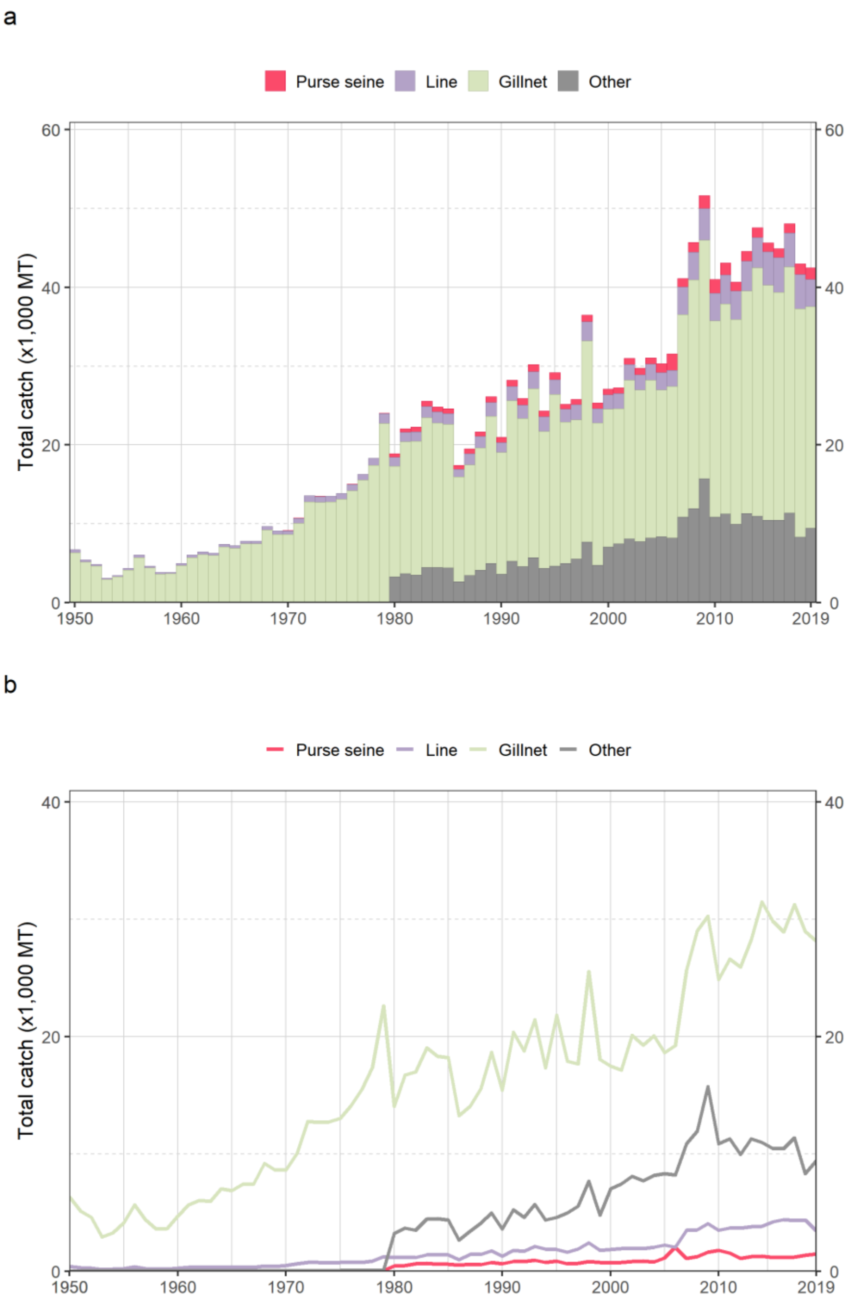


**Fig. 1.** Annual time series of (a) cumulative and (b) individual nominal catches (t) by gear group for Indo-Pacific king mackerel during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet;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

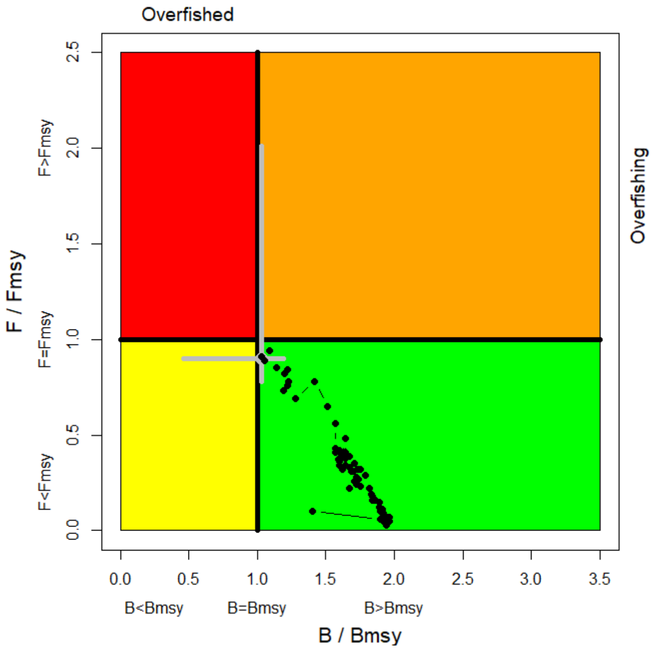


**Fig. 2.** Indo-Pacific king mackerel CMSY Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The gray cross represents the estimate of stock status in 2021 (median and 80% confidence interval).

# APPENDIX XII
## EXECUTIVE SUMMARY: NARROW-BARRED SPANISH MACKEREL

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi

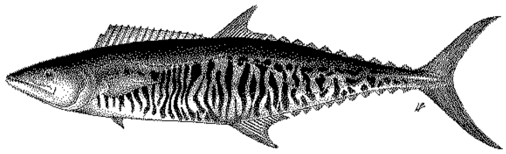

**TABLE 1.** Narrow-barred Spanish mackerel: Status of narrow-barred Spanish mackerel (*Scomberomorus commerson*) in the Indian Ocean.

| Area[1] | Indicators | | 2021 stock status determination |
|---|---|---|---|
| Indian Ocean | Catch 2019[2] (t)<br>Average catch 2015-2019 (t) | 159, 457<br>171,799 | 73% |
| | MSY (t) (80% CI)<br>$F_{MSY}$ (80% CI)<br>$B_{MSY}$ (t) (80% CI)<br>$F_{current}/F_{MSY}$ (80% CI)<br>$B_{current}/B_{MSY}$ (80% CI) | 157,760 (132,140–187,190)<br>0.49 (0.25–0.87)<br>323,500 (196,260–592,530)<br>1.24 (0.65–2.13)<br>0.80 (0.54–1.27) | |

[1] Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2] Proportion of catch estimated or partially estimated by IOTC Secretariat in 2019: 72%

| Colour key | Stock overfished($B_{year}/B_{MSY}$< 1) | Stock not overfished ($B_{year}/B_{MSY}$≥ 1) |
|---|---|---|
| Stock subject to overfishing($F_{year}/F_{MSY}$> 1) | 73% | 3% |
| Stock not subject to overfishing ($F_{year}/F_{MSY}$≤ 1) | 3% | 22% |
| Not assessed/Uncertain | | |

### INDIAN OCEAN STOCK – MANAGEMENT ADVICE

***Stock status.*** No new assessment was conducted for narrow-barred Spanish mackerel in 2021 and so the results are based on the assessment carried out in 2020 using the Optimised Catch-Only Method (OCOM). The OCOM model indicates that the stock is being exploited at a rate exceeding $F_{MSY}$ in recent years, and the stock appears to be below $B_{MSY}$. An analysis undertaken in 2013 in the Northwest Indian Ocean (Gulf of Oman) indicated that overfishing is occurring in this area and that localised depletion may also be occurring[2]. Based on the weight-of-evidence available, the stock appears to be **overfished** and **subject to overfishing** (**Table 1**, **Fig. 2**). Catches since 2012 and also recent average catches for 2015-2019 have been above or close to the current MSY estimate of 157,76 0 t in recent years (**Fig. 1**).

***Outlook.*** There is considerable uncertainty about the estimate of total catches. The continued increase in annual catches in recent years has further increased the pressure on the Indian Ocean narrow-barred Spanish mackerel stock. The apparent fidelity of narrow-barred Spanish mackerel to particular areas/regions is a matter for concern as overfishing in these areas can lead to localised depletion. Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).

***Management advice***. The catch in 2019 was just below the estimated MSY and the available gillnet CPUE shows a somewhat increasing trend in recent years although the reliability of the index as an abundance index remains unknown. Despite the substantial uncertainties, the stock is probably very close to being fished at MSY levels and higher catches may not be sustained.

[2] IOTC-2013-WPNT03-27

The following should also be noted:

- Maximum Sustainable Yield for the Indian Ocean stock was estimated at 157,760 t, with catches for 2019 (159,457 t) exceeding this level.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic species under its mandate.
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified or estimated, based on expert knowledge of the history of the various fisheries or through statistical extrapolation methods.
- Improvement in data collection and reporting is required if the stock is to be assessed using integrated stock assessment models.
- Given the increase in narrow-barred Spanish mackerel catch in the last decade, measures need to be taken to reduce catches in the Indian Ocean.
- Research emphasis should be focused on collating catch per unit effort (CPUE) time series for the main fleets, size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.).
- There is a lack of information submitted by CPCs on total catches, catch and effort and size data for neritic tunas, despite their mandatory reporting status. In the case of 2020 catches (reference year 2019) 72% of the total catches were either fully or partially estimated by the IOTC Secretariat, which increases the uncertainty of the stock assessments using these data. Therefore, the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.
- **Main fishing gears (average catches 2015-2019)**: Narrow-barred Spanish mackerel are caught mainly using gillnet (~63%), however significant numbers are also caught using troll lines (~9.3%) and trawling (~8.7%) (**Fig. 1**).
- **Main fleets (average catches 2015-2019)**: Fisheries in Indonesia, India, I.R. Iran, and United Arab Emirates account for around two-thirds of catches of narrow-barred Spanish mackerel, while the species is also targeted throughout the Indian Ocean by artisanal and recreational fisheries.

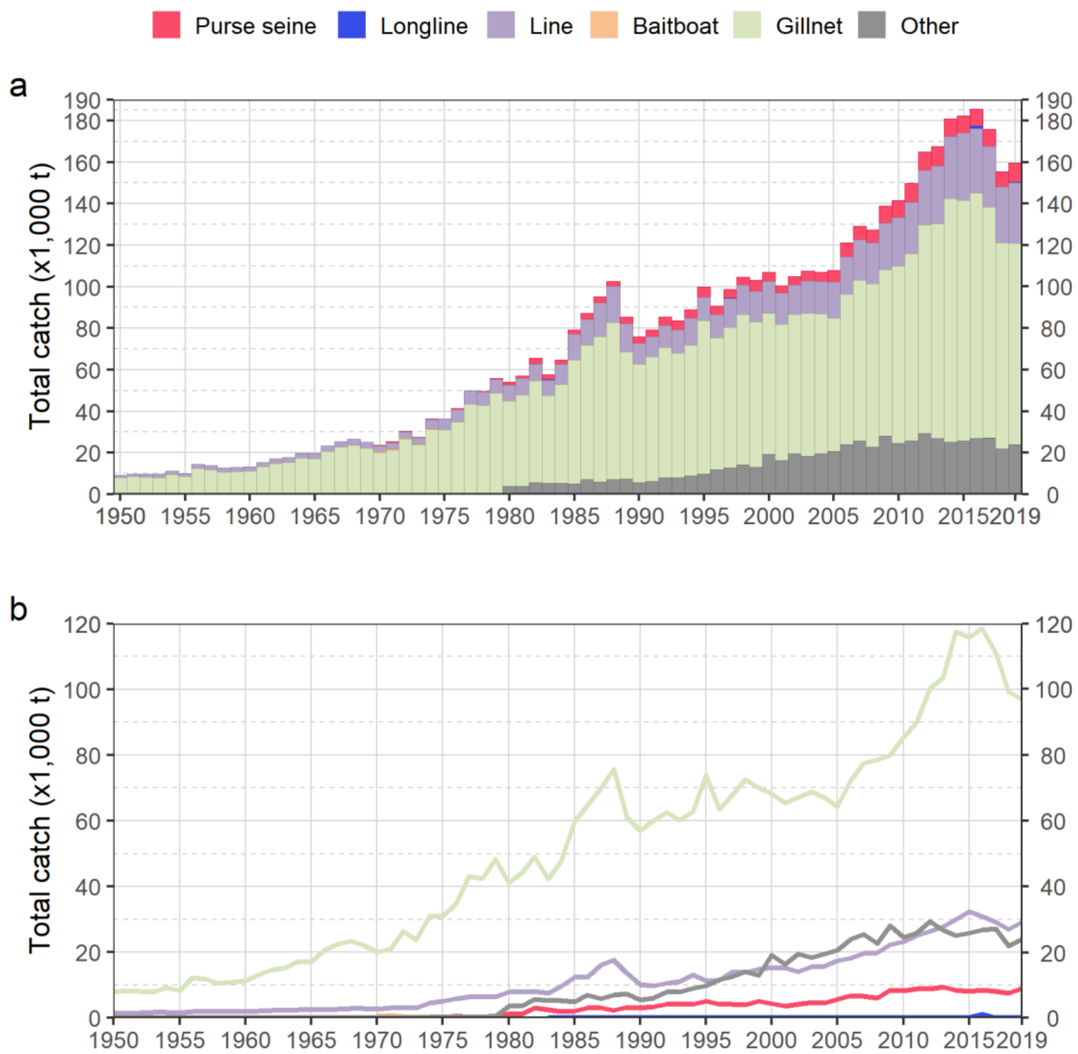


**Fig. 1**. Annual time series of (a) cumulative and (b) individual nominal catches (t) by gear group for narrow-barred Spanish mackerel during 1950–2019. Purse seine: coastal purse seine, purse seine, ring net; Line: coastal longline, hand line, troll line; Gillnet: coastal and offshore gillnets, driftnet;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

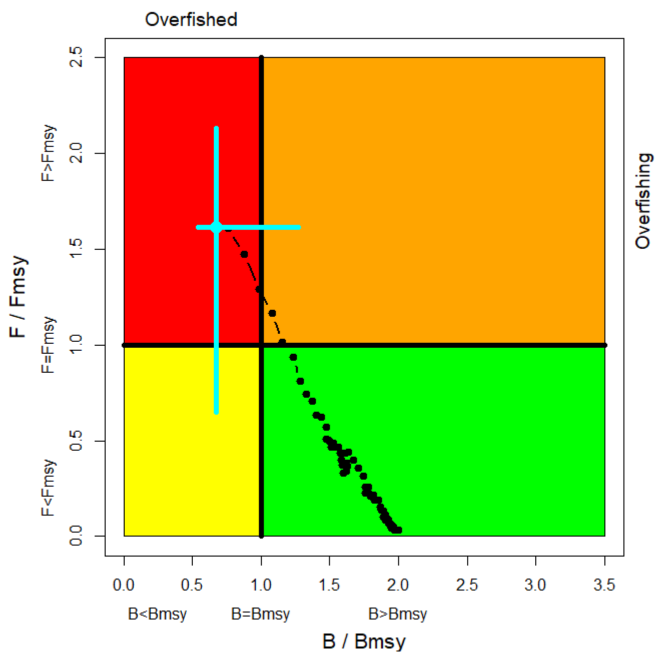


**Fig. 2.** Narrow-barred Spanish Mackerel OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories (geometric mean) for the range of plausible model options included in the formulation of the final management advice. The blue cross represents the estimate of stock status in 2018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

# APPENDIX XIII
## CONSOLIDATED RECOMMENDATIONS OF THE 11TH SESSION OF THE WORKING PARTY ON NERITIC TUNAS

*Note: Appendix references refer to the Report of the 11th Session of the Working Party on Neritic Tunas (IOTC–2021–WPNT11–R)*

**Revision of the WPNT Program of Work (2022–2026)**

WPNT11.01 (para 86) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2022–2026), as provided in Appendix VI.

**Review of the draft, and adoption of the Report of the 11th Working Party on Neritic Tunas**

WPNT11.02 (para 92) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT11, provided at 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 2021 (Fig. 10):

- 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