Report of the 7th Session of the IOTC Working Party on Neritic Tunas

Malé, Maldives, 10 – 13 July 2017

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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_{2014} is the fishing mortality estimated in the year 2014
FAD	Fish aggregating device
F_{MSY}	Fishing mortality at MSY
FRI	Frigate tuna
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
WPM	Working Party on Methods
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 7th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT07) was held in Male, Maldives from 10–13 July 2017. A total of 26 participants (20 in 2016, 31 in 2015, 37 in 2014, 42 in 2013) attended the Session. The list of participants is provided at Appendix I. The meeting was opened by the Chairperson, Dr Farhad Kaymaram from I.R. Iran, who welcomed participants to the meeting including the Invited Expert, Dr Charles Edwards, from NIWA, New Zealand and the consultant, Dr Shijie Zhou, from CSIRO, Australia.

The following are a subset of the complete recommendations from the WPNT07 to the Scientific Committee which are provided at Appendix XIII.

(para. 24) The WPNT **NOTED** that compliance with data reporting obligations is particularly low for neritic tuna species, despite the importance of scientific data for stock assessment, and **REQUESTED** CPCs do their best to collect data and comply with data reporting requirements adopted by the IOTC. The WPNT further **RECOMMENDED** that mechanisms are developed by the Commission to improve current scientific advice by encouraging CPCs to comply with their data recording and reporting requirements.

(para. 27) **NOTING** a number of long-standing data reporting or data quality issues that severely impact the assessment of neritic species, the WPNT **RECOMMENDED** that funds be made available to the IOTC Secretariat (either through the IOTC Regular Budget or from external sources) dedicated to capacity building activities, or data compliance and support missions, aimed at improving the availability of data for those countries identified as a priority for neritic species in terms of importance of catches. Specifically:

i. that the IOTC Secretariat conducts a Data Compliance and Support mission to I.R. Iran to assess the status of data collection and reporting of IOTC datasets, notably catch-and-effort, and the availability of data that could be used as a basis of a future standardized CPUE series gillnet fleets;

ii. when sufficient data is recovered, or made available, that the IOTC Secretariat allocates funds to assist with the development of a standardized CPUE series for gillnets, in collaboration with IOTC members, including organization of a joint-workshop or hiring of an international consultant;

iii. that the IOTC Secretariat formally communicates to India requesting the submission of mandatory datasets according to the requirements of IOTC Resolution 15/02 and, if necessary, conducts a Data Compliance and Support mission to facilitate the reporting of data to the IOTC;

iv. that the IOTC Secretariat continues to support the work of WWF-Pakistan and the Government of Pakistan in the evaluation and reporting of the crew-based observer program, and facilitate the reporting of length data and catch-and-effort collected by the observer log-books.

(para. 140) The WPNT **AGREED** that a new item on data mining and collation should be added as a fundamental piece of work to be undertaken as a priority and **RECOMMENDED** that this work is supported by the IOTC Secretariat. The WPNT further **AGREED** that data collation has been identified as the main priority of the group and allocated this the highest priority ranking.

(para. 141) **ACKNOWLEDGING** the importance of indices of abundance for future stock assessments, the WPNT **RECOMMENDED** that the development of standardised CPUE series is explored, with priority given to fleets which account for the largest catches of neritic tuna and tuna-like species (e.g., I.R. Iran, Indonesia, India, Pakistan, and Sri Lanka).

(para. 144) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2018–2022), as provided at Appendix VI.

(para. 147) The WPNT participants were unanimous in their thanks for the support for their participation in the meeting due to the MPF and **RECOMMENDED** that the Scientific Committee also consider the WPNT08 as a high priority meeting for MPF.

(para. 149) The WPNT **NOTED** that Kenya, Mozambique, and Pakistan have expressed interest in potentially hosting for the 8th Session of the WPNT and **RECOMMENDED** the SC consider the preferred dates of 4-7 April 2018.

(para. 151) The WPNT **RECOMMENDED** that the SC and Commission note the following:

1) The participation of developing coastal state scientists to the WPNT has been consistently high following the adoption and implementation of the IOTC Meeting Participation Fund adopted by the Commission in 2010 (Resolution 10/05 On the establishment of a Meeting Participation Fund for developing IOTC Members and Non-Contracting Cooperating Parties), now incorporated into the IOTC Rules of Procedure (2014), as well as though the hosting of the WPNT in developing coastal State Contracting Parties (Members) of the Commission (Table 8).

2) The continued success of the WPNT, at least in the short term, appears heavily reliant on the provision of support via the MPF which was established primarily for the purposes of supporting scientists to attend and contribute to the work of the Scientific Committee and its Working Parties.

3) The MPF should be utilised so as to ensure that all developing Contracting Parties of the Commission are able to attend the WPNT meeting, as neritic tunas are very important resources for many of the coastal countries of the Indian Ocean.

(para. 152) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT07, 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 2017 (Fig. 8):

- 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: 2017

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 586, 434 t being landed in 2015. 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		Prev	10	11	12	13	14	15	16	17	Advice to the Commission
Bullet tuna *Auxis rochei*	Catch 2015: Average catch 2011–2015: MSY (1,000 t) F_{MSY}: B_{MSY} (1,000 t): F_{2015}/F_{MSY}: B_{2015}/B_{MSY}: B_{2015}/B_0:	10,582 t 9,008 unknown unknown unknown unknown unknown unknown										A precautionary approach to the management of bullet tuna should be considered by the Commission, by ensuring that future catches do not exceed 9037 t (average 2009–2015). This catch advice should be maintained until an assessment of bullet tuna is available. The reference period (2009-2015) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available (longtail tuna, kawakawa and narrow barred Spanish mackerel). For these species of neritic tunas in Indian Ocean, the MSY is estimated to have been reached between 2009 and 2015. The stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice. Click here for a full stock status summary: Appendix VII
Frigate tuna *Auxis thazard*	Catch 2015: Average catch 2011–2015: MSY (1,000 t) F_{MSY}: B_{MSY} (1,000 t): F_{2015}/F_{MSY}: B_{2015}/B_{MSY}: B_{2015}/B_0:	84,237 t 95,218 t unknown unknown unknown unknown unknown unknown										A precautionary approach to the management of frigate tuna should be considered by the Commission, by ensuring that future catches do not exceed 94,607 t (average 2009-2015). The catch advice should be maintained until an assessment of frigate tuna is available. The reference period (2009-2015) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available (longtail tuna, kawakawa and narrow barred Spanish mackerel). For these species of neritic tunas in Indian Ocean, the MSY is estimated to have been reached between 2009 and 2015. The stock should be closely monitored. Mechanisms need to be developed by the Commission to improve current statistics by encouraging CPCs to comply with their recording and reporting requirements, so as to better inform scientific advice.Click here for a full stock status summary: Appendix VIII
Kawakawa *Euthynnus affinis*	Catch 2015: Average catch 2011–2015: MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): F_{2015}/F_{MSY} (80% CI): B_{2015}/B_{MSY}	154,427 t 159,145 t 152 [125 –188] 0.56 [0.42–0.69] 202 [151–315] 0.98 [0.85–1.11] 1.15										Although the stock status is classified as not overfished and not subject to overfishing, the Kobe strategy II matrix developed in 2015 showed that there is a 96% probability that biomass is below MSY levels and 100% probability that $F>F_{MSY}$ by 2016 and 2023 if catches are maintained at the 2013 levels. The modelled probabilities of the stock achieving levels consistent with the MSY reference points (e.g. $SB > SB_{MSY}$ and $F<F_{MSY}$) in 2023 are 100% for a future constant catch at 80% of 2013 catch levels, thus if the Commission wishes to recover the stock to levels above the MSY reference points with a 50% probability by 2023, the Scientific Committee recommends that catches should be reduced by 20% based on 2013 levels (170,181 t)[1]. Click here for a full stock status summary: Appendix IX

Stock	Indicators	Prev	10	11	12	13	14	15	16	17	Advice to the Commission
	(80% CI): [0.97–1.38] B_{2015}/B_0 0.58 (80% CI): [0.33–0.86]										
Longtail tuna *Thunnus tonggol*	Catch 2015: 136,849 t Average catch 2011–2015: 157,496 t MSY (1,000 t) (*): 140 (103–184) F_{MSY} (*): 0.43 (0.28–0.69) B_{MSY} (1,000 t) (*): 319 (200–623) F_{2015}/F_{MSY} (*): 1.04 (0.84–1.46) B_{2015}/B_{MSY} (*): 0.94 (0.68–1.16) B_{2015}/B_0 (*): 0.48 (0.34–0.59)										There is a substantial risk of exceeding MSY-based reference points by 2018 if catches are maintained at current (2015) levels (63% risk that $B_{2018}<B_{MSY}$, and 55% risk that $F_{2018}>F_{MSY}$) (Table 2). If catches are reduced by 10% this risk is lowered to 33% probability $B_{2018}<B_{MSY}$ and 28% probability $F_{2018}>F_{MSY}$). If the Commission wishes to recover the stock to levels above the MSY reference points with at least a 50% probability by 2025, the Scientific Committee recommends that catches should be capped at current (2015) levels (i.e. 136,849), which corresponds to catches somewhat below MSY in order to recover the status of the stock in line with the decision framework described in Resolution 15/10. Click here for a full stock status summary: Appendix X
Indo-Pacific king mackerel *Scomberomorus guttatus*	Catch 2015: 46,403 t Average catch 2011–2015: 45,575 t MSY (1,000 t) (*): 46 [38.9–54.4] F_{MSY} (*): 0.52 [0.40–0.69] B_{MSY} (1,000 t) (*): 66.0 [45.9–107.9] F_{2015}/F_{MSY} (*): 0.98 [0.85–1.14] B_{2015}/B_{MSY} (*): 1.10 [0.84–1.29] B_{2015}/B_0 (*): 0.55 [0.42–0.64]										A precautionary approach to the management of Indo-Pacific king mackerel should be considered by the Commission, by ensuring that future catches do not exceed 46,222 t (average 2009-2015). The catch advice should be maintained until an assessment of Indo-Pacific king mackerel is available. The reference period (2009-2015) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available (longtail tuna, kawakawa and narrow barred Spanish mackerel). For these species of neritic tunas in Indian Ocean, the MSY is estimated to have been reached between 2009 and 2015. 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 XI
Narrow-barred Spanish mackerel *Scomberomorus commerson*	Catch 2015[2]: 154,177 t Average catch 2011–2015: 151,501 t MSY (1,000 t) [*]: 131 [96–180] F_{MSY} [*]: 0.35 [0.18–0.7] B_{MSY} (1,000 t) [*]: 371 [187–882] F_{2015}/F_{MSY} [*]: 1.28 [1.03–1.69] B_{2015} B_{MSY} [*]: 0.89 [0.63–1.15] B_{2015}/B_0 [*]: 0.44 [0.31–0.57]										There is a continued high risk of exceeding MSY-based reference points by 2025, even if catches are reduced to 80% of the 2015 levels (73% risk that $B_{2025}<B_{MSY}$, and 99% risk that $F_{2025}>F_{MSY}$). The modelled probabilities of the stock achieving levels consistent with the MSY reference levels (e.g. $B > B_{MSY}$ and $F<F_{MSY}$) in 2025 are 93% and 70%, respectively, for a future constant catch at 70% of current catch level. If the Commission wishes to recover the stock to levels above the MSY reference points with at least a 50% probability by 2025, the Scientific Committee recommends that catches should be reduced by 30% of current levels which corresponds to catches somewhat below MSY in order to recover the status of the stock. 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 ($SB_{year}/SB_{MSY}\geq 1$)
Stock subject to overfishing($F_{year}/F_{MSY}> 1$)		
Stock not subject to overfishing ($F_{year}/F_{MSY}\leq 1$)		
Not assessed/Uncertain		

1. Opening of the Meeting

1. The 7th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT07) was held in Male, Maldives from 10 – 13 July 2017. A total of 26 participants (20 in 2016, 31 in 2015, 37 in 2014) attended the Session. The list of participants is provided at Appendix I. The meeting was opened by the Chairperson, Dr Farhad Kaymaram from I.R. Iran, who welcomed participants to the meeting including the Invited Expert, Dr Charles Edwards, from NIWA, New Zealand and the consultant, Dr Shijie Zhou, from CSIRO, Australia.

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 WPNT07 are listed in Appendix III.

3. The IOTC process: Outcomes, updates and progress

3.1 Outcomes of the 19th Session of the Scientific Committee

3. The WPNT **NOTED** paper IOTC–2017–WPNT07–03 which outlined the main outcomes of the 19th Session of the Scientific Committee (SC19), 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 **NOTED** the recommendation of the SC to develop standardised CPUE series, with priority given to fleets which account for the largest catches of neritic tuna and tuna-like species (e.g., I.R. Iran, Indonesia, India, Pakistan, and Sri Lanka) and requested CPCs to make these data available for analysis.

3.2 Outcomes of the 21st Session of the Commission

5. The WPNT **NOTED** paper IOTC–2017–WPNT07–04 which outlined the main outcomes of the 21st Session of the Commission, specifically related to the work of the WPNT.

6. The WPNT **NOTED** the 8 Conservation and Management Measures (CMMs) adopted at the 21st Session of the Commission (consisting of 8 Resolutions and 0 Recommendations) which will come into force on 3rd October 2017:
   - Resolution 17/01 *On an interim plan for rebuilding the Indian Ocean yellowfin tuna stock in the IOTC Area of Competence.*
   - Resolution 17/02 *Working Party on the implementation of Conservation and Management Measures (WPICMM).*
   - Resolution 17/03 *On establishing a list of vessels presumed to have carried out illegal, unreported and unregulated fishing in the IOTC Area of competence*.
   - Resolution 17/04 *On a ban on discards of Bigeye tuna, Skipjack tuna, Yellowfin tuna, and non-targeted species caught by vessels in the IOTC Area of Competence.*
   - Resolution 17/05 *On the conservation of sharks caught in association with fisheries managed by the IOTC.*
   - Resolution 17/06 *On establishing a programme for transhipment by large-scale fishing vessels*
   - Resolution 17/07 *On the prohibition to use large-scale driftnets in the IOTC Area.*
   - Resolution 17/08 *Procedures on a fish aggregating devices (FADs) management plan, including a limitation on the number of FADs, more detailed specifications of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species.*

7. Participants to WPNT07 were **ENCOURAGED** to familiarise themselves with the adopted Resolutions, especially those most relevant to the WPNT.

8. The WPNT **NOTED** there was a proposal on the conservation and management of kawakawa, narrow-barred Spanish mackerel and longtail tuna that was reviewed but *not* adopted by the Commission:

"The Commission noted that IOTC–2017–S21–PropL On the conservation and management of IOTC Kawakawa, Longtail Tuna and Spanish Mackerel was withdrawn. There was only limited agreement with this proposal, due largely to the uncertainty on the status of the stocks as a result of a general lack of data on catches, as well as concern by one CPC that the proposal could set an unacceptable precedent for allocation by seeking to cap catches. The Commission encouraged CPCs to improve the data collection and submission. The Commission encouraged Coastal States catching neritic tunas to propose and present to next year's Commission meeting possible management measures to recover the over-exploited IOTC neritic stocks, in response to the recommendation of the SC" (IOTC-2017-S21-R, para. 38).

3.3 Review of Conservation and Management Measures relevant for neritic tunas

9. The WPNT **NOTED** paper IOTC–2017–WPNT07–05 which aimed to encourage participants at the WPNT07 to review some of the existing Conservation and Management Measures (CMM) relating to neritic tunas, noting that these have now been revised as described in document IOTC–2017–WPNT07–04.

3.4 Progress on the Recommendations of WPNT06 and SC19

10. The WPNT **NOTED** paper IOTC–2017–WPNT07–06 which provided an update on the progress made in implementing the recommendations from the 6th Session of the WPNT for the consideration and potential endorsement by participants.

11. The WPNT participants were **ENCOURAGED** to review IOTC-2017-WPNT07-06 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 (WPNT08).

12. The WPNT **NOTED** that this paper highlighted a number of data reporting issues that are mentioned every year and **AGREED** that the Secretariat has a programme of work which involves a number of data collection capacity building projects which aim to tackle these problems and assist CPCs with improving their data collection schemes.

13. 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 RELATING TO NERITIC TUNAS

4.1 Review of the statistical data available for neritic tunas: IOTC database

14. The WPNT **NOTED** paper IOTC–2017–WPNT07–07 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 *Mandatory statistical reporting requirements for IOTC Members and Cooperating non-Contracting Parties (CPCs)*, for the period 1950–2015. A summary is provided at Appendix IVa–IVf.

15. The WPNT **NOTED** that the stock structure for Indian Ocean Neritic Tuna species is currently unknown and the unit stock structure has been assumed. As the management of neritic tuna species is based on the whole India Ocean, separate assessments conducted for individual regions would not be very useful to provide the management advice. The WPNT **ENCOURAGED** the CPCs to work collaboratively to conduct assessment for the ocean-wide stock.

16. The WPNT **NOTED** that the IOTC size frequency database currently stores length measurements by year, fleet, gear, area, and length class – which vary according to species (e.g., 1cm intervals for neritic tunas, and 2cm intervals for tropical tunas). While most of the dataset for neritic tunas is divided into 1cm length bins, the smallest classes are aggregated as 1-10cm and the largest size classes are also aggregated into a bin with a wide size range. The WPNT **SUGGESTED** that, where possible based on the reported data, finer scale length bins are used for these extreme ends of the published datasets.

17. The WPNT **REQUESTED** that data on neritic tunas, including catch, effort, and size frequency data, are submitted to the IOTC Secretariat as per the requirements adopted by IOTC Members in Resolution 15/02. This

would allow the WPNT to develop additional or more refined stock status indicators for use in undertaking stock assessments on the neritic tuna species under the IOTC mandate.

18. The WPNT **NOTED** the main data issues that are considered to negatively affect the quality of the statistics for neritic tunas 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.

19. The WPNT further **NOTED** that there may also be other issues with the data such as a lack of disaggregation by gear and by species, which require the IOTC Secretariat to apply estimation techniques or algorithms to disaggregate the catches, and **REQUESTED** that the IOTC Secretariat provide documentation of the procedures for the estimation of nominal catches by species and gear to improve the transparency of catches disseminated for the IOTC Working Parties and stock assessment scientists.

20. The WPNT **REQUESTED** that the WPDCS consider using formal statistical techniques and modelling approaches to estimate data where there are gaps in the IOTC database, and to improve methods used to disaggregate catches by species and gear.

21. The WPNT **NOTED** that the procedure to disaggregate the nominal catch by species in the IOTC database is relevant to the neritic species and bycatch species such as sharks, and that catches of frigate and bullet tuna in particular are often reported as aggregated species.

22. The WPNT **NOTED** that the data estimation procedures will be described in detail as part of the process of developing the new IOTC database and these will be made available to scientists to review and improve the procedures.

23. The WPNT **RECALLED** that a first formal definition of the nominal catch disaggregation procedures adopted by the Secretariat is already available, including its configuration details, within the appendix of paper IOTC-2016-WPNT06-09 and **ENCOURAGED** scientists to assess and evaluate the process details and provide their feedback to the Secretariat.

24. The WPNT **NOTED** that compliance with data reporting obligations is particularly low for neritic tuna species, despite the importance of scientific data for stock assessment, and **REQUESTED** CPCs do their best to collect data and comply with data reporting requirements adopted by the IOTC. The WPNT further **RECOMMENDED** that mechanisms are developed by the Commission to improve current scientific advice by encouraging CPCs to comply with their data recording and reporting requirements.

25. The WPNT further **NOTED** the distribution of catches of neritic species are not equal across CPCs but that the largest fisheries are concentrated in Indonesia, I.R. Iran, India, and Pakistan (which together account for over 75% of the total catches of neritic species in recent years), and **REQUESTED** that these countries are prioritised by the IOTC Secretariat to improve the reporting of mandatory datasets.

26. The WPNT **NOTED** a number of reasons for the low levels of compliance in terms of data reporting of neritic species, including:

    i. Technical or financial constraints in implementing data collection, processing and reporting systems for fisheries datasets, particularly in the context of small-scale coastal fisheries, which account for the majority of catches of neritic species (e.g., Pakistan).

    ii. Limitations on current data collection mechanisms to fully report catches by species or gear according to the IOTC data requirements, or difficulties sampling IOTC species in sufficient numbers (e.g., Kenya, prior to implementation of the recent Catch Assessment Survey; also Thailand and Malaysia coastal fisheries, which catch relatively low quantities of neritic species; I.R. Iran catch-and-effort according to the IOTC data reporting requirements).

    iii. Difficulties understanding IOTC data reporting obligations, or issues processing data in the format required by IOTC (e.g., Thailand size frequency data in recent years).

    iv. Limited coordination between national institutions responsible for collecting IOTC datasets which often combine data collection activities across more than one fisheries agency, such as the Ministry of Fisheries and fisheries research organizations (e.g., India, Sri Lanka, Tanzania).

27. **NOTING** a number of long-standing data reporting or data quality issues that severely impact the assessment of neritic species, the WPNT **RECOMMENDED** that funds be made available to the IOTC Secretariat (either through the IOTC Regular Budget or from external sources) dedicated to capacity building activities, or data compliance and support missions, aimed at improving the availability of data for those countries identified as a priority for neritic species in terms of importance of catches. Specifically:

v. that the IOTC Secretariat conducts a Data Compliance and Support mission to I.R. Iran to assess the status of data collection and reporting of IOTC datasets, notably catch-and-effort, and the availability of data that could be used as a basis of a future standardized CPUE series gillnet fleets;

vi. when sufficient data is recovered, or made available, that the IOTC Secretariat allocates funds to assist with the development of a standardized CPUE series for gillnets, in collaboration with IOTC members, including organization of a joint-workshop or hiring of an international consultant;

vii. that the IOTC Secretariat formally communicates to India requesting the submission of mandatory datasets according to the requirements of IOTC Resolution 15/02 and, if necessary, conducts a Data Compliance and Support mission to facilitate the reporting of data to the IOTC;

viii. that the IOTC Secretariat continues to support the work of WWF-Pakistan and the Government of Pakistan in the evaluation and reporting of the crew-based observer program, and facilitate the reporting of length data and catch-and-effort collected by the observer log-books.

28. The WPNT also strongly **ENCOURAGED** participants to be more directly involved in the collection, and compilation of data submitted to the IOTC Secretariat, and to attend the Working Party on Data Collection and Statistics to share expertise in data collection systems for coastal fisheries and to facilitate improvements in data reporting compliance.

4.2 New information on fisheries and associated environmental data for neritic tunas

A meta-analysis of length frequency data from neritic tuna fisheries

29. The WPNT **NOTED** paper IOTC–2016–WPNT06–11 Rev_1 which described a new approach to analysing length-frequency data in the Indian Ocean, including the following abstract provided by the authors:

> *"Estimates of growth for neritic tuna species in the Indian Ocean are highly variable, based on a number of independent studies that have taken place in particular regions for particular time periods. This may be due to the presence of subpopulations of the stocks with different growth rates and maximum sizes or may be due to differences based on the sampling methods such as the size selectivity of different gear types. The large differences may have also resulted from different analytical methods. The majority of studies have used ELEFAN which was developed for closed populations where modal progression can provide better estimates of growth, and so may not provide good estimates of growth for migratory species. There is likely to be migration of fish across the entire area and so isolated studies using these techniques may not be appropriate for coastal tuna populations. Therefore, the IOTC Working Party on Neritic Tuna requested a meta-analysis take place which collates the local area studies to get an overview of parameters related to growth in the Indian Ocean".*

30. The WPNT **NOTED** the series of presentations to describe the study, methods and present preliminary results.

Overview of the IOTC length-frequency database and the challenges of using the data

31. The WPNT **NOTED** that the IOTC maintains a length-frequency database for six neritic tuna species covering the time period 1983 to 2015, with data from 10 countries (fleets) using a range of fishing gears. The sample size of each stratum {species, fleet, year, month, grid, gear} ranges from 1 to over 56,000 fish and over 2 million neritic tuna have been measured in total during the 32 years at a sampling rate of 6.7%. This large database is valuable for deriving growth parameters, however, it also presents several major challenges for growth estimation. Spatial and temporal coverages and sampling rate by gear types are unbalanced, e.g. there are no data from the southern Indian Ocean. There are too few samples in many strata, too large samples in other strata and a narrow size range, resulting in few identifiable age-classes and sex is also unknown. To tackle some of these difficulties, special analytical techniques are required.

Bayesian meta-analysis of growth parameters from length data-Part 1

32. The WPNT **NOTED** that growth parameters are essential for fisheries stock assessments, both in full age-structured models and simple data-poor methods. Growth parameters can be estimated from length-frequency data, however, the classic method cannot be applied because there the range in fish length within each stratum is too small, resulting in very few (mostly 2 to 3) identifiable age classes. Knowledge about the total number of age-classes and the age of the first mode is also lacking. A lack of clear length-modal progression over time prevents the use of the modal progression method, hence a Bayesian hierarchical meta-analysis method was developed for neritic tunas through this study. Under the hierarchical structure, it is assumed that there are multiple strata (populations) within a region, fish within a region follow the same growth model, and populations

across regions share the same underlying growth pattern. The hierarchical structure allows meta-analysis of multi-populations together in one model. This method involves two steps: identifying the modes in the length-frequency data and then fitting the growth model to the modes. Modes and their variances estimated in step-1 are incorporated into a modified von Bertalanffy growth model in step-2, which is implemented using Bayesian techniques. The age of the first mode of each population takes the form of a new parameter that has been added to the traditional Bertalanffy model. The model also allows ages to be estimated at a finer scale than an integer. Preliminary results from applying this 2-step approach to narrow-barred Spanish mackerel indicate that the data issues can be overcome using this method. Comparing model results to 32 independent growth studies for the same species in various regions of the Indian Ocean shows that this method yields comparable mean growth parameters but narrower confidence intervals.

Bayesian meta-analysis of growth parameters from length data--Part 2

33. The WPNT **NOTED** that there are three potential weaknesses in the traditional growth estimation approaches: (1) length-frequency data are used rather than raw data; (2) bin-sizes may affect the location of the mode in the frequency distribution; and (3) uncertainty in the modes is not directly integrated into the growth model. To resolve these issues, a new method is developed for modelling fish growth. This integrated Bayesian approach uses length measurement of individual fish rather than length-frequency of many fish and model individual length directly. Simulation testing indicates that this method can produce precise estimates when there are only two age-classes in each populations. However, applying the method to real neritic tuna with more than 40,000 measurements reveals computing difficulties--it requires large computer power both in memory and speed. This method is considered to be in the development stage.

34. The WPNT **NOTED** that, for growth studies, sampling should take place across all gears types to obtain individuals that cover a wide range of age classes, and that evenly distributed temporal and spatial coverage is preferable.

Neritic tuna fisheries in I.R.Iran

35. The WPNT **NOTED** paper IOTC–2017–WPNT07–09 which provided an overview of the neritic tuna catches in I.R.Iran, including the following abstract provided by the authors:

> *"Tuna catch in Iran played an important role during previous years and not only for food security and coastal community's subsistence but also carried out an effective economic role in the country fisheries activity chain. In this way, different species of Neritic Tuna fishes are considered as a group of valuable species in terms of harvesting marine aquatic species. Total aquatic catch of Iran in 2015 is equivalent to 582 thousand tonnes, of which 550 thousand tonnes attributed to catch in Persian Gulf and Oman Sea. Of 550 thousand tonnes, around 271 thousand tonnes belong to Large Pelagic, of which around 132 thousand tonnes attributed to Neritic tunas including: kawakawa, skjpjack tuna, longtail tuna, Frigate tuna, N-Barred Spanish Mackerel, I-Pacific king mackerel Different fishing crafts are engaged in tuna and tuna-like species fishing operation. According to estimation, more than 6000 fishing boats and dhows are engaged in Neritic tuna fishing operation. Generally numerous fishing gears are used by fishermen to catch Neritic Tunas, including: gillnet, purse seine, trolling and, longline fishery. Recently a large number of fishing boats and dhows are encouraged to use various angling methods to catch Tuna fishes and this method is developing among fishermen. This policy is in conformity with the management approaches to gradually transfer fishing method from gillnetting to other kind of angling. Conservation and Management regulations in Neritic tuna fishery sector is set out and regulated according to the country domestic regulations and IOTC approvals and resolutions. The paper will describes details of the stuff pointed out in the abstract and compare the Neritic Tuna catch statistic status and related indicators".*

36. The WPNT **NOTED** the recent declines in longtail tuna – which have decreased by around 25% compared to the highest catches recorded in 2010 (of around 81,000 t) – which may be partly explained by a shift in fishing areas given the targeting of tropical tunas in offshore waters as a result of the reduced threat of piracy in recent years. The WPNT also **NOTED** that management actions have been taken in recent years to reduce fishing effort by controlling permit and licenses.

37. The WPNT **NOTED** that the IOTC stock structure project has now started, and that a sampling plan is currently being developed to collect regional samples in collaboration with laboratories around the region, including I.R. Iran. The current assumption is of a single stock for longtail tuna in the Indian Ocean. The unit of stocks needs to be defined first.

Application of Remote Sensing in Predicting Suitable Fishing Areas for Pelagic fish in the continental shelf of Tanzania

38. The WPNT **NOTED** paper IOTC-2017-WPNT07-10 which described the use of remote sensing information to predict suitable pelagic fishing areas for the continental shelf of Tanzania, including the following abstract provided by the authors:

"The Tanzanian offshore fish stocks and in particular the pelagic fish resources are underexploited due to inadequate knowledge of locating good fishing grounds. This study explored the use of satellite remote sensing in identifying and locating Potential Fishing Zones (PFZ) for the pelagic fishery along the continental shelf of Tanzania. The study also assessed physical (Sea Surface Temperature SST) and biological (Chlorophyll a Chl-a) environmental variables information which determines the healthiness of fisheries. Mafia Island and Nungwi Zanzibar were selected as pilot study sites. Three days composite images of Chl a, SST and the SST front (MODIS 1 km spatial resolution) used for determination of PFZ were used to ground trueth geo-referenced fish catch data collected by four fishers from each of the above mentioned study sites. Monthly mean Chl a and SST (MODIS 4 km spatial resolution) were used to assess oceanography variables which determines heathenness of fisheries. The study found a strong correlation between insitu measured SST and satellite measured SST suggesting that remote sensing SST could be used to monitor changes of sea water temperature along the coast of Tanzania. There was a good overlay between the geo-reference fish catch data in most probable feeding areas both in Zanzibar channel and Mafia channel. This observation brings a hope for artisanal fisher towards accessing offshore productive fishing area. The long term monitoring of SST using EO satellite data reveals that coastal waters of Tanzania are warming with time and significantly affect Chl a of phytoplankton) productivity. The observed reduction in phytoplankton may have negative effect on fisheries resources productivity as well to the food security and social economic development of coastal community along the coast of Tanzania. There is a need for management intervention particularly developing copping strategies for fishing communities along Tanzania and the coasts of WIO countries at large".

39. The WPNT **NOTED** the importance of this type of study and the similarly interesting results from Pakistan suggesting there may be a frigate association with a 26°C thermal front.

Reconstruction of neritic tuna catches in Pakistan

40. The WPNT **NOTED** paper IOTC–2017–WPNT07–11 which provided a description of the work undertaken by WWF-Pakistan and the Government of Pakistan to reconstruct neritic tuna catches, including the following abstract provided by the authors:

"Neritic tuna forms important component of commercial fish landings of Pakistan. The statistical data of neritic tuna along with other species of tuna and tuna like species is regularly provided by Government of Pakistan to IOTC. WWF-Pakistan started a crew based observer programme in 2012 which includes collection of information about tuna landings, including neritic tuna. This data was collected which was used for calculating annual tuna landings for Pakistan. A major difference in the two set of data (Government data and observer data) was observed. In order to reconcile the two data, a catch reconstruction exercise of catches of tuna and tuna like species was made in consultation with the Government of Pakistan. The exercise revealed that the catch of tuna species in most cases is underreported. Data of landings of neritic tuna have also some disparities. The major difference was found to be in the case of frigate tuna whose annual landings was reported to be less than 100 m. tons by Government of Pakistan whereas data collected by the observers indicates its landings to be very high (about 9, 184 m. tons in 2015). Such disparities are now resolved in the two data sets and reconstructed data is now being submitted to IOTC by Government of Pakistan which will resolves issues related with tuna statistical data".

41. The WPNT **THANKED** WWF-Pakistan for supporting the Government of Pakistan with their compliance with IOTC Conservation and Management Measures, particularly through the implementation of the crew-based observer program, funded by the ABNJ Project, and **NOTED** that the Government of Pakistan may adopt the observer scheme as a national program under the Federal government so that the scheme will continue beyond the lifetime of the ABNJ project.

42. The WPNT also **CONGRATULATED** WWF's efforts in facilitating improvements in the quality and reporting of fisheries data by Pakistan to the IOTC, as a direct result of crew based observer project, which should result in an improvement in Pakistan's compliance with IOTC data reporting requirements in 2017.

43. The WPNT **NOTED** that, based on the data collected through WWF-Pakistan's crew based observer programme, landings of tuna and tuna like species have been estimated for 2013 to 2016 and have been used to validate Pakistan's official catch estimates. The observer data was also used for reconstructing Pakistan's

catches from 1999 to 2012, which has now also been accepted by the Government of Pakistan and was formally submitted to the IOTC Secretariat in June 2017.

44. The WPNT also **NOTED** that length frequency is also collected through WWF-Pakistan's crew based observer programme and will be reported to the IOTC Secretariat by the Government of Pakistan in due course.

45. The WPNT **NOTED** the large increase in Pakistan's tuna catches in recent years, according to the reconstructed catches, which may be related to periodic increases in the number of registered vessels as well as other factors.

46. The WPNT also **NOTED** that around 300 vessels are 'double registered' to Pakistan and Iran, and have also been reported fishing in other EEZs. The WPNT **REQUESTED** Pakistan and I.R. Iran clarify this issue to avoid any double-counting of fisheries statistics by these vessels.

Fishery reformation in Thailand

47. The WPNT **NOTED** paper IOTC–2017–WPNT07–12 which provided an overview of the status of neritic tuna fisheries during the transition period of fishery reformation in Thailand, including the following abstract provided by the authors:

"During the year of 2015-2017, Thailand has in the period of fishery reformation. The reformation included not only the principle legislations on fisheries but also the fishery registration system, fishing effort control via the fishing day scheme and the monitoring control and surveillance (MCS). This changing affects number of purse seiners and their effort. So, the consequent to the catch and catch rate of this fishing gear is expected. This report reviews the historical number of purse seiners, catch and effort as well as catch rate of neritic tuna in the Andaman Sea. The assessment of the changing through the data collection program is also presented. However, it is the ongoing activities. The result of the assessment is expected to be presented in the next fishing year".

48. The WPNT **NOTED** the limited number of days permitted in the fishery is implemented through the introduction of the licences moving from open access to limited access. The number of fishing days has been determined based on estimates of multi-species MSY, based on assessments carried on national datasets by the Department of Fisheries.

Sudan neritic tuna fisheries

49. The WPNT **NOTED** paper IOTC–2017–WPNT07–13 on the status of tuna fisheries in Sudan, including the following abstract provided by the authors:

"Tuna fisheries in Sudanese Red Sea Coast under utilization, their catch sorted as by catch in industrial fishery (trawling and purse seine), and in artisanal fishery (traditional fishery), annually estimated in both fishery not more than 400 tons. Seven species record in the Sudanese red sea coast, these were: Rastrelliger kanagurta (small eye tuna), Trachurus indicus (big eye tuna), Scomberomous commerson (Spanish mackerel), Scomberomorus guttatus (indo-pacific Spanish), Auxis thazard (Frigate mackerel), Katsawonus pelamis (Skipjack Tuna) and Thunnus albacores (yellow fin tuna). Tuna catch compose 2.8% to 5% from both fishery annually".

50. The WPNT **NOTED** that the paper provides an overview of the traditional fisheries in Sudan which have low levels of catches, however, the authors were unable to attend the meeting. The WPNT **REQUESTED** that the authors clarify the species composition, noting that some of the common names do not correspond to the scientific names.

Mozambique neritic tuna fisheries

51. The WPNT **NOTED** paper IOTC–2017–WPNT07–24 which provided an overview of artisanal fisheries of northern Mozambique, including the following abstract provided by the authors:

"Interviews and sampling on catch disembarked from artisanal (motorized) handline and seine net fisheries were conducted during 30 days, between May and June 2016, in the northern coast of Mozambique (10°30'S to 16°00'S), where artisanal fisheries seems to exhibit some targeting on neritic tuna specie and other coastal related species. This exercise intended to test the feasibility of implementation of an independent biological sampling program to improve the level of artisanal fisheries data collection and reporting to IOTC, in response to the issue of species misidentification, low sampling coverage and none sampling of size data for IOTC species, detected on the National Data Collection System for the Artisanal fishery (SNAPA). The results from interview ranked Katsuwonus pelamis and Auxis thazard as the main IOTC species captured by seine nets followed by Scomberomorus commerson and Euthynnus affinis. For handline, interviews ranked Katsuwonus pelamis, Auxis thazard, and Scomberomorus commerson as main species. Sampling at landing sites, indicated that catches from seiners are composed

by small pelagic species and neritic tunas. IOTC species represented approximately 37% of total sampled catch with Euthynnus affinis (15%), Auxis rochei (12%) and Auxis thazard (7%) as the main species. Other IOTC species included Katsuwonus pelamis (2%) and Scomberomerus commerson (0.3%). For handline, sampling indicated IOTC species as the dominant group with Istiophorus platypterus (12%), Scomberomorus commerson (12%), Thunnus obesus (10%) and Katsuwonus pelamis (7%) as the main captured species. Makaira indica, Makaira nigricans and Auxis thazard were the other IOTC species sampled from handline catches all representing 2%. The catch composition, in general, indicated that there is a significant tuna oriented artisanal fishery in the studied area which needs to be monitored under the IOTC requirements for data collection and reporting (resolution 15/02). Length frequency data of sampled species were compared with the literature sourced length at maturity (L50). Results indicated that impacts on juveniles may occur in these fisheries, which is an issue that needs to be investigated by a dedicated biological sampling program".

52. The WPNT **THANKED** Mozambique for presenting the results of the sampling project, particularly given the lack of length measurements for neritic species from the Western Indian Ocean, and **NOTED** that the low sample sizes of length frequency data were the result of the study being conducted over a single month with the intention of establishing the level of accuracy of data collected by beach recorders.

53. The WPNT **NOTED** that while Mozambique has well developed national fisheries databases, there are limitations in the data collection; particularly the availability of species-specific information for IOTC tuna and tuna-like species, as most catch data are aggregated across multiple species. The WPNT **ENCOURAGED** Mozambique to implement improvements to the collection of data for individual IOTC species, including the work done by data collectors in the field.

India neritic tuna fisheries

54. The WPNT **NOTED** paper IOTC–2017–WPNT07–25 which provided an overview of the fisheries for neritic tunas in India with special reference to *Auxis* spp., including the following abstract provided by the authors:

"The tuna fishery of India is supported by nine species, five neritic (longtail, kawakawa, striped bonito, bullet and frigate tuna) and four oceanic species (Yellowfin tuna, skipjack tuna, big eye and dogtooth). The tunas are exploited by the mechanized, motorized and non-mechanized units operating within the Indian EEZ. The neritic tunas are mostly exploited by gillnetters fitted with outboard engines and seines (Inboard engines as well as outboard engines). They are fished mainly along the continental shelf and adjacent oceanic waters. Gillnetters targets mainly large pelagics, especially Spanish mackerels, tunas, queenfishes and mahimahi; and the large meshed purse seines mainly exploit tunas, seerfishes, and large carangids. Catch of neritic tunas along the Indian coast during 2010 to 2016 was analyzed. The catch varied from 44,500 t to 64,044 with an annual average catch of 57,097 t. The neritic tunas formed the mainstay of the total tuna catch and comprised 62 to 74% of the total tuna catch. Two species of Auxis viz. A.thazard and A.rochei contributed to the neritic tuna catch. The distribution and exploitation of Auxis species is mostly along the south west coast found associated with knolls and oceanic ridges. The catch during the period ranged between 6,862t (2013) and 19,991 t (2011) with an average of 12,155 t. Auxis spp. formed 11 to 40% of the total neritic catch. A.thazard comprised 54.1% of the total Auxis catch. The fishery and important biological characteristics of these two species were studied. Trend analysis indicated that yield increased during 2016".

55. The WPNT **NOTED** that sampling is undertaken at the landing sites. No logbooks, or observers are available for these fisheries, while the only management are time-area closures along the east and west coasts of India.

56. The WPNT **NOTED** the high number of age classes identified (i.e., 4 classes) in this study compared with the low number of age classes identified in the meta-analysis, which may be due to the pooling of samples over a number of years in the study conducted on Auxis spp. in India.

57. The WPNT **NOTED** that India has been conducting genetic analyses to explore stock structures, although results indicate that there is no genetic difference between the East and West coast of India.

58. The WPNT further **NOTED** that there are a large number of genetic studies being conducted by individual countries doing internal investigations to establish whether multiple stock exists within a single country so the WPNT **ENCOURAGED** scientists from different countries to collaborate so that the assumption of a single stock for the entire Indian Ocean can be explored further. The WPNT **ENCOURAGED** countries to become involved in the IOTC Stock Structure project by contacting the lead research organisation, CSIRO, via the IOTC Secretariat.

5. LONGTAIL TUNA – REVIEW OF NEW INFORMATION ON STOCK STATUS

5.1 Review new information on the biology, ecology, stock structure, their fisheries and associated environmental data for longtail tuna

Review of the statistical data available for longtail tuna

59. The WPNT **NOTED** paper IOTC–2017–WPNT07–07 which provided an overview of the standing of a range of information received by the IOTC Secretariat for longtail tuna, in accordance with IOTC Resolution 15/02 *Mandatory statistical reporting requirements for IOTC Members and Cooperating non-Contracting Parties (CPCs)*, for the period 1950–2015. A summary is provided at Appendix IVd.

60. The WPNT **NOTED** the lack of papers on the species for assessment this year from CPCs and strongly **REQUESTED** all CPCs to consider the stock assessment schedule in the programme of work approved by the SC and to prepare relevant papers for the meeting.

61. The WPNT **NOTED** that catches from longtail tuna from a number of CPCs have declined in recent years (I.R. Iran, India, Indonesia, Malaysia, Thailand), with particularly large declines reported by I.R. Iran (≈25% reduction since 2011), however, the reasons for this are unclear. In the case of I.R. Iran, catches of tropical tunas declined with the onset of the threat of piracy in the late-2000s, during which time the catches of neritic tunas increased due to changes in targeting and relocation of fishing effort. While catches of tropical tuna are now increasing again, the catches of neritic tuna species have not decreased by the same magnitude, with the notable exception of longtail tuna.

62. The WPNT **AGREED** that investigating the recent trend in fishing effort is of crucial importance to understanding changes in the catch series and to improve the stock assessments and interpretation of results of catch based data poor stock assessments.

63. The WPNT **NOTED** that in addition to the onshore-offshore fleet dynamics for targeting neritic and tropical species respectively, there is also differential targeting of species within the neritic tunas themselves. Longtail tuna and Spanish mackerel are caught using driftnets of different mesh sizes, whereas the other species (frigate, kawakawa, king mackerel) are largely considered as bycatch. However, the effort data available are not specific to the different types of fishing gear so expert knowledge of issues such as changes in targeting in recent years as well as any changes in fleet structure will need to be explored to be able to fully utilise the datasets.

64. The WPNT **NOTED** that the revised estimates from Pakistan have not yet been included in the dataset and that these are likely to impact the overall catch trend, given that Pakistan is one of the three fleets with the highest catches of longtail tuna, and also taking into account that Pakistan catches of longtail tuna have not declined in recent years.

5.2 Data for input into stock assessments

65. No papers provided.

5.3 Stock assessment updates – Summary

Indian Ocean longtail tuna assessment using data-limited methods

66. The WPNT **NOTED** paper IOTC-2017-WPNT07-15 that details three stock assessment methods for longtail tuna 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 fairly challenging due to the lack of available data. This includes limited information on stock structure, few standardised CPUE series and little biological information. Data poor stock assessments have been conducted annually for Longtail tuna (Thunnus tonggol) since 2013 (Zhou and Sharma, 2013; Zhou and Sharma, 2014; Martin and Sharma, 2015; Martin and Robinson, 2016). This paper provides an update to these assessments based on the most recent catch information report to the IOTC, using two methods to assess the status of T. tonggol: (i) an updated Catch-MSY method (Kimura and Tagart 1982; Walters et. al. 2006; Martell and Froese 2012; Froese et al. 2016) and (ii) an Optimised Catch-Only Method, OCOM (Zhou et al., 2013). A further method, stochastic SRA, was also used to explore the potential for the inclusion of size data in the assessment".*

Indian Ocean longtail tuna assessment using a C-MSY Method

67. The WPNT **NOTED** the results from the C-MSY assessment method (Table 2, Fig. 1).

Table 2. Longtail tuna: Key management quantities from the C-MSY used in 2017.

Management Quantity	Aggregate Indian Ocean
Most recent catch estimate (year)	136 849 t (2015)
Mean catch – most recent 5 years[2]	157 493 t (2011 – 2015)
MSY (plausible range)	144 000 (105 000 –198 000)
Data period used in assessment	1950 – 2015
F_{MSY} (plausible range)	0.60 (0.48 - 0.74)
B_{MSY} (plausible range)	242 000 (166 000 – 354 000)
$F_{current}/F_{MSY}$ (plausible range)	1.00 (0.79 – 2.19)
$B_{current}/B_{MSY}$ (plausible range)	0.94 (0.43 – 1.19)
$SB_{current}/SB_{MSY}$ (80% CI)	n.a
$B_{current}/B_0$ (plausible range)	0.47 (0.22 - 0.60)
$SB_{current}/SB_0$ (80% CI)	n.a
$B_{current}/B_{0, F=0}$ (80% CI)	n.a
$SB_{current}/SB_{0, F=0}$ (80% CI)	n.a

n.a. not available; Geometric means and plausible ranges: results from a combination of a specific catch only method assumed prior information, as well as catch data.

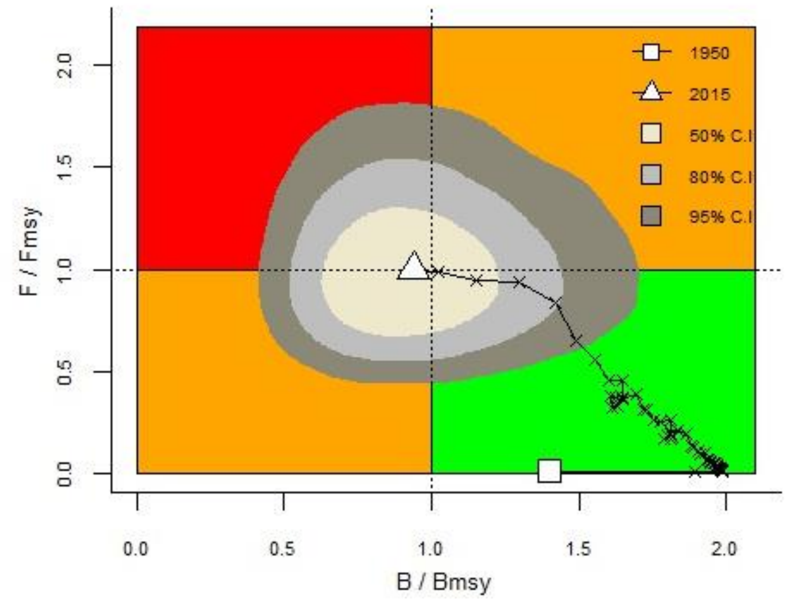

Fig. 1. Longtail tuna. C-MSY Indian Ocean assessment Kobe plot for longtail tuna. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

Indian Ocean longtail assessment using an Optimised Catch Only Method (OCOM)

68. The WPNT **NOTED** the results from the OCOM assessment method (Table 3, Fig. 2).

Table 3. Longtail tuna: Key management quantities from the OCOM used in 2017.

[2] Data at time of assessment

Management Quantity	Indian Ocean
Most recent catch estimate	136 849 t (2015)
Mean catch over last 5 years[3]	157 493 t (2011 – 2015)
MSY (plausible range)	139 710 t (103 025 – 183 977)
Data period used in assessment	1950 – 2015
F_{MSY} (plausible range)	0.43 (0.28 – 0.69)
B_{MSY} (plausible range)	318 940 (199 822 – 622 778)
$F_{current}/F_{MSY}$ (plausible range)	1.04 (0.84 – 1.46)
$B_{current}/B_{MSY}$ (plausible range)	0.94 (0.67 – 1.16)
$SB_{current}/SB_{MSY}$ (80% CI)	n.a.
$B_{current}/B_0$ (plausible range)	0.48 (0.34 – 0.59)
$SB_{current}/SB_0$ (80% CI)	n.a
$B_{current}/B_{0,\ F=0}$ (80% CI)	n.a
$SB_{current}/SB_{0,\ F=0}$ (80% CI)	n.a

n.a. not available; Geometric means and plausible ranges: results from a combination of a specific catch only method assumed prior information, as well as catch data.

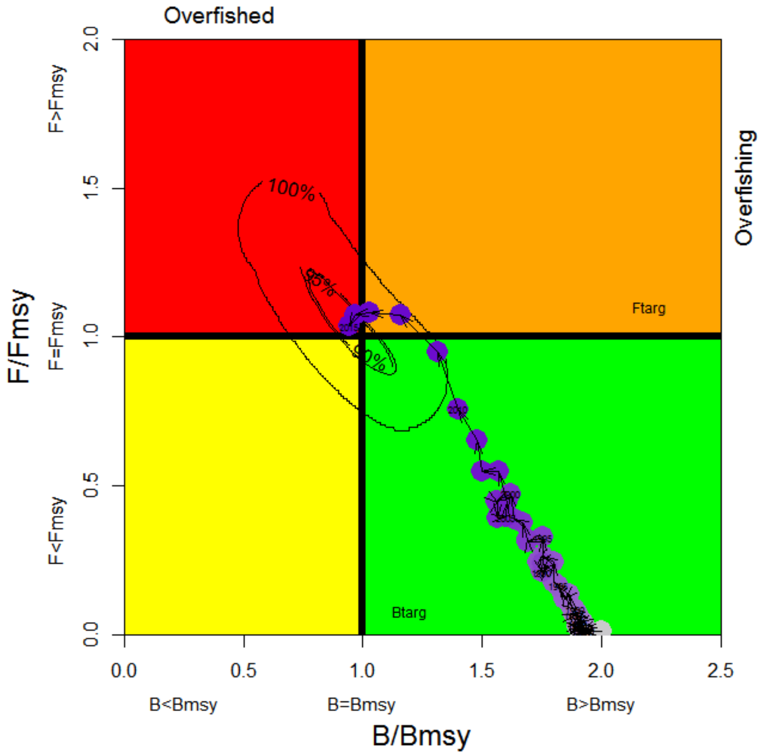

Fig. 2. Longtail tuna OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

69. The WPNT **NOTED** the modifications made to the C-MSY[4] model since the previous version (Catch-MSY).

70. The WPNT **NOTED** that the assessment results are highly sensitive to assumptions regarding productivity and final depletion. For C-MSY the choice of a high r from the range of plausible r values is poorly justified but has

[3] Data at time of assessment

[4] R Froese, N Demirel, G Coro, KM Kleisner, H Winker, 2016. Estimating fisheries references points from catch and resilience. *Fish and Fisheries* 18 (3), 506-526

a noticeable effect on estimates of F_{MSY}. To derive depletion values, a set of rules is used by the C-MSY method. For OCOM, a wider range of depletion values is used and r is based on informative priors from available life history information. The WPNT **AGREED** that it would be useful to compare model outputs from the OCOM and C-MSY methods when using the same assumptions for r and final depletion.

71. The WPNT **NOTED** that the C-MSY model should include the assumption that the stock is at virgin biomass at the start of the time series modelled, i.e., $B_0 = K$, given the lack of any recorded catches prior to then. While this will not affect the current results, it was agreed that in principle, expert opinion should be used where possible to adjust the priors and assumptions.

72. The WPNT **NOTED** relevant auxiliary analyses[5] conclude that catch contains information on stock status in only 22% of the stocks examined, however, Zhou S, Punt AE, Ye Y, et al.[6] examined correlations between the catch time series and stock status in the RAM legacy database which could be useful in choosing prior depletion values for the models. This study observed that the most important predictor is the trend in catch rather than single year predictors (e.g. $C_{final\ year}/C_{max}$). Using this approach it was estimated a current depletion for longtail of 44%. The WPNT **AGREED** that these results would be used to inform the prior range for model runs next year.

73. The WPNT **NOTED** that estimates of MSY are more stable than estimates of F_{MSY} or B_{MSY}, and therefore Catch/MSY may be a more suitable indicator for management than B/B_{MSY}y or F/Fv.

74. The WPNT **AGREED** that an alternative stock production function that is skewed to the left (i.e. $B_{MSY} / K < 0.5$) should be explored at the next assessment as this may be more suitable for tuna due to their life history characteristics.

75. The WPNT **NOTED** the adjustment for productivity at low population sizes in the C-MSY model is good as it prevents the stock from recovering too quickly, although it is arbitrary.

Indian Ocean longtail assessment using a stochastic SRA

76. The WPNT **NOTED** the results from the stochastic SRA assessment method (Table 4, Fig. 3).

Table 4. Longtail tuna: Key management quantities from the stochastic SRA used in 2017.

Management Quantity	Indian Ocean
Most recent catch estimate	136 849 t (2015)
Mean catch over last 5 years[7]	157 493 t (2011 – 2015)
MSY (95% CI)	130 240 t (75 974 – 190 475)
Data period used in assessment	1950 – 2015
F_{MSY} (95% CI)	0.25 (0.10 – 0.40)
B_{MSY} (95% CI)	561 691 t (308 737– 822 471)
$F_{current}/F_{MSY}$ (95% CI)	3.27 (0.82 – 6.69)
$C_{current}/MSY$ (95% CI)	1.04 (0.71 – 1.79)
$SB_{current}/SB_{MSY}$ (95% CI)	1.02 (0.32 – 1.86)
$B_{current}/B_0$	-
$SB_{current}/SB_0$ (95% CI)	0.39 (0.12 – 0.60)
$B_{current}/B_{0, F=0}$	-
$SB_{current}/SB_{0, F=0}$	-

Means and 95% confidence intervals: results from a combination of a specific catch only method assumed prior information, as well as catch data.

[5] Szuwalski CS and Thorson JT. Global fishery dynamics are poorly predicted by classical models. Fish and Fisheries; 2017; 00:1–11. https://doi.org/10.1111/faf.12226)

[6] Estimating stock depletion level from patterns of catch history. Fish and Fisheries; 2017; 18:742
751. https://doi.org/10.1111/faf.12201

[7] Data at time of assessment

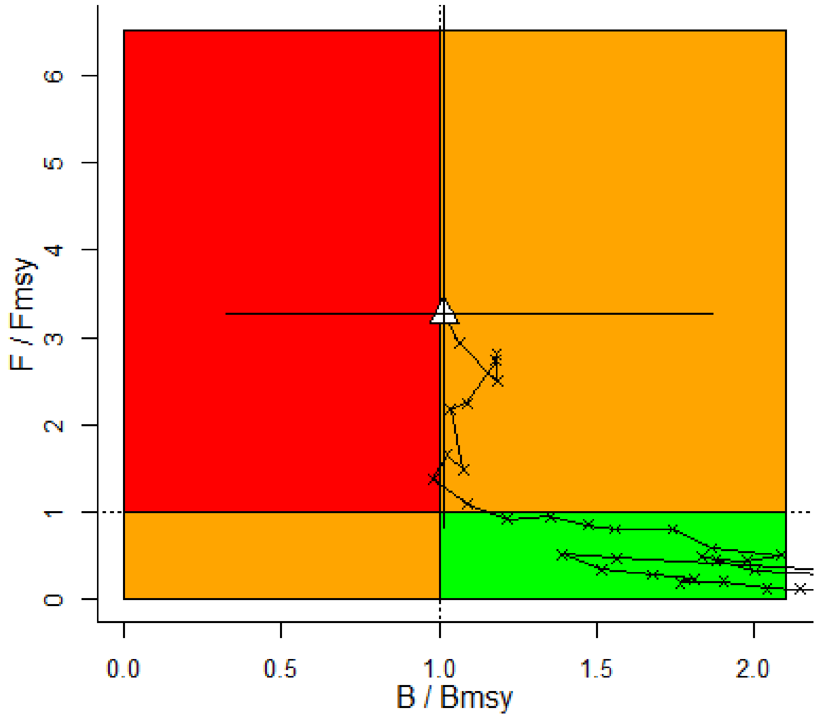

Fig. 3. Longtail tuna Stochastic SRA Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice.

77. The WPNT **NOTED** the routines available that may be used to slice the length frequency data into age frequency data[8].

78. The WPNT **AGREED** that the stochastic SRA approach provides an exploration of alternative methods that utilise other types of data, but may not be well supported by data currently available. In this situation it is preferable to develop a CPUE index and then apply the surplus production modelling approach (i.e. improve on the catch only approaches) rather than apply a more complicated model such as SRA.

79. The WPNT **AGREED** that abundance indices are crucially important for improving the assessments, and that the priority fleet for this analysis for longtail tuna is I.R. Iran, followed by Indonesia, Pakistan and India, given the substantial proportion of the total Indian Ocean catch taken by these fleets.

80. The WPNT **NOTED** the consistency in the assessment results between all models with respect to MSY and stock status which suggest that longtail tuna is currently being fished above the optimal rate of fishing mortality (F_{MSY}) and that the biomass has declined to below B_{MSY} levels due to the continued catches above MSY levels. Nevertheless, model results also suggest that fishing mortality has declined in recent years, corresponding to the decline in catches, and that catches are currently below the estimated MSY.

81. The WPNT **NOTED** that assumptions regarding the final depletion range are highly influential in determining the outcome of both models, but somewhat less so for the OCOM model given that a final simulation is run with no predefined final depletion level.

5.4 Selection of Stock Status indicators

82. **NOTING** that the C-MSY method is not a noticeable improvement on the previous Catch-MSY approach and the lack of representativeness of the size data used in the stochastic SRA, the WPNT **AGREED** that the OCOM

[8] Kell, L. T. and Kell, A. 2011. A comparison of age slicing and statistical age estimation for mediterranean swordfish (xiphias gladius). Collect. Vol. Sci. Pap. ICCAT, 66(4):1522– 1534.
Scott, F., Osio, G. and Cardinale, M. 2011. Comparison of age slicing methods. In Final Report of Working Group on the Assessment of Mediterranean Sea stocks – part 2 (STECF-11-14). EUR 25053.

model should continue to be used for providing management advice given its use of more informative priors and fewer assumptions about the final depletion levels compared with the C-MSY method.

83. The WPNT **NOTED** the importance of exploring alternative models or sources of information that can evidence results from data-poor assessments, and **REQUESTED** that other methods utilising other types of data and alternative models continue to be explored.

84. The WPNT **NOTED** that the type of advice provided for management should be appropriate for the model used. The stock biomass is largely driven by the depletion priors when using these catch based methods, whereas the yield is not so this provides a better indicator. The WPNT therefore **AGREED** that where data poor methods are used and stock status is highly uncertain but target yield can be estimated fairly robustly, it may be more appropriate to present management advice in an alternative way to a KOBE plot.

85. The WPNT **RECALLED** the recommendation that the SC request the WPM evaluate alternative methods of presenting management advice based on data poor stock assessments such as using reference points around target catches and **REQUESTED** that this is investigated further by WPM.

86. The WPNT **AGREED** that the next steps in assessments for neritic tunas should include requesting guidance from the Working Party on Methods on the presentation of advice from data-poor assessments, further refinement of catch-only methods (e.g. setting depletion levels), standardising CPUE series and collating size frequency distributions to broaden the range of indicators and models available to the WPNT, and exploring alternative assessment methods.

5.5 Development of technical advice on the status of longtail tuna

87. The WPNT **ADOPTED** the OCOM management advice developed for longtail tuna (*Thunnus tonggol*) as provided in the draft resource stock status summary – Appendix X, and **REQUESTED** that the IOTC Secretariat update the draft stock status summary for longtail tuna with the latest 2016 catch data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration.

6. NARROW-BARRED SPANISH MACKEREL – REVIEW OF NEW INFORMATION ON STOCK STATUS

6.1 Review new information on the biology, ecology, stock structure, their fisheries and associated environmental data for narrow-barred Spanish mackerel

88. The WPNT **NOTED** paper IOTC-2017-WPNT07-16 describing the results of a study on the stock structure of *Scomberomorus commerson* in the Northern Tanzania Coastal Waters, including the following abstract provided by the authors:

"The present study used mitochondrial DNA control region to investigate the genetic stock structure and phylogenetic relationship of 38 individuals of Spanish mackerel Scomberomorus commerson from the two localities in the northern Tanzania coastal waters. The study revealed that the Spanish mackerel were characterized by high levels of mitochondrial DNA genetic diversity at both haplotypes and nucleotide levels, indicative of large population size. The AMOVA results (F_{ST} = 0.0011) were statically low, indicating lack of genetic differentiation between populations (p = 0.925). Furthermore, AMOVA analysis showed that 99.50% of the total molecular variance was distributed within the populations and 0.5% distributed between populations. The Median-Joining network revealed a star-like median network; indicative of similar evolutionary history for the collected samples and existence of a recent historical population expansion. The present study recommends a single stock model for management of Spanish mackerel in the northern coastal waters of Tanzania. However, considering the migratory nature of this species, a co-management between coastal nations with further studies on the genetic stock structure covering large geographical areas is recommended if sustainable exploitation is to be achieved".

89. The WPNT **ENCOURAGED** the authors to seek funding to include more samples from a wider geographic area, and to collaborate with the IOTC stock structure project team that is investigating the stock structure of several IOTC species in the Indian Ocean.

90. The WPNT **NOTED** that sampling locations are geographically very close and that samples were collected during different time periods following the migration patterns of the species so it is not certain that samples are from different spawning locations, affecting the conclusions of the results.

91. The WPNT also **NOTED** that SEAFDEC is also conducting a study on the stock structure of kawakawa and longtail tuna in the eastern Indian Ocean.

92. The WPNT **NOTED** paper IOTC-2017-WPNT07-27 investigating the phylogenetic relationships of *Scomberomorus commerson* using sequence analysis of the mtDNA D-loop region in the Persian Gulf, Oman Sea and Arabian Sea, including the following abstract provided by the authors:

"Narrow-barred Spanish mackerel, Scomberomorus commerson, is an epipelagic and migratory species of family Scombridae which have a significant role in terms of ecology and fishery. 100 samples were collected from the Persian Gulf, Oman Sea and Arabian Sea. Part of their dorsal fins was snipped and transferred to micro-tubes containing ethanol; then, DNAs were extracted and HRM-Real Time PCR was performed to designate representative specimens for sequencing. Phylogenetic relationships of S. commerson from Persian Gulf, Oman Sea and Arabian Sea were investigated using sequence data of mitochondrial DNA D-loop region. None clustered Neighbor Joining tree indicated the proximity amid S. commerson in four sites. As numbers demonstrated in sequence analyses of mitochondrial DNA D-Loop region a sublimely high degree of genetic similarity among S. commerson from the Persian Gulf and Oman Sea were perceived, thereafter, having one stock structure of S. commerson in four regions were proved, and this approximation can be merely justified by their migration process along the coasts of Oman Sea and Persian Gulf. Therefore, the assessment of distribution patterns of 20 haplotypes in the constructed phylogenetic tree using mtDNA D-Loop sequences ascertained that no significant clustering according to the sampling sites was concluded".

93. The WPNT **NOTED** that the authors are planning to incorporate samples from other parts of the Indian Ocean to expand the study further.

Review of the statistical data available for narrow-barred Spanish mackerel

94. The WPNT **NOTED** paper IOTC–2017–WPNT07–07 which provided an overview of the standing of a range of information received by the IOTC Secretariat for narrow-barred Spanish mackerel, in accordance with IOTC Resolution 15/02 *Mandatory statistical reporting requirements for IOTC Members and Cooperating non-Contracting Parties (CPC)*, for the period 1950–2015. A summary is provided at <u>Appendix IVf.</u>

95. The WPNT **NOTED** that catches of narrow-barred Spanish mackerel have shown a continuous increasing trend, peaking in 2012, and have since remained at similar levels. The WPNT **NOTED** that a significant portion (>50%) of the catch is adjusted or estimated by the Secretariat (partly due to catches that are reported aggregated with Indo-Pacific king mackerel due to the similarities) including catches for some of the main fleets catching the species (e.g., Indonesia and India).

96. The WPNT **NOTED** that catch and effort and size data are highly incomplete and not available for the main fisheries, including Indonesia, India and I.R. Iran which together account for around two thirds of the catches of narrow-barred Spanish mackerel.

6.2 Data for input into stock assessments

97. No papers provided.

6.3 Stock assessment updates

Indian Ocean narrow-barred Spanish mackerel assessment using catch-based methods

98. The WPNT **NOTED** paper IOTC-2017-WPNT07-17 which described two stock assessments conducted for narrow-barred Spanish mackerel using catch-only methods, including the following abstract provided by the authors:

"Assessing the status of the stocks of neritic tuna species in the Indian Ocean is fairly challenging due to the data limitations. There is limited information available on stock structure, a lack of standardised (or nominal) CPUE series and biological information is also sparse. Since 2014, data-poor approaches using basic catch information have been used to assess the status of Indian Ocean narrow-barred Spanish mackerel (Scomberomorus commerson) (Zhou and Sharma, 2014; Martin and Sharma 2015; Martin and Robinson, 2016). These assessments are updated in this paper based on the latest catch information. Two methods are used to assess the status of S. commerson: (i) an updated Catch-MSY method (Kimura and Tagart 1982; Walters et. al. 2006; Martell and Froese 2012; Froese et al. 2016) and (ii) an Optimised Catch-Only Method OCOM (Zhou et al., 2013; Zhou et al., 2016). The other neritic species investigated in 2017, as requested by the Scientific Committee, using the same methods was longtail tuna (Thunnus tonggol) (Martin and Fu, 2017)."

99. The WPNT **NOTED** the consistency among these results and the previous assessments carried out as well as between assessment models. These suggest that narrow-barred Spanish mackerel is currently being fished above the optimal rate of fishing mortality (F_{MSY}) and that the biomass has declined to below B_{MSY} levels. However, considering the uncertainty in the data-poor methods and results, the point estimates should be interpreted with caution.

100. The WPNT **NOTED** that the stock status has deteriorated slightly since last year due to the continued high level of catches above MSY levels since 2009.

101. The WPNT **NOTED** that the differences between the C-MSY results this year and last year (i.e., this year being slightly more pessimistic) are mostly because catches have remained above MSY since 2010 resulting in continuing decline of biomass.

102. The WPNT **NOTED** that assumptions regarding the final depletion range are highly influential in determining the outcome of both models, but less so for the OCOM model given that a final simulation is run with no predefined final depletion level. Thus, the WPNT **CONSIDERED** that OCOM estimates are more reliable for providing the management advice.

103. The WPNT **NOTED** that a number of OCOM projections were carried out to explore constant catch and catch rates (where catch is variable catch, e.g. C_{2015}/B_{2015}), however, the WPNT **NOTED** that constant catch projections were used for the Kobe II Strategy Matrix available in the Executive Summary (Appendix XII) following the SC guidelines for the presentation of stock assessment results.

104. The WPNT **NOTED** that recently developed methods[9] based on relationships between catch history and final depletion levels found in the RAM-legacy database could be used to create a more informative prior for depletion levels. Application of this method suggests that the final depletion level for narrow-barred Spanish mackerel is 46 % which corresponds well with the OCOM result.

105. The WPNT **ENCOURAGED** the use of alternate prior ranges for population intrinsic growth (r) using all available life-history data based on the method of McAllister (2001).

106. The WPNT **NOTED** that in order to improve the assessments for neritic tunas, historic catches, length frequencies data and catch and effort data should be obtained to develop CPUE series which will allow for a broader range of indicators and models available to the WPNT. In the meantime, alternative assessment methods should be explored further and guidance requested from the Working Party on Methods on setting advice from data-poor assessments

Indian Ocean Narrow-barred Spanish mackerel: assessment using Catch-MSY method

107. The WPNT **NOTED** the results from the Catch-MSY assessment method (Table 5, Fig. 4).

Table 5. Narrow-barred Spanish mackerel: Key management quantities from the C-MSY used in 2017. Geometric means and plausible ranges across all feasible model runs.

Management Quantity	Aggregate Indian Ocean
Most recent catch estimate	154 177 t (2015)
Mean catch	151 502 t (2011 – 2015)
MSY (plausible range)	138 000 (104 000 to 183 000)
Data period used in assessment	1950 – 2015
F_{MSY} (plausible range)	0.60 (0.48 - 0.74)
B_{MSY} (plausible range)	232 000 (161 000 – 333 000)
F_{2015}/F_{MSY} (plausible range)	1.19 (0.94 – 2.59)
B_{2015}/B_{MSY} (plausible range)	0.94 (0.43 – 1.19)
SB_{2015}/SB_{MSY} (80% CI)	n.a
B_{2015}/B_0 (plausible range)	0.47 (0.22 - 0.60)
SB_{2015}/SB_0 (80% CI)	n.a
$B_{2015}/B_{0,\ F=0}$ (80% CI)	n.a

[9] Zhou et al., 2017. Estimating stock depletion level from patterns of catch history. Fish and Fisheries. DOI: 10.1111/faf.12201

SB_{2015} /$SB_{0,\ F=0}$ (80% CI)	n.a

n.a. not available; Geometric means and plausible ranges: results from a combination of a specific catch only method assumed prior information, as well as catch data.

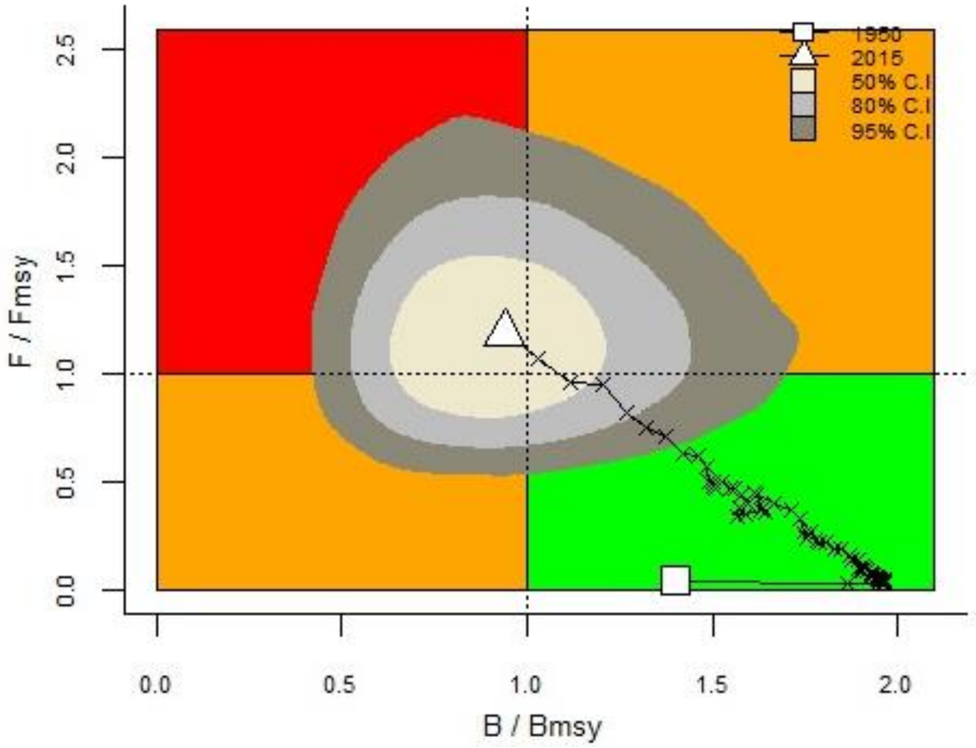

Fig. 4. Narrow-barred Spanish mackerel. C-MSY Indian Ocean assessment for *S. commerson.* The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

Indian Ocean Narrow-barred Spanish mackerel: assessment using OCOM

108. The WPNT **NOTED** that the OCOM method would be used for stock status advice (Table 6, Fig. 5).

Table 6. Narrow-barred Spanish mackerel: Key management quantities from the OCOM used in 2017.

Management quantity	Indian Ocean Region
Most recent catch estimate (year)	154 177 t (2015)
Mean catch – most recent 5 years[10]	151 502 t (2011 – 2015)
MSY (plausible range)	130 720 t (95 598 – 180 164)
Data period used in assessment	1950 – 2015
F_{MSY} (plausible range)	0.35 (0.18 – 0.7)
B_{MSY} (plausible range)	370 974 (186 702 – 881 633)
$F_{current}/F_{MSY}$ (plausible range)	1.28 (1.03 – 1.69)
$B_{current}/B_{MSY}$ (plausible range)	0.89 (0.63 – 1.15)
$SB_{current}/SB_{MSY}$ (80% CI)	-
$B_{current}/B_0$ (plausible range)	0.44 (0.31 – 0.57)
$SB_{current}/SB_0$ (80% CI)	-
$B_{current}/B_{0,\ F=0}$ (80% CI)	-

[10] Data at time of assessment

$SB_{current}/SB_{0,\ F=0}$ (80% CI)	-

n.a. not available; Geometric means and plausible ranges: results from a combination of a specific catch only method assumed prior information, as well as catch data.

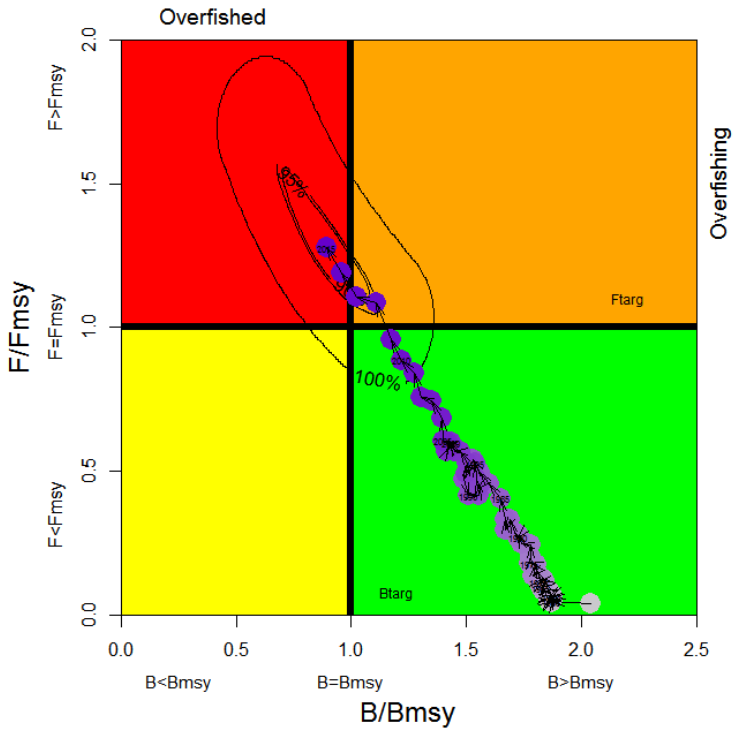

Fig. 5. *S. commerson* OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

6.4 Selection of Stock Status indicators

109. **NOTING** that the Commission adopted Resolution 12/01 *On the implementation of the precautionary approach*, which effectively means that in a situation of increased uncertainty (e.g. data poor situations), a more precautionary approach should be undertaken when developing advice and possible management actions, the WPNT **AGREED** that a precautionary approach should be adopted in framing the management advice for narrow-barred Spanish mackerel.

110. The WPNT **NOTED** that the results from both models were very similar, suggesting the stock status is overfished and overfishing is occurring. The WPNT **AGREED** that management advice on stock status for narrow-barred Spanish mackerel should be based on the OCOM model given its use of more informative priors and fewer assumptions about the final depletion levels compared to the C-MSY method.

8.5 Development of technical advice on the status of narrow-barred Spanish mackerel

111. The WPNT **ADOPTED** the management advice developed for narrow-barred Spanish mackerel (*Scomberomorus commerson*) as provided in the draft resource stock status summary – <u>Appendix XII</u> and **REQUESTED** that the IOTC Secretariat update the draft stock status summary for narrow-barred Spanish mackerel with the latest 2016 catch data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration.

7. OTHER NERITIC TUNA SPECIES – REVIEW OF NEW INFORMATION ON STOCK STATUS

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

Review of data available at the Secretariat for other neritic tuna species

112. The WPNT **RECALLED** paper IOTC–2017–WPNT07–07 which provided an overview of the standing of a range of information received by the IOTC Secretariat for kawakawa, bullet tuna, frigate tuna and Indo-Pacific king mackerel, in accordance with IOTC Resolution 15/02 *Mandatory statistical reporting requirements for IOTC Members and Cooperating non-Contracting Parties (CPCs)*, for the period 1950–2015. Summaries are provided in Appendix IVa, b, c and e.

Frigate tuna

Maldives neritic tuna fisheries

113. The WPNT **NOTED** paper IOTC–2017–WPNT07–18 which provided an overview of catches of neritic tuna by the Maldives fleet, including the following abstract provided by the authors:

"Indian Ocean frigate tuna catch has increased steadily for the last 20 years, with a total catch of 102,000 t being reported in 2014. In Maldives, the catch, predominantly caught using PL gear, have been highly fluctuating without an obvious trend. In terms of data, Maldives has a long history of catch and effort data collection from its tuna fisheries. Vessel specific pole and line CPUE data available from 2004 onwards was standardized and used for stock assessments of Indian Ocean skipjack tuna and kawakawa. The frigate tuna catch records in the dataset were explored and is presented. Frigate tuna is important in the northern and central atolls where it is mostly caught by the mid-sized vessels that would operate within and in close proximity of the atolls. In contrast, significantly low catches were reported from the southern atolls where skipjack tuna fishery is well established. A clear pattern of reduced number of records, and in turn, reduced effort and frigate catch from 2010 onwards was also revealed. Similarly, the quarterly nominal CPUE showed contrasting trends in the pre and post 2009 data periods which suggests underlying issues with the explored frigate positive subset of the CPUE dataset rather than a true decline in nominal CPUE."

114. The WPNT **NOTED** the sharp decline in reported catches of frigate tuna from around 2010 onwards (i.e., from around 3000 t in 2010 to 115 t in 2015) coinciding with the introduction of a new logbook system in place of the previous island office reporting system, and **REQUESTED** Maldives investigate the reason for the decline in catches, with the assistance of the IOTC Secretariat, and explore whether catches of frigate tuna in recent years need to be revised.

Madagascar neritic tuna fisheries

115. The WPNT **NOTED** paper IOTC–2017–WPNT07–19 which provided an overview of sampling of frigate tuna by the Madagascar fleet, including the following abstract provided by the authors:

"Almost the six neritic tuna (and mackerel) species under the IOTC mandate are caught in Madagascar waters by small scale and artisanal fisheries using gillnets, handline and trolling. However, no catch monitoring has so far been specifically carried out for neritic tunas concerning these fisheries. Regarding the industrial fishing, foreign purse seiners often caught Frigate tuna in the Madagascar waters while operating in the Mozambique Channel, particularly from February to June. Since catches of Frigate tuna are considered as byproducts and are seldom recorded in the logbooks, Madagascar has recently started from 2011 to evaluate and sample the catches of frigate tuna at the port of landing. The results of the sampling are presented in this paper, mainly the annual variation of the Frigate tuna landed and its length frequency data".

Kawakawa

Malaysia neritic tuna fisheries

116. The WPNT **NOTED** paper IOTC–2017–WPNT07–20 which provided an overview of catches of neritic tuna by the Malaysian fleet, including the following abstract provided by the authors:

"Neritic tuna species are among the important pelagic fish caught by commercial and traditional fishing gears. The main neritic tuna found in Malaysian waters were longtail (Thunnus tonggol) and kawakawa (Euthynnus affinis) while frigate tuna (Auxis thazard) were rarely caught because they were mostly found toward the offshore area. In 2016, neritic tuna contributed 10% of the total Malaysia's marine fish landings. Purse sienes are the most important fishing gear in neritic tuna fisheries, especially the 40-69.9 GRT and >70 GRT vessel size. It contributed more than 80% of the annual catches of neritic tuna in Malaysia. Monthly length weight

measurement of the three species of neritic tuna showed a relationship of W = 0.000020 L 2.9678 for kawakawa in the Malacca Straits. Monthly length distribution analysis indicated that larger kawakawa are more readily available in September/October and November, respectively. This present study will also include information on biological aspects of E. affinis such as growth parameters and length distribution."

117. The WPNT **NOTED** that a high proportion of purse seine catches of neritic tunas in the Kuala Perlis region were juveniles.

Kenya neritic tuna fisheries

118. The WPNT **NOTED** paper IOTC–2017–WPNT07–21 which provided a description of the seasonality, size and gear impacts in the Kenyan fisheries, including the following abstract provided by the authors:

"This paper looks at the seasonality, length frequency and the impact of gear selectivity on kawakawa (Euthynnus affinis) caught between May 2014 and June 2015. During the sampling period, a total of 4,457 fish were recorded with lengths ranging between 10 and 96 cm. The period between October and March was to the peak season for the kawakawa catches. Most of the fish were caught using monofilament nets while handline, trolling lines and ringnet were the other main gears with all the four gears representing 88% of the sampled catch. Kawakawa catches from gill nets, trolling lines and ringnet were larger with average sizes of 60.3±4.1 cm, 56.5±4.0 cm and 55.0 ± 2.8 cm for standard error respectively while handline and monofilament nets caught smaller sized individuals with average lengths of 44.5± 6.1 cm and 27.0±3.0 cm respectively. Most of the small sized kawakawa were caught using monofilament nets and small sized hooks and mainly were reported from the creeks. To mitigate against catches of juvenile kawakawa in the creeks, removal of monofilament nets and hook size restriction in the marine fishery is important. A study on the maturity of kawakawa in the Kenyan waters is relevant to determine the length at massive maturity and can assist in the improvement of gear management in the marine waters.".

119. The WPNT **ACKNOWLEDGED** the excellent progress Kenya has made implementing the Catch Assessment Survey, and **REQUESTED** that the IOTC Secretariat continue to provide support, particularly in the quality assurance of the survey results and technical advice on development of the new in-house database and electronic data reporting in field.

120. The WPNT **NOTED** the presence of a substantial proportion of juveniles in the artisanal catches of the artisanal fisheries. Very few fleets report catches of such small individuals, Thailand and Malaysia being the other exceptions, and given the limited migration of these juveniles their presence may be potentially be indicative of spawning patterns. Nevertheless, many other fisheries do not select for such small fish (e.g., the large scale driftnets) and there are minimum size limits imposed in other areas and so surveys would need to be conducted to fully explore such hypotheses.

121. The WPNT **ENCOURAGED** Kenya to report information on length frequencies collected by the Catch Assessment Survey, particularly given the lack of samples for neritic species in the IOTC database from the western Indian Ocean.

Sri Lanka neritic tuna fisheries

122. The WPNT **NOTED** paper IOTC–2017–WPNT07–26 providing an overview of the Sri Lanka fisheries for neritic tunas in 2014 and 2015, including the following abstract provided by the authors:

"Sri Lanka is one of the most important tuna fish producing island nations in the Indian Ocean. Of the tuna; neritic tuna namely Euthynnus affinis (kawakawa), Auxis rochei (bullet tuna) and A. thazard (frigate tuna) are only targeted seasonally by coastal fishing crafts operated in the country. However multiday tuna gillnet boat operations catch neritic tuna while they target oceanic tuna viz. yellowfin and skipjack tuna. Today gillnet has become key fishing gear in the multiday tuna fishery within and beyond EEZ and has firmly been established as the dominant gear for made neritic tuna as a non target group. Consequently from 2014-2015 the percentage catch amounts of neritic tuna in the gill nets within EEZ were 55 and 34. Of the neritic tuna, bullet tuna averagely contributes 39% while frigate tuna 38% and Kawakawa 23%. Relatively higher the amounts of bullet tuna in the gill net catches may resulted from multiple reasons such as stock status and seasonality. Fluctuations in monthly average landings for three different species during 2014 to 2015 could be the result of reduction of gillnet fishing pressure within EEZ of Sri Lankan waters or potential decreases in the abundance of resources in the tuna fishing grounds". – See paper for full abstract.

123. The WPNT **NOTED** that the length of gillnets used by Sri Lanka is approximately 2-2.5km and 14-15.5cm mesh size.

124. The WPNT **NOTED** that all vessel operating on the high seas now have VMS so the logbook records of these vessel can now be verified. While the correspondence between the geospatial information reported in logbooks was initially fairly low, it is now improving due to the verification work undertaken. While the coastal vessels operating within the Sri Lankan EEZ are not required to have VMS installed, an electronic logbook system is currently being implemented that will record geospatial information. This pilot project has started with approximately 10-20 tablets used on vessels so far with the plan to expand the activities to cover 40% of the multi-day vessels which are operating in the EEZ of Sri Lanka.

125. The WPNT **NOTED** that while the information presented covers the period 2014-2015, Sri Lanka also has some very good historical datasets and **REQUESTED** Sri Lanka to work on these datasets.

7.2 Data for input into stock assessments

126. No papers provided.

7.3 Stock assessment updates

Spawning Potential Ratio for Kawakawa

127. The WPNT **NOTED** paper IOTC-2017-WPNT07-23 which described a stock assessment for kawakawa using a length-based Spawning Potential Ratio (SPR) method, including the following abstract provided by the authors:

"Kawakawa (Euthynnus affinis Cantor, 1849) is the one of the important catch for small-scale fishermen in eastern Indian Ocean waters south of Indonesia. However, the limited data of this species create several obstacles to implement proper management strategies. The objective of this study is to investigate the stock status of kawakawa in Indonesia from spawning potential ratio (SPR) analysis. The SPR analysis is convincing tools as biological reference point and to inform management strategies for data-limited fisheries Analyses were carried out based on a number of 2,115 length frequency data from sampled fish landed in Tanjung Luar Port (West Nusa Tenggara) and Oeba Port (East Nusa Tenggara), Indonesia. Monthly based data were collected from January to December 2016. The length distribution of collected fish ranged from 25 to 71 cm. The methods used to perform stock assessment analysis is length-based spawning potential ratio (LBSPR). The result showed that the estimated SPR was 52% above the target (40%). This indicated that the utilization of kawakawa in Indonesia was under exploited. As a result, local authority can support the fishermen to increase the effort to improve their catch for this species".

128. The WPNT **NOTED** that the length-based SPR assessment method is based on the dubious assumption of equilibrium length distributions so using it as evidence that the exploitation rate can be increased is probably not a good idea.

129. The WPNT **NOTED** that the use of length-based SPR assessment approach is of concern as the stock is not local to the sampling area. The model is based on the assumption that there is an isolated stock within the area and is therefore not appropriate if fish are migrating.

130. The WPNT **NOTED** that it is always desirable for assessments to be conducted at the stock level rather than for just a portion of the stock.

7.4 Selection of Stock Status indicators for other neritic tuna species

131. The WPNT **NOTED** that there are still three neritic tuna species for which no stock status advice has been provided. Nevertheless, stock assessments are not a necessary prerequisite to determining stock status and in the absence of available data for assessments, alternative methods of deriving stock status may be explored. This might include some of the approaches based directly on trends in catch history and other available information[11].

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[11] e.g. Grainger and Garcia, 1996. Chronicles of marine fishery landings (1950 - 1994): Trend analysis and fisheries potential. *FAO Fisheries Technical Paper. No. 359*. Rome: FAO. 51 pp.;

Costello et al., 2012. Status and solutions for the world's unassessed fisheries. Science 228, 517-520;

Zhou *et al. 2017*. Estimating stock depletion level from patterns of catch history. *Fish Fish*. 2017*;*18*:*742–751. https://doi.org/10.1111/faf.12201

132. The WPNT **NOTED** that neritic tunas are often caught together in the multispecies fisheries, resulting in mixed catches and a correspondingly strong correlation in their catch trends (Fig. 6). Based on these catch trajectories, which are generally increasing sharply before reaching a plateau, it appears that the most stocks are at the very least approaching target reference points. If the species for which assessments have been carried out so far can be considered indicator species for the fisheries then this would suggest that most stocks are currently around target reference points levels.

133. Nevertheless, while some correlation in the catches of nominal catches of neritic tuna species may be expected due to the mixed species nature of the fisheries, the WPNT **NOTED** that the very high correlations observed, particularly in early years, may also be due to the estimation procedures used when species are reported as aggregates and therefore more indicative of the poor data quality.

134. **NOTING** that the Commission adopted Resolution 12/01 *On the implementation of the precautionary approach*, which effectively means that precaution should be used in a situation of increased uncertainty (e.g. data poor situations), the WPNT **AGREED** that a precautionary approach should be undertaken when developing advice and possible management actions.

135. If a precautionary approach to management is to be considered, then the WPNT **AGREED** that in the absence of an assessment, the advice provided to the Commission should be to ensure that future catches do not exceed the average catches of 2009–2015. This reference period was selected based on the timeframe in which the most recent assessments of longtail tuna, kawakawa and narrow barred Spanish mackerel were estimated to reach MSY.

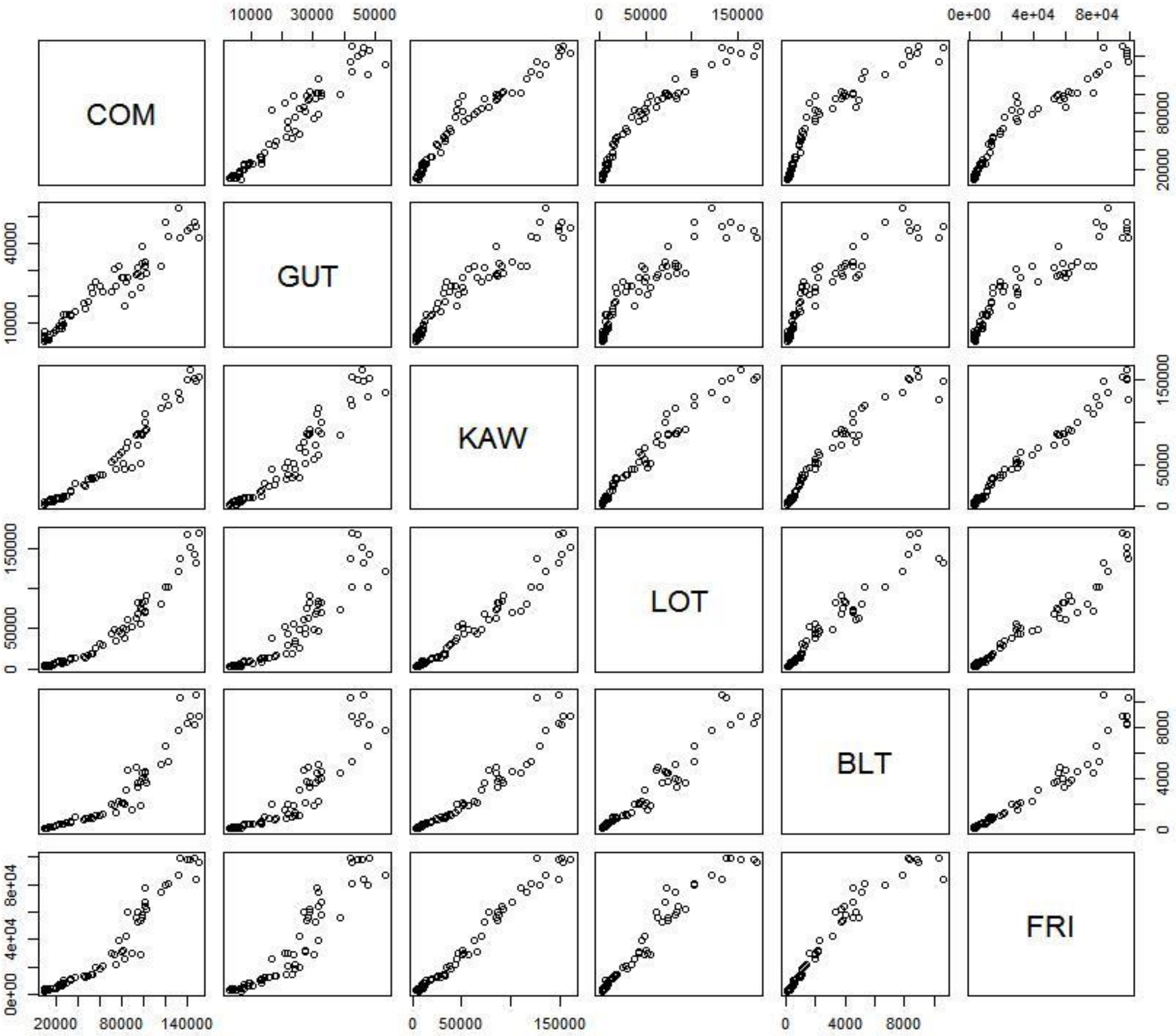

Fig. 6. Scatterplot matrix showing the correlations between catches of the six neritic tuna species. COM *(Scomberomorus commerson)*, GUT *(Scomberomorus guttatus*), KAW *(Euthynnus affinis)*, LOT *(Thunnus tonggol)*, BLT (*Auxis rochei*) and FRI (*Auxis thazard*) (1950-2015).

7.5 Development of management advice for other neritic tuna species

136. The WPNT **ADOPTED** the management advice developed for kawakawa, bullet tuna, Indo-Pacific king mackerel and frigate tuna as provided in the draft resource stock status summary for each species and **REQUESTED** that the IOTC Secretariat update the draft stock status summary with the latest (2016) catch data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration:
   - Kawakawa (*Euthynnus affinis*) – Appendix IX
   - Bullet tuna (*Auxis rochei*) – Appendix VII
   - Frigate tuna (*Auxis thazard*) – Appendix VIII
   - Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix XII.

8. PROGRAM OF WORK (RESEARCH AND PRIORITIES)

137. The WPNT **RECALLED** that the SC, at its 17th Session, **REQUESTED** that during the 2015 Working Party meetings, each group not only develop a Draft Program of Work for the next five years containing low, medium and high priority projects, but that all High Priority projects are ranked. The intention is that the SC would then be able to review the rankings and develop a consolidated list of the highest priority projects to meet the needs of the Commission. Where possible, budget estimates should be determined, as well as the identification of potential funding sources (SC17 Para.178).

10.1 Revision of the WPNT Program of Work (2018–2022)

138. The WPNT **NOTED** paper IOTC-2017-WPNT07-08 providing an outline of the programme of work for 2018 – 2022.

139. The WPNT **AGREED** that a new item on data mining and collation should be added as a fundamental piece of work to be undertaken as a priority and **RECOMMENDED** that this work is supported by the IOTC Secretariat. The WPNT further **AGREED** that data collation has been identified as the main priority of the group and allocated this the highest priority ranking.

140. **ACKNOWLEDGING** the importance of indices of abundance for future stock assessments, the WPNT **RECOMMENDED** that the development of standardised CPUE series is explored, with priority given to fleets which account for the largest catches of neritic tuna and tuna-like species (e.g., I.R. Iran, Indonesia, India, Pakistan, and Sri Lanka).

141. The WPNT **ACKNOWLEDGED** that sufficient time series of data must be available for CPUE standardisation and that the success of any projects/workshops would be dependent on participants sourcing and making available the required information in advance. The WPNT further **REQUESTED** the IOTC Secretariat also formally request the data from key CPCs and seek their support in accessing, compiling and analysing these data. Key datasets held were identified during the meeting and are described in Table 7.

Table 7. Neritic tuna datasets by CPC

CPC	Fishery	Logbook data	Port sampling data	Contact organisation
Thailand	Coastal Seine	2015? - present	>10 years	Marine Fisheries Research and Development Division, Department of Fisheries, Thailand
Malaysia	Seine/trawl/gillnet	-	1980 - present	nor_azlin@dof.gov.my
Indonesia[12]	Line/seine	2013-2016	2014-2016	Directorate General Capture Fisheries (DGCF) Ministry of Marine Affairs and Fisheries of Indonesia.
Oman	Artisanal fleet (unspecified gear types)	-	1984 - present	
I.R.Iran	Gillnet, PS	GN >10 yrs, PS 5-6 years	2013 - present	IFO
Sri Lanka	Gillnet/ Longline/ring net/other	2015-present (2016 data more precise)	>10 years	NARA/ DFAR

[12] Indonesia: Regarding neritic data report to IOTC, RITF (Research Agency) are in communication with the DGCF (current institution that have mandate to report data to IOTC).

Maldives		Very recent (2004-2015 exist but quality uncertain)		MRC
India	Gillnet/seine/trawls/ Artisanal gears		>10 years	CMFRI
Tanzania	Artisanal	1980s		
Mozambique	Artisanal			Fisheries Research Institute (IIP)
Kenya	Sport fisheries data			
Pakistan	Gillnet fleet	[13]	1985-1995; 2012	Marine Fisheries Department, Govt. Pakistan

142. The WPNT **AGREED** that the development of CPUE is the second highest priority for the working party, closely following the accessing and collation of available datasets.

143. The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2018–2022), as provided at Appendix VI.

9. OTHER BUSINESS

9.1 Election of a chair and vice-chair of the WPNT for the next biennium

144. The WPNT **NOTED** that the 1st term of the current Chairperson, Dr Farhad Kaymaram and Vice-Chairperson, Dr Mathius Igulu are due to expire at the closing of the current WPNT meeting and as per the IOTC Rules of Procedure (2014), participants are required to re-elect or elect a Chairperson for the next biennium.

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

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

146. 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 2018, by an Invited Expert:
    1) data poor assessment approaches (e.g. catch only methods, Bayesian approaches);
    2) stock structure/connectivity; including from regions other than the Indian Ocean;

147. The WPNT **NOTED** with thanks the excellent contributions of the invited expert for the meeting, Dr Charles Edwards (NIWA – New Zealand). The WPNT also **THANKED** Dr Shijie Zhou (CSIRO – Australia) for contributing his expertise over the past six years and for his novel approach to analysing the length frequency data of the Indian Ocean neritic tuna species to improve growth estimates for assessment models.

9.3 Date and place of the 8th Working Party on Neritic Tunas

148. The WPNT **NOTED** that Kenya, Mozambique, and Pakistan have expressed interest in potentially hosting for the 8th Session of the WPNT and **RECOMMENDED** the SC consider the preferred dates of 4-7 April 2018.

Meeting participation fund (MPF)

149. The WPNT participants were unanimous in their thanks for the support for their participation in the meeting due to the MPF and **RECOMMENDED** that the Scientific Committee also consider the WPNT08 as a high priority meeting for MPF.

150. The WPNT **RECOMMENDED** that the SC and Commission note the following:
    1) The participation of developing coastal state scientists to the WPNT has been consistently high following the adoption and implementation of the IOTC Meeting Participation Fund adopted by the Commission in 2010 (Resolution 10/05 *On the establishment of a Meeting Participation Fund for developing IOTC Members and Non-Contracting Cooperating Parties*), now incorporated into the IOTC Rules of Procedure (2014), as well as though the hosting of the WPNT in developing coastal State Contracting Parties (Members) of the Commission (Table 8).

[13] Crew based observer data available from 2013 to present on request from Govt. of Pakistan, collected by WWF-Pakistan.

2) The continued success of the WPNT, at least in the short term, appears heavily reliant on the provision of support via the MPF which was established primarily for the purposes of supporting scientists to attend and contribute to the work of the Scientific Committee and its Working Parties.
3) The MPF should be utilised so as to ensure that all developing Contracting Parties of the Commission are able to attend the WPNT meeting, as neritic tunas are very important resources for many of the coastal countries of the Indian Ocean.

Table 8. Working Party on Neritic Tunas participation summary.

Meeting	Host Country	Total participants	Developing CPC participants	Host country participants	MPF recipients
WPNT01	India	28	23	11	9
WPNT02	Malaysia	35	26	13	10
WPNT03	Indonesia	42	34	16	11
WPNT04	Thailand	37	28	12	13
WPNT05	Tanzania	26	26	16	9
WPNT06	Seychelles	20	12	0	8
WPNT07	Maldives	26	18	5	13
Total		214	167	73	73

9.4 Review of the draft, and adoption of the Report of the 7th Working Party on Neritic Tunas

151. The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT07, 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 2017 (Fig. 8):

- 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

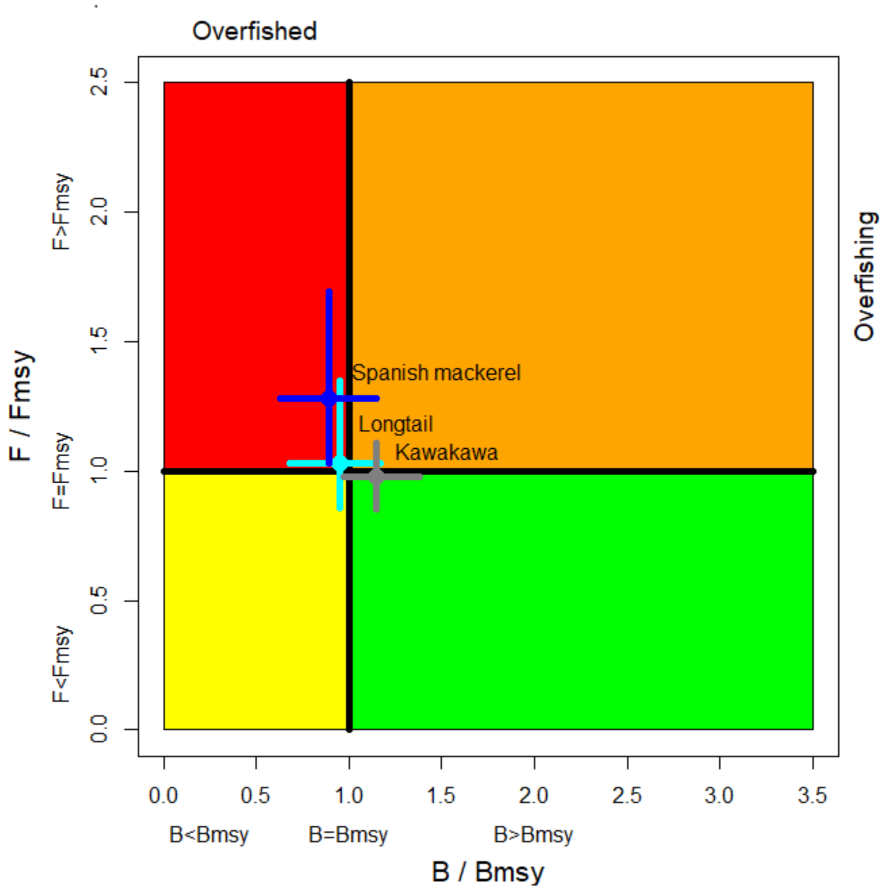

Fig. 7. Combined Kobe plot for longtail tuna, narrow-barred Spanish mackerel and kawakawa, showing the estimates of stock size (B) and current fishing mortality (F) in 2015 in relation to optimal spawning stock size and optimal fishing mortality. Cross bars illustrate the range of uncertainty from the model runs.

152. The report of the 7th Session of the Working Party on Neritic Tunas (IOTC–2017–WPNT07–R) was **ADOPTED** on the 13 July 2017.

APPENDIX I
LIST OF PARTICIPANTS

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APPENDIX II
AGENDA FOR THE 7TH WORKING PARTY ON NERITIC TUNAS

Date: 10–13 July 2017
Location: Malé, Maldives
Venue: STELCO Training Room
Time: 09:00 – 17:00 daily
Chair: Dr Farhad Kaymaram; **Vice-Chair**: Dr Mathias Igulu

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 19th Session of the Scientific Committee (IOTC Secretariat)
   - 3.2 Outcomes of the 21st Session of the Commission (IOTC Secretariat)
   - 3.3 Review of Conservation and Management Measures relevant to neritic tunas (IOTC Secretariat)
   - 3.4 Progress on the recommendations of WPNT06 (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. **LONGTAIL TUNA – REVIEW OF NEW INFORMATION ON STOCK STATUS**
   - 5.1 Review new information on the biology, ecology, stock structure, their fisheries and associated environmental data for longtail tuna (CPC papers)
   - 5.2 Data for input into stock assessments:
     - Catch and effort
     - Catch at size
     - Growth curves and age-length key
     - Catch at age
     - CPUE indices and standardised CPUE indices
     - Tagging data
   - 5.3 Stock assessment updates
   - 5.4 Selection of Stock Status indicators
   - 5.5 Development of technical advice on the status of longtail tuna

6. **NARROW-BARRED SPANISH MACKEREL – REVIEW OF NEW INFORMATION ON STOCK STATUS**
   - 6.1 Review new information on the biology, ecology, stock structure, their fisheries and associated environmental data for narrow-barred Spanish mackerel (CPC papers)
   - 6.2 Data for input into stock assessments:
     - Catch and effort
     - Catch at size
     - Growth curves and age-length key
     - Catch at age
     - CPUE indices and standardised CPUE indices
     - Tagging data
   - 6.3 Stock assessment updates
   - 6.4 Selection of Stock Status indicators
   - 6.5 Development of technical advice on the status of narrow-barred Spanish mackerel

7. **OTHER NERITIC TUNA SPECIES – REVIEW OF NEW INFORMATION ON STOCK STATUS**
   - 7.1 Review new information on the biology, stock structure, fisheries and associated environmental data (all)
   - 7.2 Data for input into stock assessments (all)
   - 7.3 Stock assessment updates (all)

7.4 Stock status indicators for other neritic tuna species (all)
7.5 Development of management advice for other neritic tuna species (all)

8. PROGRAM OF WORK (RESEARCH AND PRIORITES)
8.1 Revision of the WPNT Program of Work 2018–2022 (Chair)
8.2 Development of priorities for an Invited Expert at the next WPNT meeting

9. OTHER BUSINESS
9.1 Election of a Chairperson and a Vice-Chairperson of the WPNT for the next biennium
9.2 Date and place of the 8th and 9th Working Party on Neritic Tunas (Chair)
9.3 Review of the draft, and adoption of the Report of the 7th Working Party on Neritic Tunas (Chair)

APPENDIX III
LIST OF DOCUMENTS

Document	Title	Availability
IOTC–2017–WPNT07–01a	Draft: Agenda of the 7th Working Party on Neritic Tunas	✓ 7 March 2017 ✓ 26 June 2017
IOTC–2017–WPNT07–01b	Annotated agenda of the 7th Working Party on Neritic Tunas	✓ 26 June 2017
IOTC–2017–WPNT07–02	List of documents of the 7th Working Party on Neritic Tunas	✓ 26 June 2017
IOTC–2017–WPNT07–03	Outcomes of the 19th Session of the Scientific Committee (IOTC Secretariat)	✓ 26 June 2017
IOTC–2017–WPNT07–04	Outcomes of the 21st Session of the Commission (IOTC Secretariat)	✓ 26 June 2017
IOTC–2017–WPNT07–05	Review of current Conservation and Management Measures relating to neritic tuna species (IOTC Secretariat)	✓ 26 June 2017
IOTC–2017–WPNT07–06	Progress made on the recommendations and requests of WPNT06 and SC19 (IOTC Secretariat)	✓ 26 June 2017
IOTC–2017–WPNT07-07	Review of the statistical data available for the neritic tuna species (IOTC Secretariat)	✓ 26 June 2017
IOTC–2017–WPNT07–08	Revision of the WPNT Program of Work (2018–2022) (IOTC Secretariat)	✓ 26 June 2017
IOTC–2017–WPNT07–09	Importance of Neritic Tuna catch in I.R.Iran capture fishery (R. Naderi)	✓ 9 July 2017
IOTC–2017–WPNT07–10	Application of Remote Sensing in Predicting Suitable Fishing Areas for Pelagic fish in the continental shelf of Tanzania (B. Kuguru, S. Mahongo, I. Sailale, M. Chande, M. Semba, C. Muhando)	pending
IOTC–2017–WPNT07–11	Catch reconstruction of neritic tuna landings of Pakistan based on data collected by WWF-Pakistan's crew based observer programme (M. Moazzam and S. Ayub)	✓ 26 June 2017
IOTC–2017–WPNT07–12	The status of neritic tuna in the Andaman Sea during the transition period of fishery reformation in Thailand (K. Maeroh, S.Panjarat)	✓ 9 July 2017
IOTC–2017–WPNT07–13	Status of tuna fishery in Sudan (Y. Gameredinn)	✓ 7 July 2017
IOTC–2017–WPNT07–14	A hierarchical Bayesian approach to estimate growth parameters from length data of narrow spread (S. Zhou, S. Martin, D.Fu)	✓ 7 July 2017
IOTC–2017–WPNT07–15	Assessment of Indian Ocean longtail tuna (*Thunnus tonggol*) using data poor catch-based methods (IOTC Secretariat)	✓ 28 June 2017
IOTC–2017–WPNT07–16	Mitochondrial DNA Control Region Revealed a Single Genetic Stock Structure of *Scomberomorus commerson* Lacepede(1800) in the Northern Tanzania Coastal Waters (M.G.I. Johnson, Y.D.Mgaya and Y.W. Shaghude)	✓ 6 July 2017
IOTC–2017–WPNT07–17	Assessment of Indian Ocean narrow-barred Spanish mackerel (*Scomberomorus commerson*) using data poor catch-based methods (IOTC Secretariat)	✓ 28 June 2017
IOTC–2017–WPNT07–18	Exploring the pole-and-line frigate tuna (*Auxis thazard*) catches in the Maldives tuna catch-effort dataset (2004-2015) (M. Ahusan)	✓ 26 June 2017
IOTC–2017–WPNT07–19	Sampling of Frigate tuna (FRI: *Auxis thazard)* as bycatch of purse seiners at the port of Antsiranana-Madagascar (2011-2017) (D.L. Joachim)	✓ 7 July 2017
IOTC–2017–WPNT07–20	Neritic tuna fishery and some biological aspects of kawakawa (*Euthynnus affinis*) in the Malacca Straits (E. M. Faizal, N. A. Jamaluddin, S. Jamon, S. Basir)	✓ 7 July 2017

Document	Title	Availability
IOTC–2017–WPNT07–21	Seasonality and size frequency and gear impact on Kawakawa (*Euthynnus affinis*) caught by artisanal fishers in Kenya (E. Mueni, S. Ndegwa)	✓ 9 July 2017
IOTC–2017–WPNT07–22	Size selectivity of Indo-pacific king mackerel, *Scomberomorus guttatus*, taken by drift gillnet in the north of Persian Gulf (S.A. Hosseini, F. Kaymaram, S. Behzady, E. Kamaly)	withdrawn
IOTC–2017–WPNT07–23	Preliminary study for stock status of kawakawa using data-limited approach (*Euthynnus affinis* Cantor, 1849) in Indonesia (I. Jatmiko, F. Rochman and Z. Fahmi)	✓ 26 June 2017
IOTC–2017–WPNT07–24	Catch composition and size frequency of tuna and tuna like species in the artisanal handline and seine net fisheries of Northern Mozambique (R. Mutombene, A. Salenca and I. Chauca)	pending
IOTC–2017–WPNT07–25	Neritic tunas with special reference to distribution and fishery of the Auxis spp. along Indian coast (P. Rohit, E.M. Abdussamad, K.G. Mini and Rajesh K. M.)	✓ 9 July 2017
IOTC–2017–WPNT07–26	Neritic Tuna Catch, Species composition and monthly average landings in Sri Lankan Tuna Gillnet Fishery operate within EEZ (M.I.G. Rathnasuriya, .J.W.W.M.M.P. Weerasekera, K.H.K.Bandaranayake & S.S.K. Haputhantri)	✓ 10 July 2017
IOTC–2017–WPNT07–27	Phylogenetic relationships of Scomberomorus commerson using sequence analysis of the mtDNA D-loop region in the Persian Gulf, Oman Sea and Arabian Sea Ana Mansourkiaei (P.G. Mostafavi, S.M.R. Fatemi, F. Kaymaram and A. Nazemi)	✓ 13 July 2017
IOTC-2017-WPNT07-INF01	Size at first maturity and fecundity of Auxis spp. From west coast of Sumatera and south coast of Java, eastern Indian Ocean (P.A.R.P.Tampubolon, D.Novianto, I.Jatmiko)	✓ 13 July 2017
IOTC–2017–WPNT07–DATA01	IOTC Neritic tuna datasets available	✓ 13 June 2017
IOTC–2017–WPNT07–DATA02	IOTC Species data catalogues – availability of data	✓ 19 May 2017
IOTC–2017–WPNT07–DATA03	Nominal catches per Fleet, Year, Gear, IOTC Area and species	✓ 19 May 2017
IOTC–2017–WPNT07–DATA04	Catch and effort data - vessels using drifting longlines	✓ 19 May 2017
IOTC–2017–WPNT07–DATA05	Catch and effort data - vessels using pole and lines or purse seines	✓ 19 May 2017
IOTC–2017–WPNT07–DATA06	Catch and effort data - vessels using other gears (e.g., gillnets, lines and unclassified gears)	✓ 19 May 2017
IOTC–2017–WPNT07–DATA07	Catch and effort data - all gears	✓ 19 May 2017
IOTC–2017–WPNT07–DATA08	Catch and effort – reference file	✓ 19 May 2017
IOTC–2017–WPNT07–DATA09	Size frequency data - neritic tunas	✓ 19 May 2017
IOTC–2017–WPNT07–DATA10	Size frequency – reference file	✓ 19 May 2017
IOTC–2017–WPNT07–DATA11	Equations used to convert from fork length to round weight for neritic tuna species	✓ 13 June 2017

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

Extract from IOTC–2017–WPNT07–07

Fisheries and main catch trends

- Main fisheries: bullet tuna is mainly caught using gillnets, handlines and trolling, across the broader Indian Ocean area. This species is also an important catch for coastal purse seiners (**Table 4; Fig.19**).
- Main fleets (i.e., in terms of highest catches in recent years):
  Catches are highly concentrated: in recent years over 90% of catches in the Indian Ocean have been accounted for by fisheries in Sri Lanka, Indonesia and India (**Fig.20**).
- Retained catch trends:
  Estimated catches of bullet tuna reached around 2,000 t in the early 1990's, increasing markedly in the following years to reach a peak in 1997, at around 4,900 t. The catches decreased slightly in the following years and remained at values of between 3,700 t and 4,000 t until the late-2000's, increasing sharply again up to the 10,000 t recorded in 2010, the highest catch ever recorded for this species in the Indian Ocean.
- Discard levels: are moderate for industrial purse seine fisheries. The EU recently reported discard levels of bullet tuna for its purse seine fleet, for 2003–07, estimated using observer data.

***Changes to the catch series*:** No major changes to the catch series of bullet tuna since the WPNT meeting in 2016.

Bullet tuna – estimation of catches: data related issues

Retained catches for bullet tuna were derived from incomplete information, and are therefore uncertain[14] (**Fig.21**), due to:

- Aggregation: Bullet tunas are usually not reported by species, but are instead aggregated with frigate tunas or, less frequently, other small tuna species.
- Mislabelling: Bullet tunas are usually mislabelled as frigate tuna, with their catches reported under the latter species.
- Underreporting: the catches of bullet tuna by industrial purse seiners are rarely, if ever, reported.

For the reasons listed above the catches of bullet tunas in the IOTC database are thought to be highly uncertain and represent only a small fraction of the total catches of this species in the Indian Ocean.

[14] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of non-reporting fisheries for which catches had to be estimated.

TABLE 4. Bullet tuna: scientific estimates of catches of bullet tuna by type of fishery for the period 1950–2015 (in metric tonnes).

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Purse seine	-	-	28	278	552	655	650	581	908	1,055	1,372	635	549	513	2,516	3,011
Gillnet	41	153	296	531	1,222	1,741	1,872	1,692	2,236	2,587	3,347	2,692	2,830	2,724	3,133	2,993
Line	113	193	325	393	780	1,190	1,165	1,141	1,858	2,182	2,903	1,162	1,078	1,054	1,294	3,288
Other	5	13	44	242	755	1,322	1,465	1,908	1,638	2,022	2,748	3,905	4,503	4,597	1,275	1,290
Total	**159**	**360**	**693**	**1,444**	**3,309**	**4,907**	**5,152**	**5,323**	**6,640**	**7,847**	**10,370**	**8,394**	**8,960**	**8,888**	**8,217**	**10,582**

Definition of fishery: Gillnet: gillnet, including offshore gillnet; Line: coastal longline, hand line, troll line; Purse seine: coastal purse seine, purse seine, ring net; Other gears: baitboat, Danish seine, liftnet, longline, longline fresh, trawling.

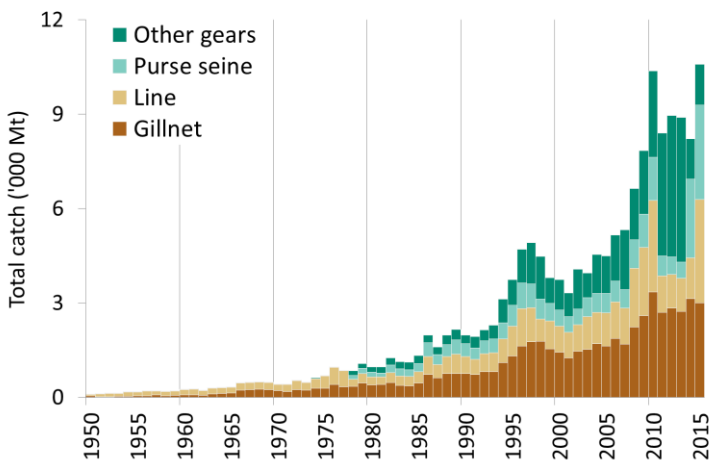


Fig.19. Bullet tuna: Annual catches by gear recorded in the IOTC Database (1950–2015).

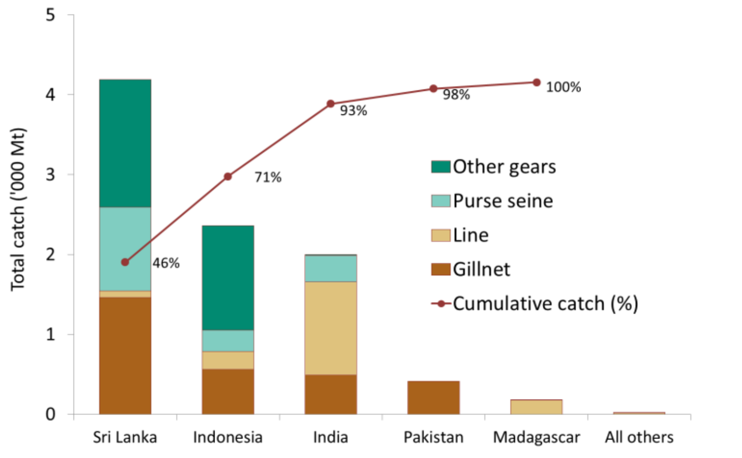


Fig.20. Bullet tuna: Average catches in the Indian Ocean over the period 2012–15, by country[15].

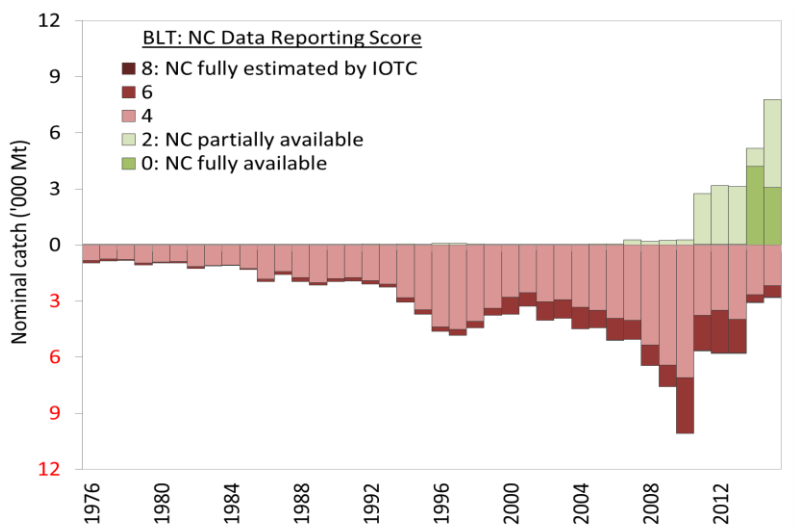


Fig.21. Bullet tuna: nominal catch; uncertainty of annual catch estimates (1976–2015).

Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully by gear and/or species (i.e., partially adjusted by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document; catches with a score of 8 refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat).

[15] Countries are ordered from left to right, according to the importance of catches of longtail reported for 2012-2014. The red line indicates the (cumulative) proportion of catches of longtail tuna for the countries concerned, over the total combined catches of this species reported from all countries and fisheries for 2012-2015.

Bullet tuna – Effort trends

- Availability: Effort trends are unknown for bullet tuna in the Indian Ocean, due to a lack of catch-and-effort data.

Bullet tuna – Catch-per-unit-effort (CPUE) trends

- Availability: highly incomplete, and, when available, are considered to be of poor quality for the fisheries having reasonably long catch-and-effort data series – as is the case with the gillnet fisheries of Sri Lanka (**Fig.22**).
- Main CPUE series available: Sri Lanka (gillnets) (**Fig.23**).

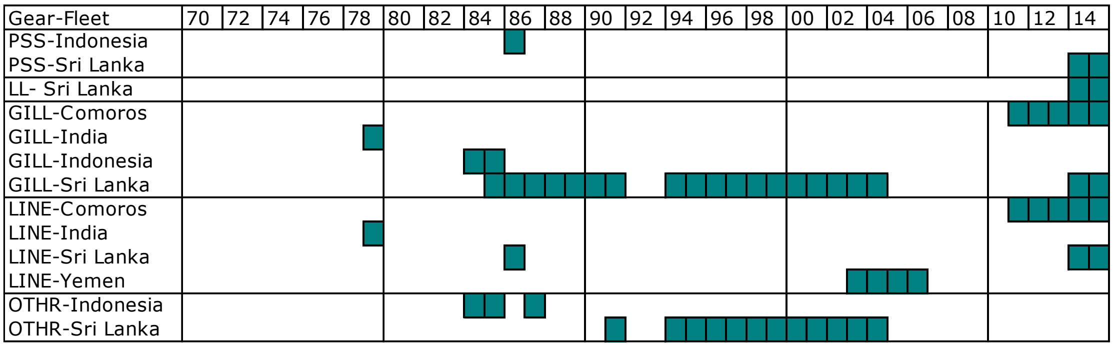


Fig.22. Bullet tuna: Availability of catches and effort series, by fishery and year (1970–2015)[16]. Note that no catches and effort are available at all for 1950–78.

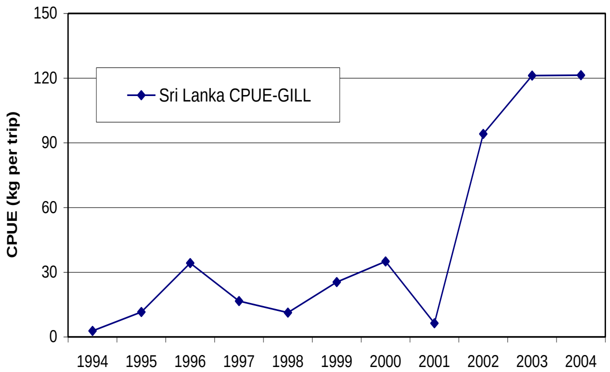


Fig.23. Bullet tuna: Nominal CPUE series for the gillnet fishery of Sri Lanka derived from the available catches and effort data (1994–2004).

Bullet tunas – Fish size or age trends (e.g., by length, weight, sex and/or maturity)

- Sizes: Fisheries catching bullet tuna in the Indian Ocean tend to catch specimens ranging between 15 and 35 cm.
- Size frequency data: highly incomplete, with data only available for selected years and/or fisheries (**Fig.24**).

  Main sources for size samples: Sri Lanka (gillnet and trolling).
  Total numbers of samples, across all years, are also well below the minimum sampling standard of 1 fish per tonne of catch recommended by the IOTC Secretariat to reliably assess changes in average weight.
- Catch-at-Size (Age) table: Not available due to lack of size samples and uncertainty over the reliability of retained catch estimates.
- Sex ratio data: have not been provided to the Secretariat by CPCs.

[16] Note that the above list is not exhaustive, showing only the fisheries for which catches and effort are available in the IOTC database. Furthermore, when available catches and effort may not be available throughout the year existing only for short periods

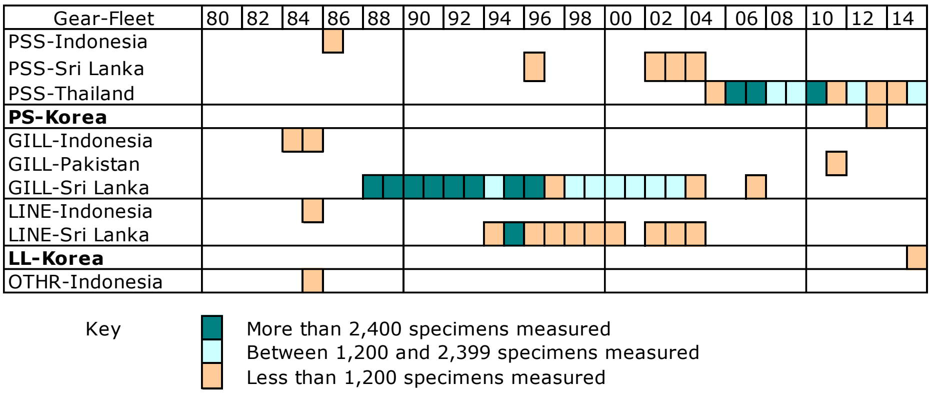


Fig. 24. Bullet tuna: Availability of length frequency data, by fishery and year (1980–2015)[17]. Note that no length frequency data are available at all for 1950–83.

Other biological data: Equations available for bullet tuna are shown below:

Species	From type measurement – To type measurement	Equation	Parameters	Sample size	Length
Bullet tuna	Fork length – Round Weight	RND=a*L^b	a= 0.00001700 b= 3.0		Min:10 Max:40

Source: Data from North Indian Ocean: IPTP Sampling Programme in Sri Lanka (1989).

[17] Note that the above list is not exhaustive, showing only the fisheries for which size data are available in the IOTC database. Furthermore, when available size data may not be available throughout the year existing only for short periods

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

Extract from IOTC–2017–WPNT07–07

Fisheries and main catch trends

- Main fisheries: frigate tuna is mainly caught using gillnets, coastal longline and trolling, handlines and trolling, and to a lesser extent coastal purse seine nets (**Table 3; Fig.12**). The species is also an important bycatch for industrial purse seine vessels and is the target of some ring net fisheries (recorded as purse seine in Table 3).
- Main fleets (i.e., highest catches in recent years):

  Catches of frigate tuna are highly concentrated: Indonesia accounts for around two-thirds of catches, while over 90% of catches are accounted for by four countries (Indonesia, India, Sri Lanka and I.R. Iran) (**Fig.13**).
- Retained catch trends:
  Estimated catches have increased steadily since the late-1970's, reaching around 30,000 t in the late-1980's, to between 55,000 and 60,000 t by the mid-1990's, and remaining at the same level in the following ten years. Between 2010 and 2014 catches have increased to over 95,000 t, rising to the highest levels recorded.
- Discard levels**:** are moderate for industrial purse seine fisheries. In previous years the EU has reported discard levels of frigate tuna for its purse seine fleet, for 2003–07, estimated using observer data.

Changes to the catch series**:** no major changes to the catch series of frigate tuna since WPNT in 2015.

Frigate tuna: estimation of catches – data related issues

Retained catches for frigate tuna were derived from incomplete information, and are therefore uncertain[18] (**Fig.14**), notably for the following fisheries:

- Artisanal fisheries of Indonesia: Indonesia did not report catches of frigate tuna by species or by gear for 1950–2004; catches of frigate tuna, bullet tuna and other species were reported aggregated for this period. In the past, the IOTC Secretariat used the catches reported since 2005 to break the aggregates for 1950–2004, by gear and species. However, in a recent review by the IOTC Secretariat conducted by an independent consultant in 2012 he indicated that the catches of frigate tuna had been underestimated by Indonesia. While the new catches estimated for the frigate tuna in Indonesia remain uncertain, the new figures are considered more reliable than those existing in the past.
- Artisanal fisheries of India and Sri Lanka: Although these countries report catches of frigate tuna until recently the catches have not been reported by gear. The catches of both countries were also reviewed by an independent consultant in 2012 and assigned by gear on the basis of official reports and information from various other alternative sources. The new catch series was previously presented to the WPNT in 2013, in which the new catches estimated for Sri Lanka are as much as three times higher than compared to previous estimates.
- Artisanal fisheries of Myanmar and Somalia: None of these countries have ever reported catches of frigate tuna to the IOTC Secretariat, and catch levels are highly uncertain. In the case of Myanmar, catches are taken from FAO and SEAFDEC (various years).
- Other artisanal fisheries: The catches of frigate tuna and bullet tuna are seldom reported by species and, when they are reported by species, usually refer to both species (due to species misidentification or commercial categories used within countries, with all catches often assigned as frigate tuna).
- Industrial fisheries: The catches of frigate tuna recorded for industrial purse seiners are thought to be a fraction of those retained on board. Due to this species being a bycatch, catches of frigate tuna are seldom recorded in the logbooks, nor can they be monitored in port. Currently the only discards data for frigate tuna reported to the IOTC Secretariat refer to the EU purse seine fleet, for 2003–07, estimated using observer data.

[18] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of non-reporting fisheries for which catches had to be estimated.

TABLE 3. Frigate tuna: Best scientific estimates of the catches of frigate tuna by type of fishery for the period 1950–2015 (in metric tonnes). Data as of June 2017.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Purse seine	-	15	824	4,664	7,550	10,021	11,320	10,337	9,501	9,663	12,044	11,636	10,362	10,264	12,682	9,141
Gillnet	485	1,240	2,837	6,948	14,519	20,190	22,193	23,322	24,082	23,750	30,908	30,361	31,026	30,079	38,006	28,605
Line	1,264	2,408	4,419	7,432	13,753	27,150	27,801	31,820	30,806	34,923	38,209	37,687	36,689	39,416	34,803	33,861
Other	1,441	2,007	2,349	3,683	9,276	13,670	12,715	15,382	15,193	18,112	18,550	18,934	17,649	18,766	13,492	12,630
Total	**3,191**	**5,670**	**10,428**	**22,728**	**45,098**	**71,031**	**74,030**	**80,862**	**79,582**	**86,448**	**99,710**	**98,618**	**95,725**	**98,524**	**98,983**	**84,237**

Definition of fishery: Gillnet: gillnet, including offshore gillnet; Line: coastal longline, hand line, troll line; Purse seine: coastal purse seine, purse seine, ring net; Other gears: baitboat, Danish seine, liftnet, longline, longline fresh, trawling.

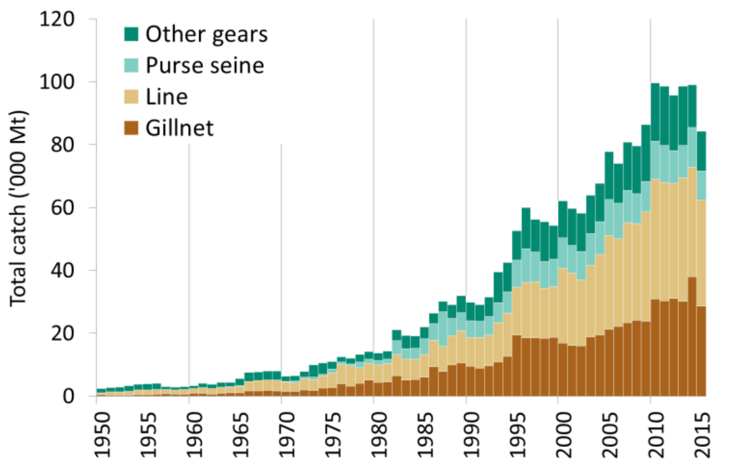


Fig.12. Frigate tuna: Annual catches by gear recorded in the IOTC Database (1950–2015).

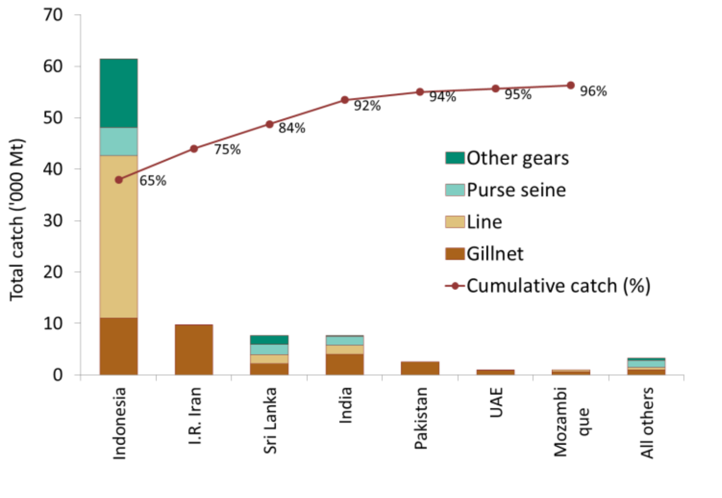


Fig.13. Frigate tuna: Average catches in the Indian Ocean over the period 2012–15, by country[19].

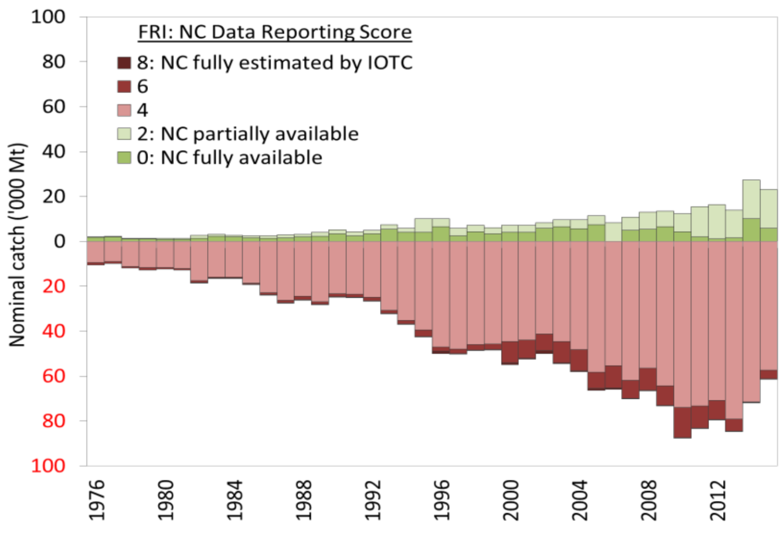


Fig.14. Frigate tuna: nominal catch; uncertainty of annual catch estimates (1976–2015).

Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully by gear and/or species (i.e., partially adjusted by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document; catches with a score of 8 refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat).

[19] Countries are ordered from left to right, according to the importance of catches of longtail reported for 2012-2014. The red line indicates the (cumulative) proportion of catches of longtail tuna for the countries concerned, over the total combined catches of this species reported from all countries and fisheries for 2012-2015.

Frigate tuna – Effort trends

- Availability: Effort trends are unknown for frigate tuna in the Indian Ocean, due to a lack of catch-and-effort data.

Frigate tuna – Catch-per-unit-effort (CPUE) trends

- Availability: highly incomplete, although data are available for short periods of time (e.g., more than 10 years) for selected fisheries (**Fig.15**).
- Main CPUE series available: Sri Lanka (gillnets), and Maldives (pole and line, hand and troll lines) (**Fig.16**). However the quality of catch-and-effort recorded for Sri Lankan gillnets are thought to be low due to large changes in the CPUE between consecutive years.

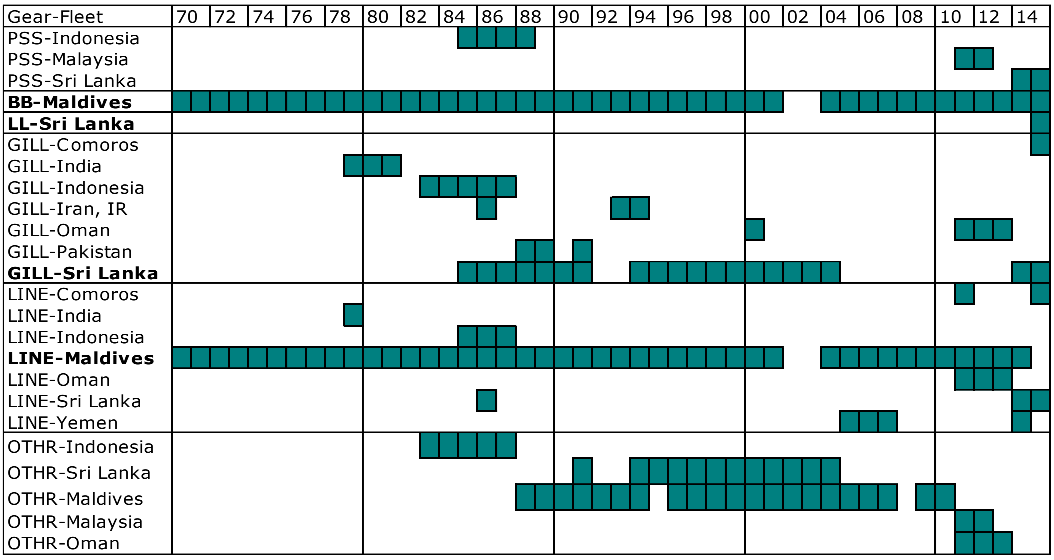


Fig.15: Frigate tuna: Availability of catches and effort series, by selected fishery and year (1970–2015)[20]. Note that no catch-and-effort data are available for 1950–69.

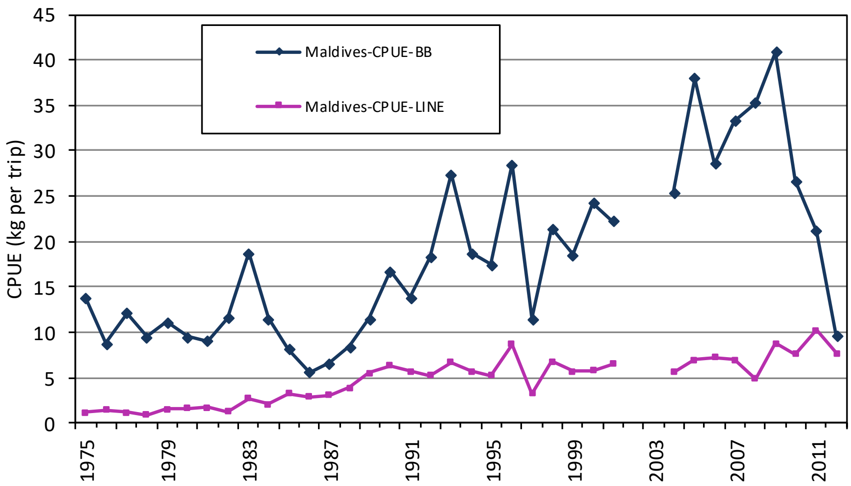


Fig.16. *Frigate tuna: Nominal CPUE series for the baitboat (BB using mechanized boats) and line (LINE, including handlines and trolling using mechanized boats) fisheries of Maldives derived from the available catches and effort data (1975–2015). Data since 2013 has been reported as fishing days (rather than as fishing trips for data up to 2013).*

Frigate tunas – Fish size or age trends (e.g., by length, weight, sex and/or maturity)

[20] Note that the above list is not exhaustive, showing only the fisheries for which catches and effort are available in the IOTC database. Furthermore, when available catches and effort may not be available throughout the year existing only for short periods

- Sizes: the sizes of frigate tunas taken by Indian Ocean fisheries typically range between 20 – 50 cm depending on the type of gear used, season and location. Fisheries operating in the Andaman Sea (coastal purse seines and troll lines) tend to catch frigate tuna of small to medium size (15–40 cm) while the gillnet, baitboat and other fisheries operating in the Indian Ocean catch usually larger specimens (25–50 cm).

- Size frequency data: highly incomplete, with data only available for selected years and/or fisheries (**Fig.17**).

  Main sources for size samples: Sri Lanka (gillnet) and Thailand (coastal purse seiners).
  Length distributions derived from data available for gillnet fisheries are shown in **Fig.18**. Generally speaking total numbers of samples are below the minimum sampling standard of 1 fish per tonne of catch recommended by the IOTC Secretariat to reliably assess changes in average weight – with the exception of samples recorded for Sri Lanka gillnets during the mid-1980s to early-1990, which were obtained with the support of IPTP funding.
- Catch-at-Size (Age) table: Not available, due to lack of size samples and uncertainty over the reliability of retained catch estimates.

- Sex ratio data: have not been provided to the Secretariat by CPCs.

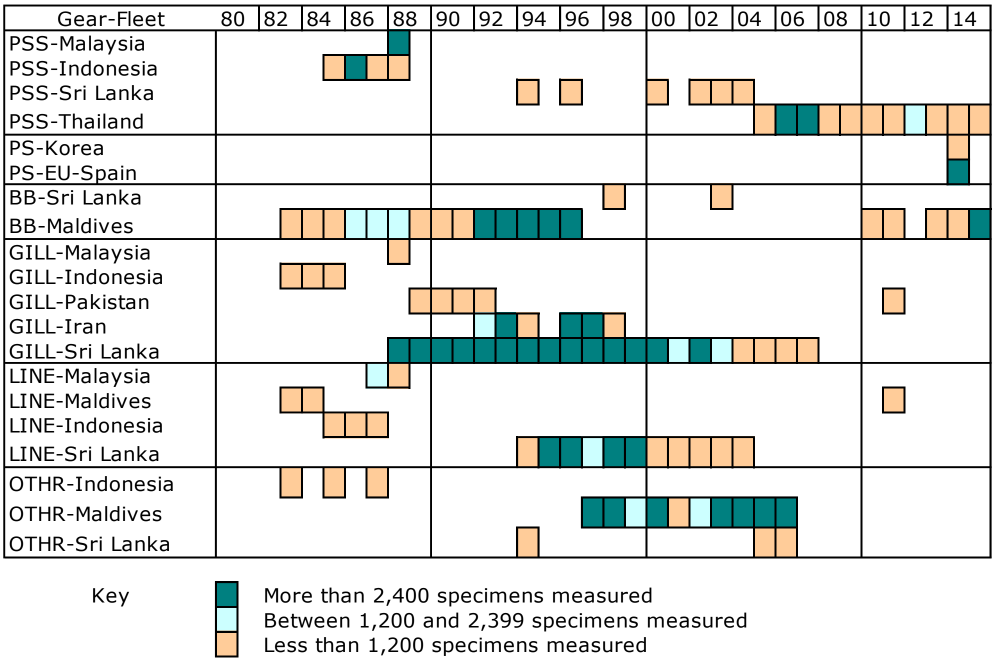


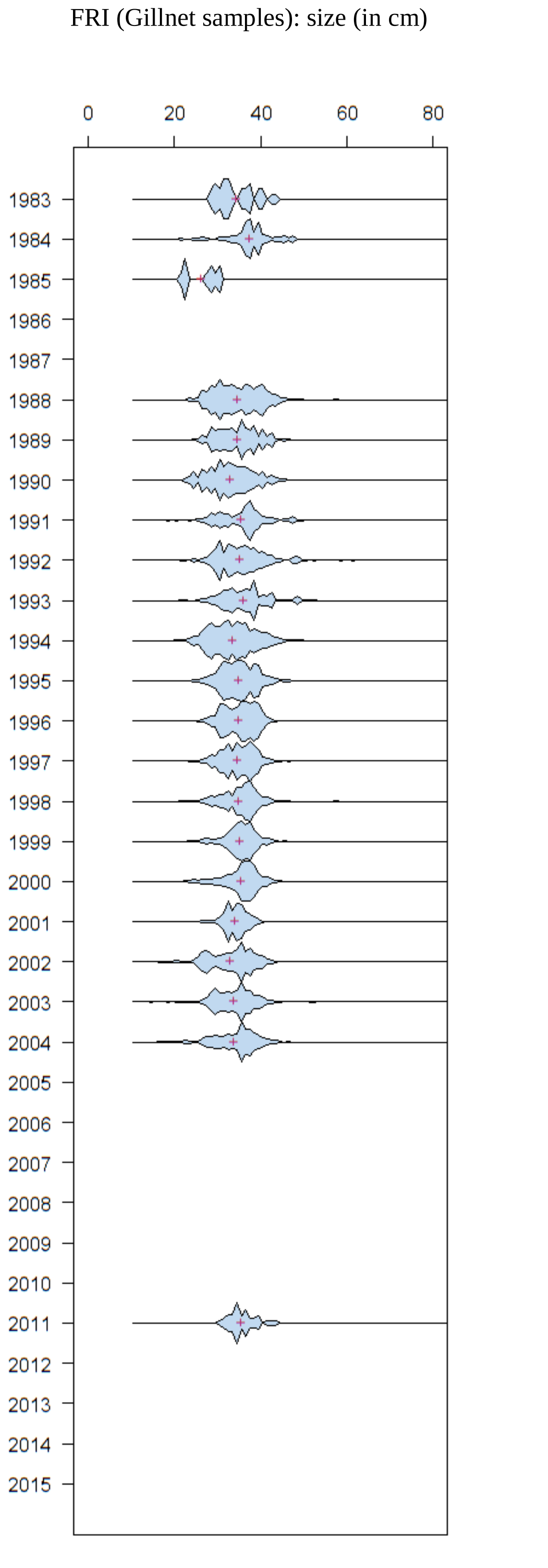
Fig.17. Frigate tuna: Availability of length frequency data, by fishery and year (1980–2015)[21]. Note that no length frequency data are available at all for 1950–82.

Other biological data: Equations available for frigate tuna are shown below:

Species	From type measurement – To type measurement	Equation	Parameters	Sample size	Length
Frigate tuna	Fork length – Round Weight	RND=a*L^b	a= 0.00001700 b= 3.0		Min:20 Max:45

Source: Data from Indian Ocean: IOTC-2011-WPNT01-10 Tuna Fishery of India with Special Reference to Biology and Population Characteristics of Neritic Tunas Exploited from Indian EEZ.

[21] Note that the above list is not exhaustive, showing only the fisheries for which size data are available in the IOTC database. Furthermore, when available size data may not be available throughout the year existing only for short periods



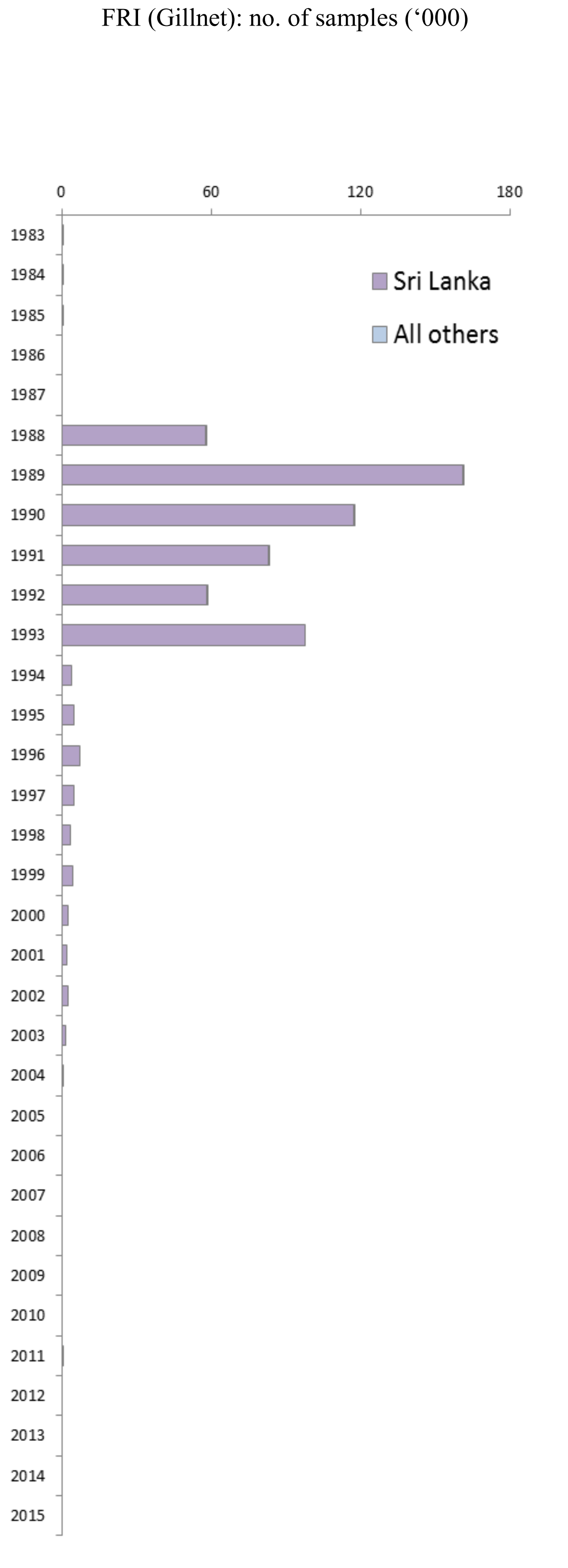


Fig.18a-b. Left: Frigate tuna (gillnet fisheries): Length frequency distributions (by 1cm length class) derived from data available at the IOTC Secretariat, 1983-2015.

Right: Number of frigate tuna specimens (gillnet fisheries) sampled for lengths, by fleet and year.

APPENDIX IVC
MAIN STATISTICS FOR KAWAKAWA (EUTHYNNUS AFFINIS)

Extract from IOTC–2017–WPNT07–07

Fisheries and main catch trends

- Main fisheries: Kawakawa are caught mainly by coastal purse seines, gillnets, handlines and trolling, and may be also an important bycatch of the industrial purse seiners (**Table 5; Fig.25**).
- Main fleets (i.e., highest catches in recent years): Indonesia, India, I.R. Iran, and Pakistan (**Fig.26**).
- Retained catch trends:
  Annual estimates of catches for the kawakawa increased markedly from around 20,000 t in the mid-1970's to reach the 45,000 t mark in the mid-1980's to over 155,000 t in recent years (since 2011), the highest catches ever recorded for this species.
- Discard levels: are moderate for industrial purse seine fisheries. In recent years the EU has reported discard levels of kawakawa for its purse seine fleet, for 2003–07, estimated using observer data.

***Changes to the catch series*:** No major revisions to the catch series since the WPNT meeting in 2016.

Kawakawa tuna – estimation of catches: data related issues

Retained catches for kawakawa were derived from incomplete information, and are therefore uncertain[22] (**Fig.27**), notably for the following fisheries:

- Artisanal fisheries of Indonesia: Indonesia did not report catches of kawakawa by species or by gear for 1950–2004; catches of kawakawa, longtail tuna and, to a lesser extent, other species were reported as species aggregates for this period. In the past, the IOTC Secretariat used the catches reported since 2005 to break the aggregates for 1950–2004, by gear and species. A review by the IOTC Secretariat conducted by an independent consultant in 2012 indicated that the catches of kawakawa had been overestimated by Indonesia. While the new catches estimated for kawakawa in Indonesia remain uncertain, the new figures are considered more reliable than those previously recorded in the IOTC database – while fundamental issues remain with the quality of official catches reported by Indonesia to the IOTC Secretariat (e.g., unexplained fluctuations in catches by species between years, as well as large revisions in catches).
- Artisanal fisheries of India: Although India reports catches of kawakawa they are not always reported by gear. The catches of kawakawa in India were also reviewed by the IOTC Secretariat in 2012 and assigned by gear on the basis of official reports and information from various other alternative sources.
- Artisanal fisheries of Myanmar and Somalia: None of these countries have ever reported catches to the IOTC Secretariat. Catch levels are unknown.
- Other artisanal fisheries: The catches of kawakawa are usually not reported by species, being combined with catches of other small tuna species like skipjack tuna and frigate tuna (e.g., coastal purse seiners of Thailand, and until recently Malaysia).
- Industrial fisheries: The catches of kawakawa recorded for industrial purse seiners are thought to be a fraction of those retained on board. Due to this species being a bycatch, its catches are seldom recorded in the logbooks, nor are they monitored in port. The EU recently reported catch levels of frigate tuna for its purse seine fleet, for 2003–07, estimated using observer data.

[22] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of non-reporting fisheries for which catches had to be estimated.

TABLE 5. Kawakawa: Best scientific estimates of the catches of kawakawa by type of fishery for the period 1950–2015 (in metric tonnes). Data as of June 2017.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Purse seine	109	385	2,616	12,070	21,396	28,613	34,785	32,586	32,441	37,051	35,064	44,892	42,700	42,124	38,879	39,263
Gillnet	2,567	4,486	9,691	17,958	30,709	53,547	55,651	59,138	70,971	69,772	64,713	74,884	75,600	86,264	84,949	76,461
Line	1,713	3,262	6,642	9,865	15,673	19,874	20,409	22,299	22,524	23,804	23,356	25,710	32,656	29,105	25,190	31,443
Other	295	719	1,357	2,690	5,127	7,819	8,027	9,629	9,015	10,129	9,994	10,007	9,976	10,255	8,108	7,260
Total	**4,684**	**8,852**	**20,306**	**42,583**	**72,905**	**109,853**	**118,871**	**123,652**	**134,952**	**140,756**	**133,127**	**155,492**	**160,932**	**167,748**	**157,125**	**154,427**

Definition of fishery: Gillnet: gillnet, including offshore gillnet; Line: coastal longline, hand line, troll line; Purse seine: coastal purse seine, purse seine, ring net; Other gears: baitboat, Danish seine, liftnet, longline, longline fresh, trawling.

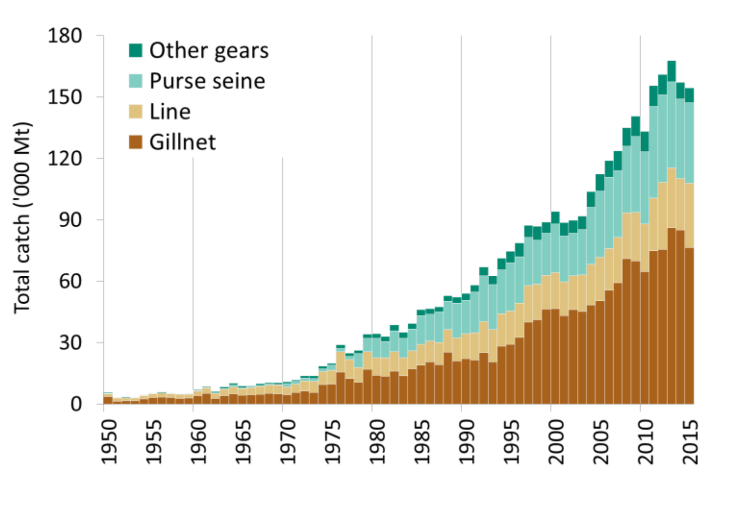


Fig.25. Kawakawa: Annual catches by gear recorded in the IOTC Database (1950–2015).

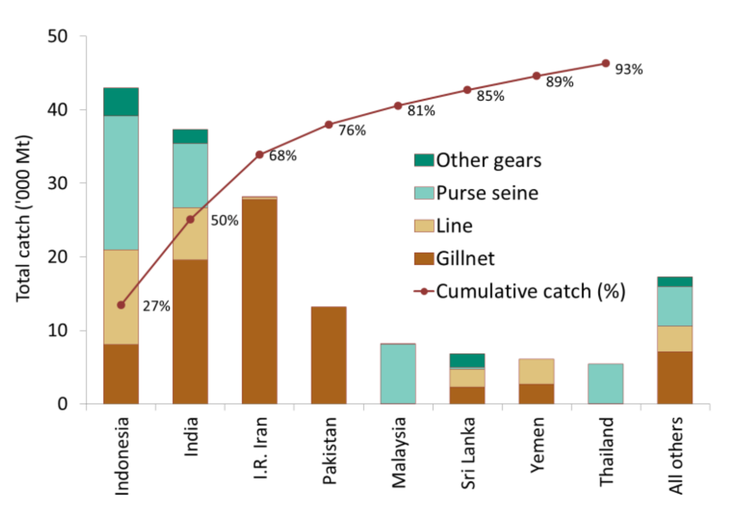


Fig.26. Kawakawa: Average catches in the Indian Ocean over the period 2012–15, by country[23].

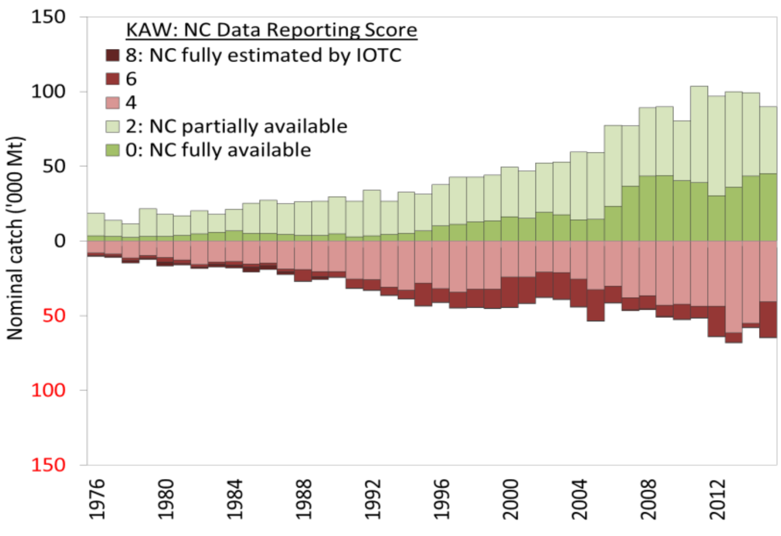


Fig.27. Kawakawa: nominal catch; uncertainty of annual catch estimates (1976–2015).

Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully by gear and/or species (i.e., partially adjusted by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document; catches with a score of 8 refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat).

[23] Countries are ordered from left to right, according to the importance of catches of longtail reported for 2012-2014. The red line indicates the (cumulative) proportion of catches of longtail tuna for the countries concerned, over the total combined catches of this species reported from all countries and fisheries for 2012-2015.

Kawakawa tuna – Effort trends

- Availability: Effort trends are unknown for longtail tuna in the Indian Ocean.

Kawakawa tuna – Catch-per-unit-effort (CPUE) trends

- Availability: highly incomplete, with data available for only short periods of time and selected fisheries (**Fig.28**).
- Main CPUE series available: Maldives (baitboats and troll lines) (**Fig.29**), and Sri Lanka (gillnets). However the catch-and-effort data recorded for Sri Lankan gillnets are thought to be unreliable, due to the dramatic changes in CPUE recorded between consecutive years. Also the fishing effort units reported by Maldives changed from trips to fishing days from 2013 onwards.

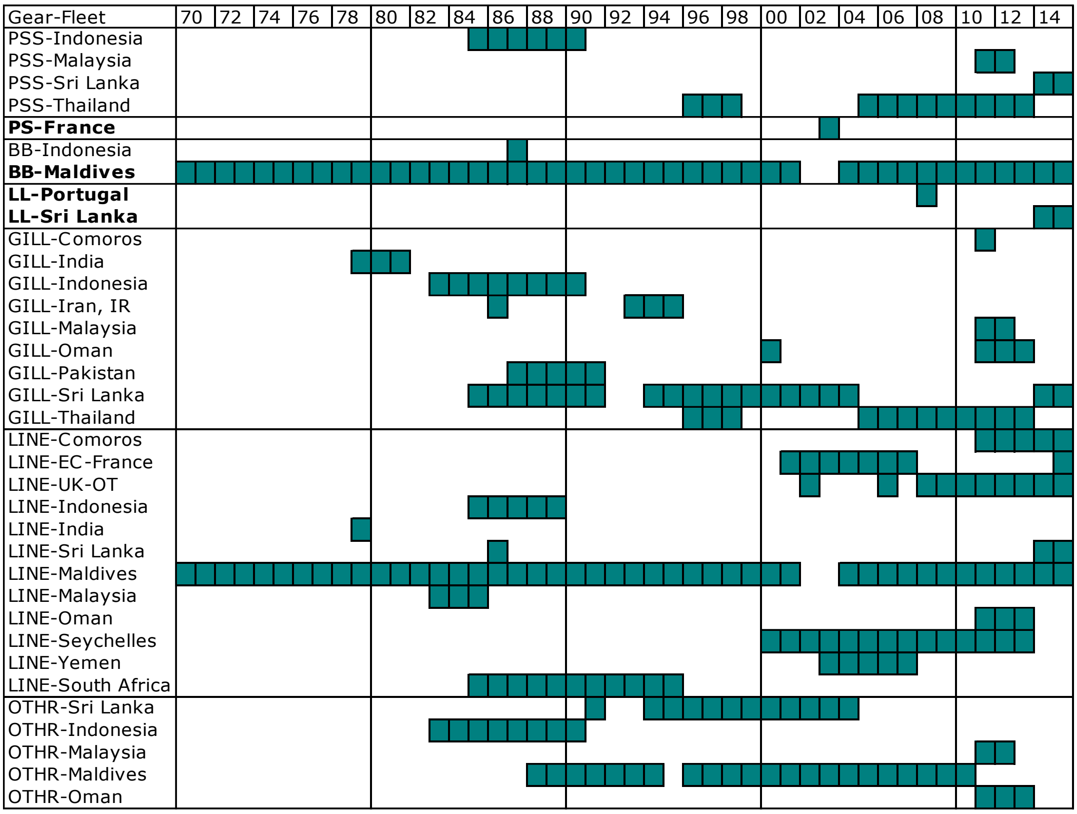


Fig. 28. Kawakawa: Availability of catches and effort series, by fishery and year (1970-2015)[24]. Note that no catches and effort are available at all for 1950–69.

[24] Note that the above list is not exhaustive, showing only the fisheries for which catches and effort are available in the IOTC database. Furthermore, when available catches and effort may not be available throughout the year existing only for short periods

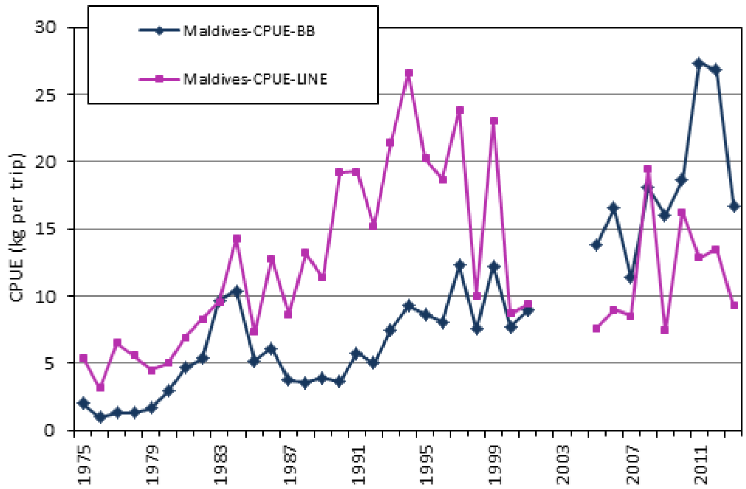
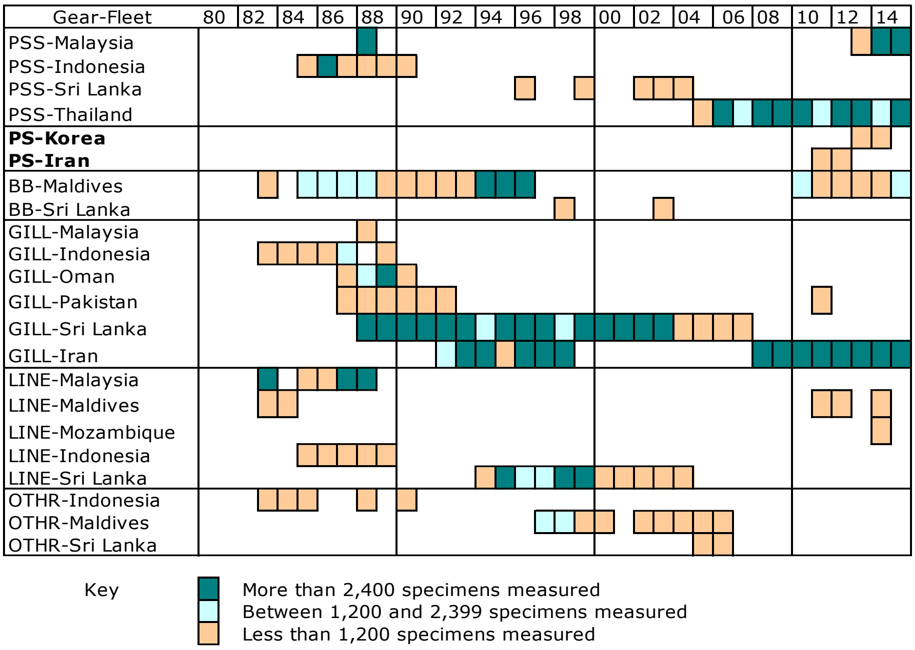


Fig. 29. Kawakawa: Nominal CPUE series for baitboat (BB) and troll line (TROL) fisheries of Maldives (1975–2015) derived from the available catch-and-effort data.

Kawakawa tuna – Fish size or age trends (e.g., by length, weight, sex and/or maturity)

- Sizes: the size of kawakawa taken by the Indian Ocean fisheries typically ranges between 20 and 60 cm depending on the type of gear used, season and location (**Fig.31a**). The coastal purse seine fisheries operating in the Andaman Sea tend to catch kawakawa of a relatively small size (15–30 cm) while gillnet, baitboat and other fisheries operating in the Indian Ocean catch usually larger specimens (25–55 cm).
- Size frequency data: overall highly incomplete, with data only available for selected years and/or fisheries (**Fig.30**).

  Main sources for size samples: Sri Lanka (gillnet), and I.R. Iran (gillnets).
  Trends in average weight can be assessed for Sri Lankan gillnets from the mid-1980s to early-1990s, but the amount of specimens measured has been very low in recent years (**Fig. 31b**). Since 1998 there has also been some sampling of lengths from Iranian gillnets – although average lengths are significantly larger than specimens reported by other fleets which reflect differences in the selectivity of offshore gillnets operating in the Arabian Sea, rather than an actual change in average sizes in the underlying population.
  Length distributions derived from the data available for gillnet fisheries are shown in **Fig.31a**. Data are not available in sufficient numbers for all other fisheries.
- Catch-at-Size (Age) table: Not available, due to lack of size samples and uncertainty over the reliability of retained catch estimates.
- Sex ratio data: have not been provided to the Secretariat by CPCs.



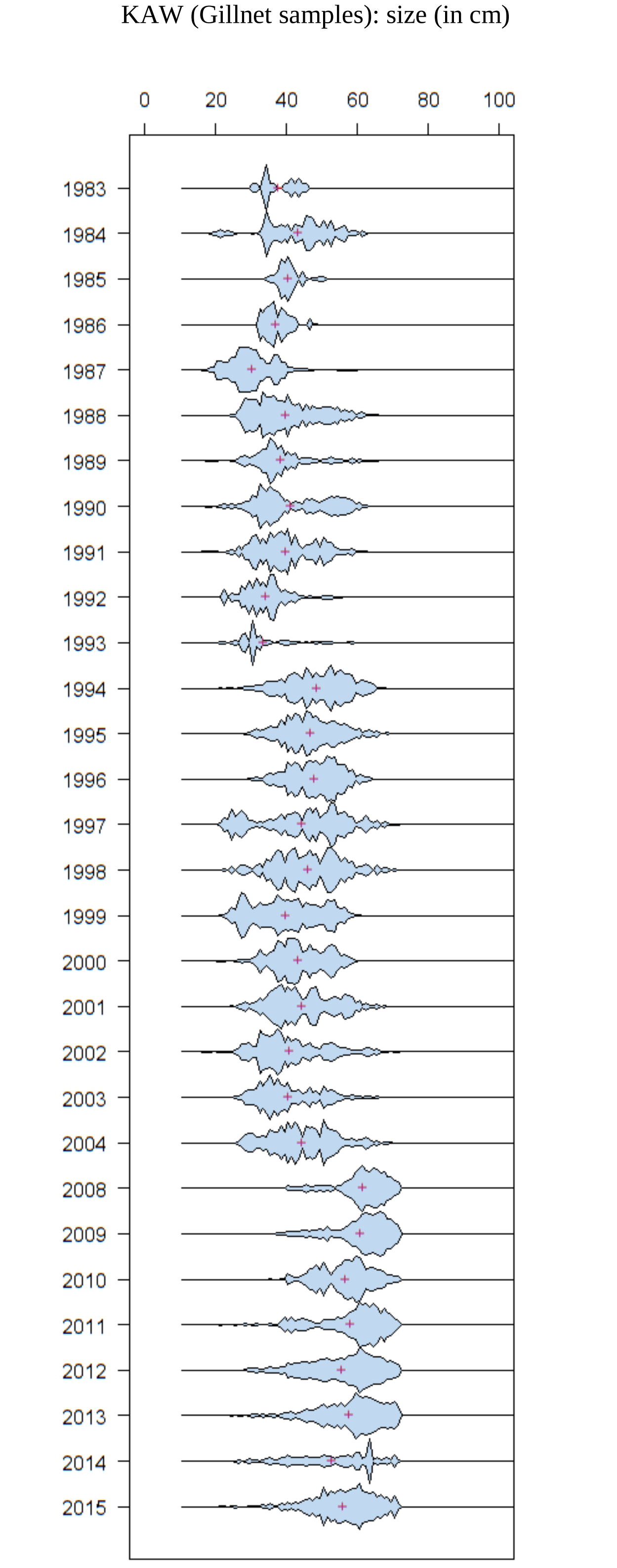
- **Fig.30.** Kawakawa: Availability of length frequency data, by fishery and year (1980-2015)[25]. Note that no length frequency data are available for 1950–82.

Other biological data: Equations available for kawakawa are shown below

Species	*From type measurement – To type measurement*	*Equation*	*Parameters*	*Sample size*	*Length*
Kawakawa	*Fork length – Round Weight*	*RND=a*L^b*	*a= 0.0000260 b= 2.9*		*Min: 20 Max: 65*

Source: Data from North Indian Ocean: IPTP Sampling Programme in Sri Lanka (1989).

[25] Note that the above list is not exhaustive, showing only the fisheries for which size data are available in the IOTC database. Furthermore, when available size data may not be available throughout the year existing only for short periods



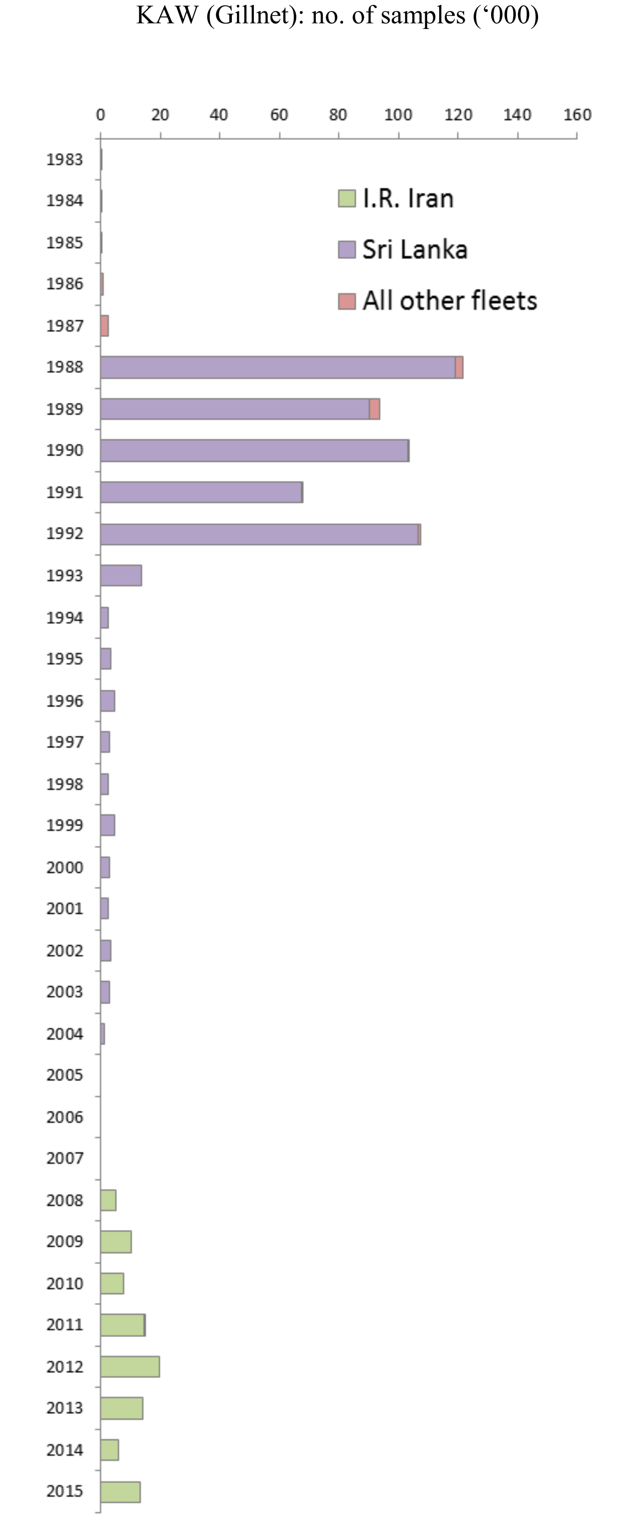


Fig.31a-b. Left: Kawakawa (gillnet fisheries): Length frequency distributions (by 1cm length class) derived from data available at the IOTC Secretariat, 1983-2015.

Right: Number of kawakawa specimens (gillnet fisheries) sampled for lengths, by fleet and year.

APPENDIX IVD
MAIN STATISTICS FOR LONGTAIL TUNA (*THUNNUS TONGGOL*)

Extract from IOTC–2017–WPNT07–07

Fisheries and main catch trends

- Main fisheries: longtail tuna are caught mainly using gillnets and, to a lesser extent, coastal purse seine nets and trolling (**Table 2; Fig. 5**).
- Main fleets (i.e., highest catches in recent years):
  Over 40% of the catches of longtail in the Indian Ocean are accounted for by I.R. Iran (gillnetters), followed by Indonesia (gillnet and trolling), Pakistan (gillnetters) (**Fig.6**).
- Retained catch trends:
  Estimates catches of longtail tuna have increased steadily from the mid-1950s, reaching around 15,000t in the mid-1970's, over 35,000t by the mid-1980's, and more than 96,000 t in 2000. Between 2000 and 2005, catches declined, but have since recovered and reached the highest levels recorded – over 170,000 t in 2011.

  From around 2009 I.R. Iran has reported large increases catches of longtail tuna in coastal waters in the Arabian Sea, as a result of the threat of piracy and displacement of fishing effort (and change of targeting) by gillnet vessels formerly operating in the North-West Indian Ocean. Since 2013 lower catches have been reported – albeit not to pre-piracy levels – in response to the reduced threat of piracy, and resumption of fishing activity on the high seas.
- Discard levels**:** are thought to be very low, although estimates of discards are unknown for most fisheries.

Changes to the catch series**:** no major changes to the catch series of longtail tuna since WPNT in 2016.

Longtail tuna: estimation of catches – data related issues

Retained catches for longtail tuna were derived from incomplete information – due to deficiencies in port sampling for many of the main fleets – and are therefore uncertain[26] (**Fig.7**); notably for the following fisheries:

- Artisanal fisheries of Indonesia: Indonesia did not report catches of longtail tuna by species or by gear for 1950–2004; instead catches of longtail tuna, kawakawa and other species were reported as aggregated for this period. In the past, the IOTC Secretariat used the catches reported since 2005 to break the aggregates for 1950–2004, by gear and species. However, a recent review by the IOTC Secretariat conducted by an independent consultant in 2012 indicated that catches of longtail tuna had been severely overestimated by Indonesia. While the new catches estimated for the longtail tuna in Indonesia remain uncertain, the new figures are considered more reliable than those existing in the past.

  In addition, the IOTC Secretariat has been conducting a pilot sampling project of artisanal fisheries in North and West Sumatra since 2014 to improve estimates of catch by species for coastal fisheries. One of the key issues is the misclassification of juvenile tunas (*tongkol*) as longtail tuna (*Thunnus tonggol*) by District authorities in Indonesia, which is believed to have led to over-estimates of catches of longtail for a number of years. Based on the results of the pilot sampling, the IOTC Secretariat is working with Indonesia to further improve the estimates of longtail tuna.
- Artisanal fisheries of India and Oman: Although these countries report catches of longtail tuna, until recently the catches have not been reported by gear. The IOTC Secretariat used alternative information to assign the catches reported by Oman by gear. The catches of India were also reviewed by the independent consultant in 2012 and assigned by gear on the basis of official reports and information from various alternative sources.
- Artisanal fisheries of Myanmar and Somalia: None of these countries have ever reported catches of longtail tuna to the IOTC Secretariat. While catch levels are unknown they are unlikely to be substantial. In the case of Myanmar, catches are taken from FAO and SEAFDEC (various years).

[26] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of non-reporting fisheries for which catches had to be estimated.

- Other artisanal fisheries: The IOTC Secretariat had to estimate catches of longtail tuna for the artisanal fisheries of Yemen (as no data has been reported to the IOTC Secretariat) and until recently Malaysia (with catches of the main neritic tunas aggregated and reported to the IOTC Secretariat as longtail tuna).

TABLE 2. Longtail tuna: latest scientific estimates of the catches of longtail tuna by type of fishery for the period 1950–2015 (in metric tonnes). Data as of June 2017.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Purse seine	61	204	1,012	4,863	10,933	17,719	16,128	23,838	18,885	20,649	16,531	26,062	25,218	17,227	12,770	11,111
Gillnet	2,960	6,224	10,026	25,838	41,648	63,485	59,802	68,398	69,708	87,159	105,094	121,672	115,278	113,370	107,038	99,145
Line	551	809	1,564	4,349	5,016	9,502	9,514	11,929	11,206	12,494	12,977	15,295	25,891	20,707	22,127	20,761
Other	0	0	125	1,090	1,992	3,731	3,638	5,686	5,460	5,300	6,513	8,467	9,073	5,789	4,642	5,839
Total	**3,572**	**7,238**	**12,727**	**36,141**	**59,589**	**94,437**	**89,081**	**109,851**	**105,260**	**125,601**	**141,115**	**171,496**	**175,459**	**157,093**	**146,578**	**136,856**

Definition of fishery: Gillnet: gillnet, including offshore gillnet; Line: coastal longline, hand line, troll line; Purse seine: coastal purse seine, purse seine, ring net; Other gears: baitboat, danish seine, liftnet, longline, longline fresh, trawling.

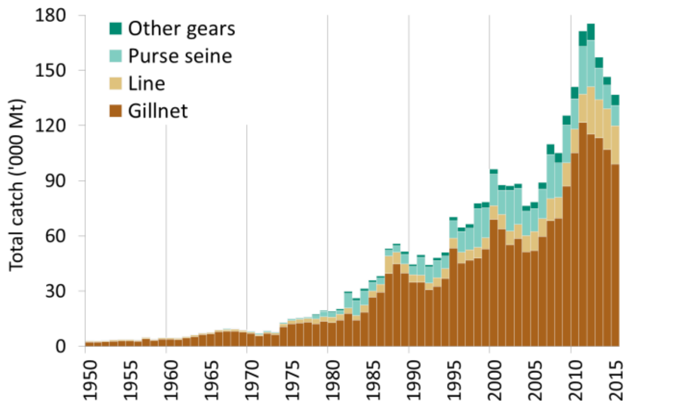


Fig.5. Longtail tuna: Annual catches by gear recorded in the IOTC Database (1950–2015).

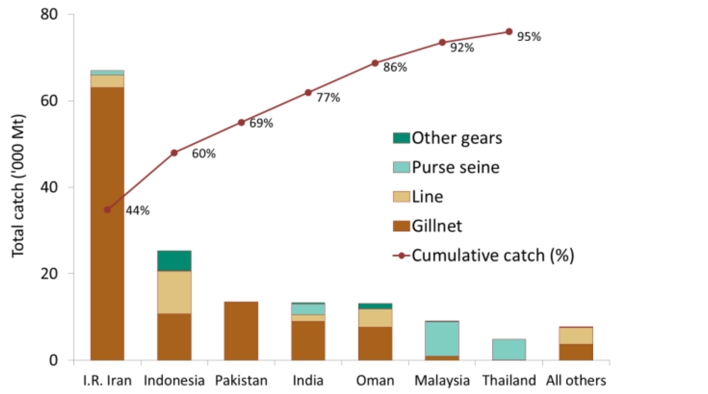


Fig.6. Longtail tuna: Average catches in the Indian Ocean over the period 2012–15, by country[27].

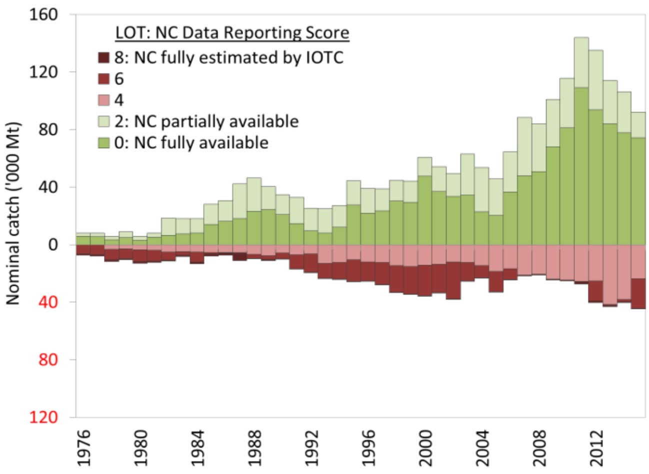


Fig.7. Longtail tuna: nominal catch; uncertainty of annual catch estimates (1976–2015).

Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully by gear and/or species (i.e., partially adjusted by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document; catches with a score of 8 refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat).

[27] Countries are ordered from left to right, according to the importance of catches of longtail reported for 2012-2014. The red line indicates the (cumulative) proportion of catches of longtail tuna for the countries concerned, over the total combined catches of this species reported from all countries and fisheries for 2012-2015.

Longtail tuna – Effort trends

- Availability: Effort trends are unknown for longtail tuna in the Indian Ocean due to the lack of catch-and-effort data.

Longtail tuna – Catch-per-unit-effort (CPUE) trends

- Availability: highly incomplete, with data available for only short periods of time and selected fisheries (**Fig.8**).
- Main CPUE series available: Thailand coastal purse seine and gillnet vessels (i.e., available over 10 years) (**Fig.9**).

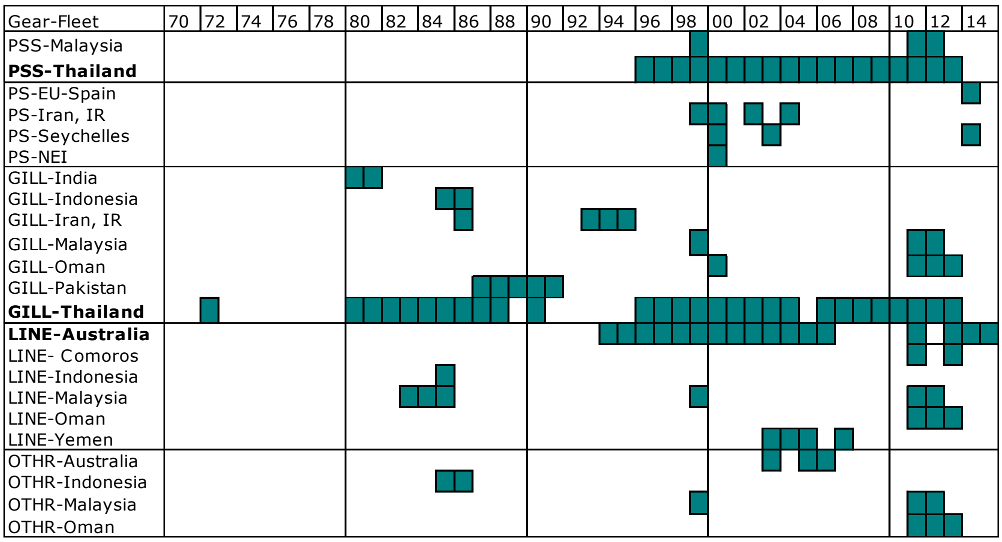


Fig.8. Longtail tuna: Availability of catches and effort series, by fishery and year (1970–2015)[28]. No catch-and-effort is available for 1950–1971.

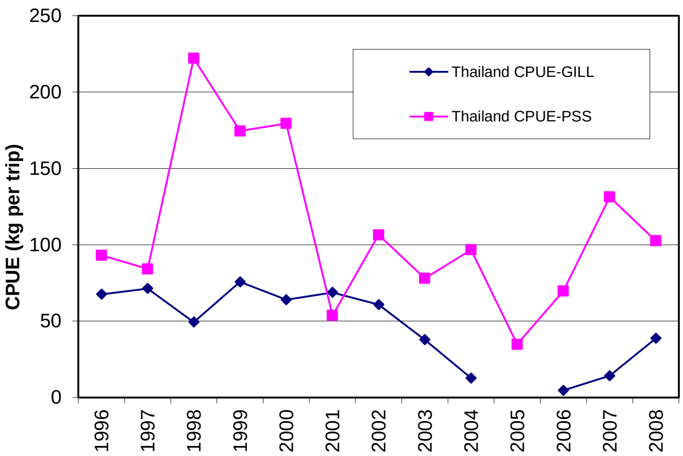


Fig.9. Longtail tuna: Nominal CPUE series for gillnet (GILL) and coastal purse seine (PSS) fisheries of Thailand derived from available catch-and-effort data (1996–2008). Effort reported as fishing days post-2008.

Longtail tuna – Fish size or age trends (e.g., by length, weight, sex and/or maturity)

- Sizes: longtail tunas taken by Indian Ocean fisheries typically range between 20 – 100 cm depending on the type of gear used, season and location (**Fig.10**). Fisheries operating in the Andaman Sea (coastal purse seines and trolling) tend to catch smaller sized longtail tuna (e.g., 20–45cm), while gillnet fisheries of I.R. Iran and Pakistan (Arabian Sea) catch larger specimens (e.g., 50–100cm).
- Size frequency data**:** highly incomplete, with data available only for selected fisheries.

[28] Note that the above list is not exhaustive, showing only the fisheries for which catches and effort are available in the IOTC database. Furthermore, catch-and-effort data are sometimes incomplete for a given year, existing only for short periods.

Main sources for size samples: I.R. Iran (gillnet), Oman (gillnet), and Thailand (coastal purse seiners). Length distributions derived from data available for gillnet fisheries are shown in **Fig.11**. Total numbers of samples, across all years, are also well below the minimum sampling standard of 1 fish per tonne of catch recommended by the IOTC Secretariat to reliably assess changes in average weight.

- Catch-at-Size (Age) table: Not available, due to lack of size samples and uncertainty over the reliability of retained catch estimates.
- Sex ratio data: have not been provided to the Secretariat by CPCs.

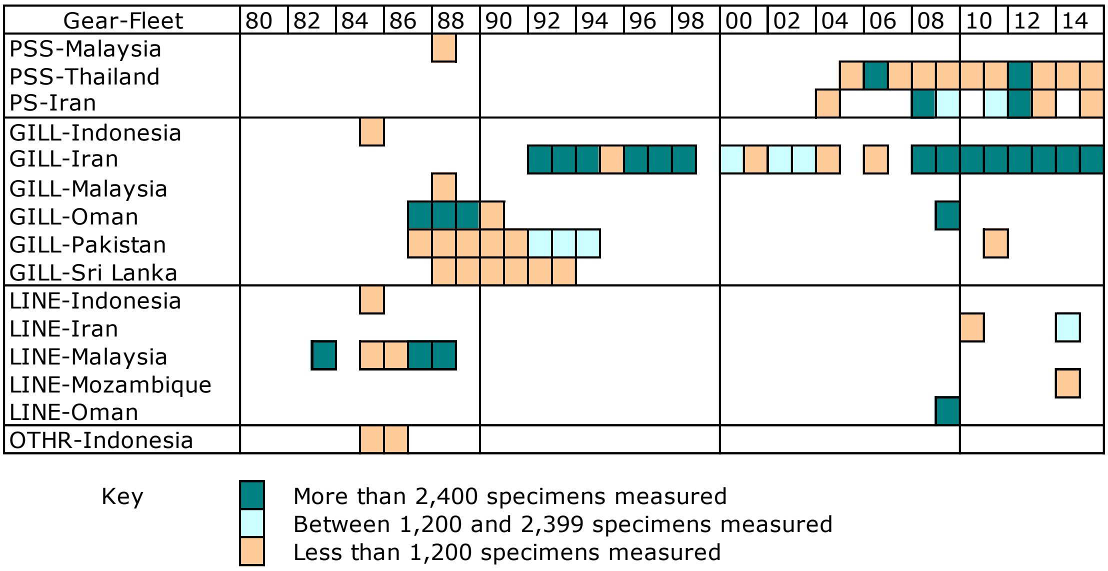


Fig.10. Longtail tuna: Availability of length frequency data, by fishery and year (1980–2015)[29]. Note that no length frequency data are available at all for 1950–1982.

Other biological data: Equations available for longtail tuna are shown below:

Species	*From type measurement – To type measurement*	*Equation*	*Parameters*	*Sample size*	*Length*
Longtail tuna	Fork length – Round Weight	RND=a*L^b	a= 0.00002 b= 2.83		Min:29 Max:128

Source: Data from Indian Ocean: IOTC-2011-WPNT01-18 Population dynamic parameters of Thunnus tonggol in the north of the Persian Gulf and Oman Sea; F.Kaymaram, M. Darvishi, F. Parafkandeh, Sh. Ghasemi & S.A. Talebzadeh.

[29] Note that the above list is not exhaustive, showing only the fisheries for which size data are available in the IOTC database. Furthermore, when available size data may not be available throughout the year existing only for short periods

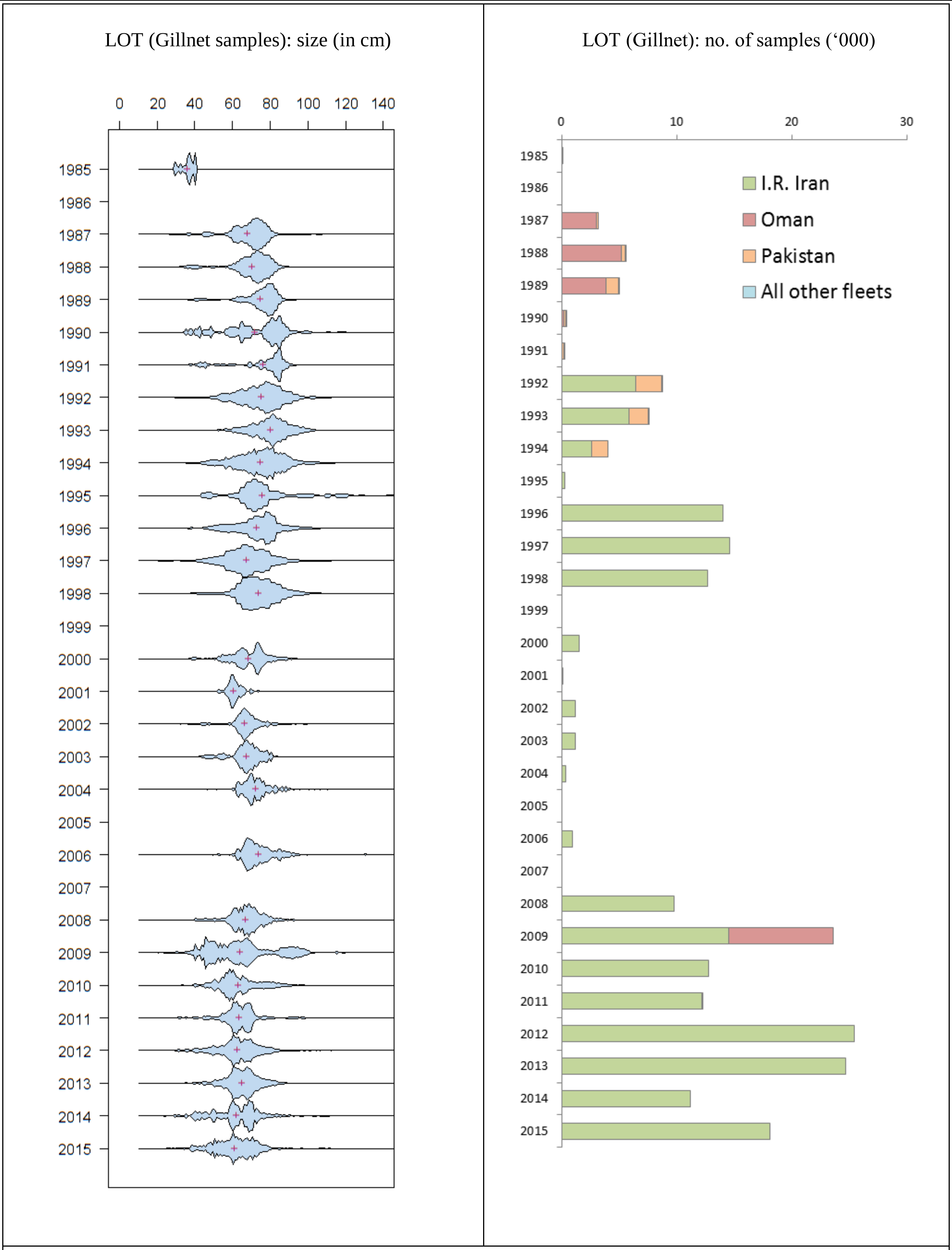


Fig.11a-b. Left: Longtail tuna (gillnet fisheries): Length frequency distributions (by 1cm length class) derived from data available at the IOTC Secretariat, 1985-2015.

Right: Number of longtail tuna specimens (gillnet fisheries) sampled for lengths, by fleet and year.

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

Extract from IOTC–2017–WPNT07–07

Fisheries and main catch trends

- Main fisheries: Indo-Pacific king mackerel[30] are caught mainly by gillnet fisheries in the Indian Ocean, however significant numbers are also caught trolling (**Table7; Fig.39**).
- Main fleets (i.e., in terms of highest catches in recent years):
  Almost two-thirds of catches are accounted for by fisheries in India and Indonesia; with important catches also reported by I.R. Iran (**Fig.40**).
- Retained catch trends:
  Estimated catches have increased steadily since the mid 1960's, reaching around 24,000 t in the late 1970's and over 30,000 t by the mid-1990's, when catches remained stable until around 2006. Since the late-2000s catches have increased sharply, to over 40,000 t, with the highest catches recorded in 2009 at around 53,000 t.
- Discard levels**:** are thought to be very low, although estimates of discards are unknown for most fisheries.

***Changes to the catch series*:** there have been no major revisions to the catch series for King mackerel since the WPNT meeting in 2016.

Indo-Pacific King mackerel: estimation of catches – data related issues

Retained catches for King mackerel were derived from incomplete information, and are therefore uncertain[31] (**Fig.41**), notably for the following fisheries:

- Species aggregation: King mackerels are often not reported by species but are aggregated with narrow-barred Spanish mackerel or, less frequently, other small tuna species.
- Mislabelling: King mackerels are often mislabelled as narrow-barred Spanish mackerel, their catches reported under the latter species.
- Underreporting: the catches of King mackerel may be not reported for some fisheries catching them as a bycatch.

It is for the above reasons that the catches of King mackerel in the IOTC database are thought to represent only a small fraction of the total catches of this species in the Indian Ocean.

TABLE 7. *Indo-Pacific king mackerel: Best scientific estimates of the catches of Indo-Pacific king mackerel by type of fishery for the period 1950–2014 (in metric tonnes). Data as of June 2017.*

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Purse seine	-	-	34	584	772	938	720	1,109	1,239	1,605	1,104	1,268	1,103	1,230	1,235	1,169
Gillnet	4,367	6,898	13,947	17,096	21,709	23,634	20,915	27,450	31,192	32,069	26,800	28,547	27,834	29,898	32,690	31,004
Line	250	349	769	1,334	1,834	2,504	2,046	3,493	3,520	4,041	3,497	3,601	3,575	3,656	3,596	3,970
Other	13	21	48	3,879	5,099	9,353	8,208	10,872	11,929	15,733	10,859	11,268	9,964	11,259	10,747	10,260
Total	**4,630**	**7,269**	**14,798**	**22,893**	**29,414**	**36,428**	**31,889**	**42,923**	**47,880**	**53,448**	**42,260**	**44,684**	**42,476**	**46,042**	**48,268**	**46,403**

Definition of fishery: Gillnet: gillnet, including offshore gillnet; Line: coastal longline, hand line, troll line; Purse seine: coastal purse seine, purse seine, ring net; Other gears: baitboat, Danish seine, liftnet, longline, longline fresh, trawling.

[30] Hereinafter referred to as King mackerel.

[31] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of non-reporting fisheries for which catches had to be estimated.

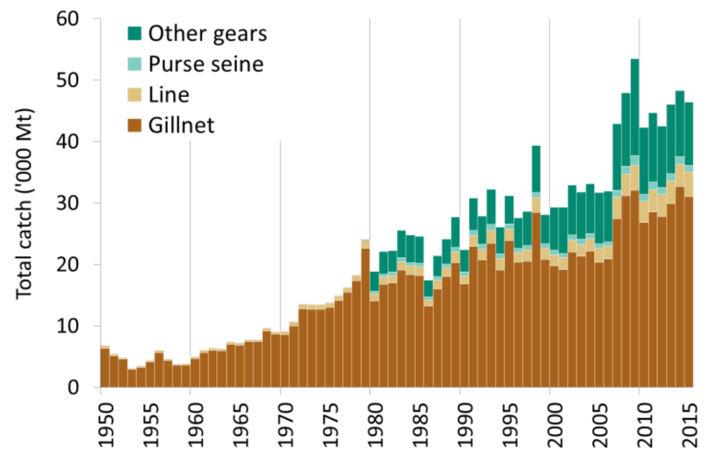


Fig. 39. Indo-Pacific king mackerel: Annual catches by gear recorded in the IOTC Database (1950–2015).

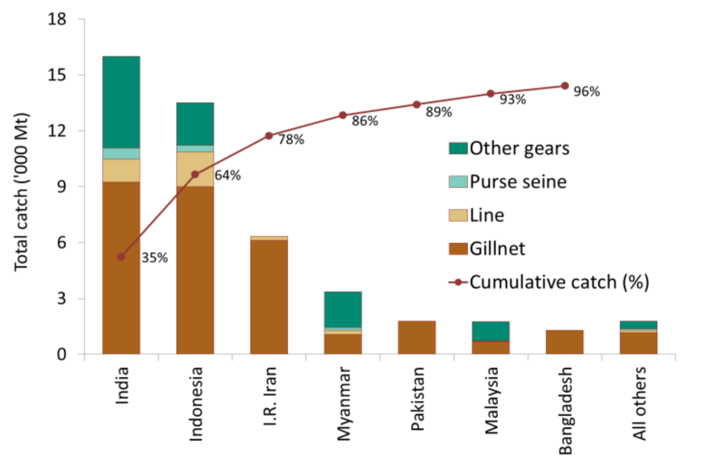


Fig. 40. Indo-Pacific king mackerel: Average catches in the Indian Ocean over the period 2012–15, by country[32].

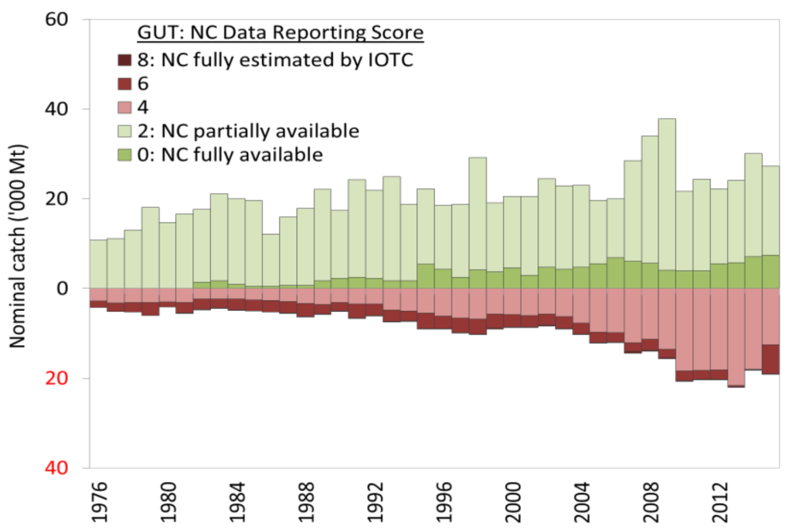


Fig. 41. Indo-Pacific king mackerel: nominal catch; uncertainty of annual catch estimates (1976–2015).

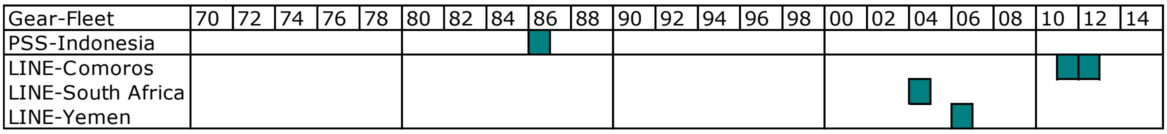
Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully by gear and/or species (i.e., partially adjusted by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document; catches with a score of 8 refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat).

Indo-Pacific King Mackerel – Effort trends

- Availability: Effort trends are unknown for King Mackerel in the Indian Ocean, due to a lack of catch-and-effort data.

Indo-Pacific King Mackerel – Catch-per-unit-effort (CPUE) trends

- Availability: no data available for most fisheries, and where available, data refer to very short periods (**Fig.42**). This makes it impossible to derive any meaningful CPUE from the existing data.



[32] Countries are ordered from left to right, according to the importance of catches of longtail tuna 2012-2015. The red line indicates the (cumulative) proportion of catches of longtail tuna for the countries concerned, over the total combined catches of this species reported from all countries and fisheries for 2012-2015.

Fig. 42. Indo-Pacific king mackerel: Availability of catches and effort series, by fishery and year (1970–2015)[33]. Note that no catches and effort are available at all for 1950–85.

Indo-Pacific king mackerel – Fish size or age trends (e.g., by length, weight, sex and/or maturity)

- Size frequency data: trends in average weight cannot be assessed for most fisheries due to lack of data.

  Main sources of size samples: Thailand (coastal purse seiner) and Sri Lankan (gillnet) – however the number of samples is very small and the data refer to very short periods (**Fig.43**).
- Catch-at-Size (Age) table: Not available, due to lack of size samples and uncertainty over the reliability of retained catch estimates.
- Sex ratio data: have not been provided to the Secretariat by CPCs.

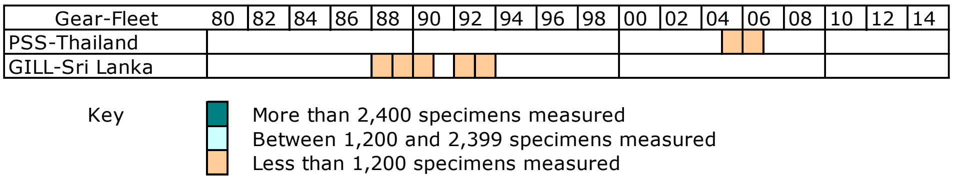


Fig. 43. Indo-Pacific king mackerel: Availability of length frequency data, by fishery and year (1980–2015)[34]. Note that no length frequency data are available for 1950–82.

Other biological data: The equations available for King mackerel are shown below

Species	*From type measurement – To type measurement*	*Equation*	*Parameters*	*Sample size*	*Length*
Indo-pacific king mackerel	*Fork length – Round Weight*	*RND=a*L^b*	*a= 0.0000100000 b= 2.89400*		*Min:20 Max:80*

Source: Data from North Indian Ocean: IPTP Sampling Programme in Sri Lanka (1989).

[33] Note that the above list is not exhaustive, showing only the fisheries for which catches and effort are available in the IOTC database. Furthermore, when available catches and effort may not be available throughout the year existing only for short periods.

[34] Note that the above list is not exhaustive, showing only the fisheries for which size data are available in the IOTC database. Furthermore, when available size data may not be available throughout the year existing only for short periods.

APPENDIX IVF
MAIN STATISTICS FOR NARROW-BARRED SPANISH MACKEREL (*SCOMBEROMORUS COMMERSON*)

Extract from IOTC–2017–WPNT07–07

Fisheries and main catch trends

- Main fisheries: Narrow-barred Spanish mackerel[35] are caught mainly using gillnet, however significant numbers are also caught using troll lines (**Table 6; Fig.32**).
- Main fleets (i.e., highest catches in recent years):
  Fisheries in Indonesia, India, and I.R. Iran account for around two-thirds of catches in recent years (**Fig.33**). Spanish mackerel is also targeted throughout the Indian Ocean by artisanal and sports/recreational fisheries.
- Retained catch trends:
  Catches of Spanish mackerel increased from around 50,000 t in the late-1970's to over 100,000 t by the late-1990's. The highest catches of Spanish mackerel have been recorded in recent years since 2011, at over 145,000 t.
- Discard levels**:** are thought to be very low, although estimates of discards are unknown for most fisheries.

***Changes to the catch series*:** No major revisions to the catch series since the WPNT meeting in 2016.

Narrow-barred Spanish mackerel: estimation of catches – data related issues

Retained catches for Spanish mackerel were derived from incomplete information, and are therefore uncertain[36] (**Fig.34**), notably for the following fisheries:

- Artisanal fisheries of Indonesia and India: Indonesia and India have only recently reported catches of Spanish mackerel by gear, including catches by gear for the years 2005–08 and 2007–08, respectively. In the past, the IOTC Secretariat used the catches reported in recent years to break the aggregates for previous years, by gear and species. However, in a review conducted by the IOTC Secretariat by an independent consultant in 2012 the catches of narrow-barred Spanish mackerel were reassigned by gear for both India and Indonesia. In recent years, the catches of narrow-barred Spanish mackerel estimated for Indonesia and India component represent around 50% of the total catches of this species in the Indian Ocean.
- Artisanal fisheries of Madagascar: To date, Madagascar has not reported catches of narrow-barred Spanish mackerel to the IOTC. During 2012 the IOTC Secretariat conducted a review aiming to break the catches recorded in the FAO database as narrow-barred Spanish mackerel by species, on the assumption that all catches of tunas and tuna-like species had been combined under this name (the review used data from various sources including a reconstruction of the total marine fisheries catches of Madagascar (1950–2008), undertaken by the Sea Around Us Project). However the new catches estimated are still considered to be highly uncertain.
- Artisanal fisheries of Somalia: Catch levels are unknown.
- Other artisanal fisheries: UAE do not report catches of narrow-barred Spanish mackerel by gear. Although most of the catches are believed to be taken by gillnets, some narrow-barred Spanish mackerel may be also caught by using small surrounding nets, lines or other artisanal gears. In addition, Thailand report catches of narrow-barred Spanish mackerel and Indo-Pacific king mackerel aggregated.
- All fisheries: In some cases the catches of seerfish species are misreported, with catches of Indo-Pacific king mackerel and, to a lesser extent, other seerfish species, reported as narrow-barred Spanish mackerel. Similarly, the catches of wahoo in some longline fisheries are thought to be misreported as narrow-barred Spanish mackerel – although this is thought to have little impact in the case of the narrow-barred Spanish mackerel but may be important for other seerfish species.

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[35] Hereinafter referred to as Spanish mackerel.

[36] The uncertainty in the catch estimates has been assessed by the Secretariat and is based on the amount of processing required to account for the presence of conflicting catch reports, the level of aggregation of the catches by species and or gear, and the occurrence of non-reporting fisheries for which catches had to be estimated.

TABLE 6. Narrow-barred Spanish mackerel: Best scientific estimates of the catches of narrow-barred Spanish mackerel by type of fishery for the period 1950–2015 (in metric tonnes). Data as of June 2017.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Purse seine	-	0	285	2,355	4,145	5,611	7,631	6,588	6,133	8,459	8,789	9,113	8,894	9,314	8,075	8,065
Gillnet	9,527	17,708	32,168	54,918	62,712	67,281	67,804	73,041	75,675	77,071	81,734	80,963	88,731	84,682	91,314	87,704
Line	1,735	2,472	4,672	11,334	12,071	17,139	18,259	19,755	18,747	21,328	22,075	28,645	30,664	28,339	28,564	33,452
Other	57	96	468	5,603	9,743	21,351	23,915	25,530	22,741	28,170	24,551	25,802	29,347	26,653	24,231	24,957
Total	**11,318**	**20,277**	**37,593**	**74,210**	**88,671**	**111,382**	**117,609**	**124,914**	**123,297**	**135,028**	**137,148**	**144,523**	**157,636**	**148,988**	**152,184**	**154,177**

Definition of fishery: Gillnet: gillnet, including offshore gillnet; Line: coastal longline, hand line, troll line; Purse seine: coastal purse seine, purse seine, ring net; Other gears: baitboat, Danish seine, liftnet, longline, longline fresh, trawling.

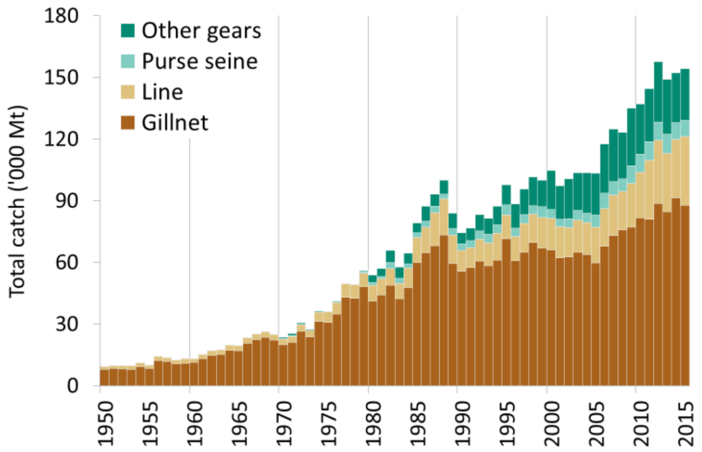


Fig.32. Narrow-barred spanish mackerel: Annual catches by gear recorded in the IOTC Database (1950–2015).

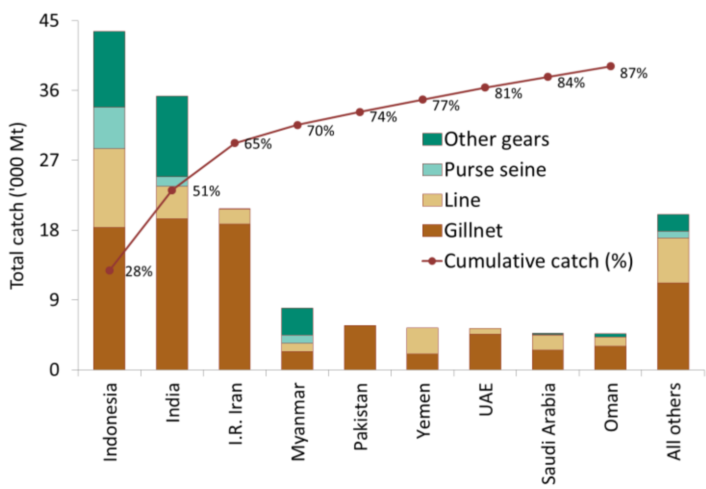


Fig.33. Narrow-barred spanish mackerel: Average catches in the Indian Ocean over the period 2012–15, by country[37].

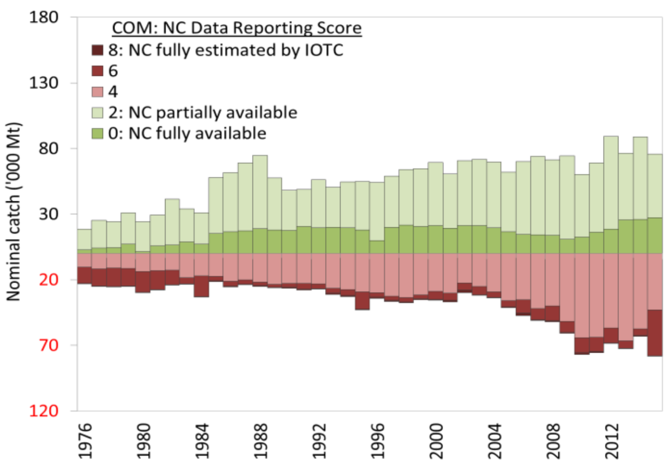


Fig.34. Narrow-barred spanish mackerel: nominal catch; uncertainty of annual catch estimates (1976–2015).

Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully by gear and/or species (i.e., partially adjusted by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document; catches with a score of 8 refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat).

[37] Countries are ordered from left to right, according to the importance of catches of longtail reported for 2012-2014. The red line indicates the (cumulative) proportion of catches of longtail tuna for the countries concerned, over the total combined catches of this species reported from all countries and fisheries for 2012-2015.

Narrow-barred Spanish mackerel – Effort trends

- Availability: Effort trends are unknown for Spanish mackerel in the Indian Ocean, due to a lack of catch-and-effort data.

***Narrow-barred Spanish mackerel – Catch-per-unit-effort (CPUE) trends**:*

- Availability: highly incomplete data, available only for selected years and/or fisheries (**Fig.35**).
- Main CPUE series available (i.e., over 10 years or more):
  Sri Lanka (gillnets) – however the catches and effort recorded are thought to be unreliable due to the dramatic changes in CPUE recorded in 2003 and 2004 (**Fig.36**).

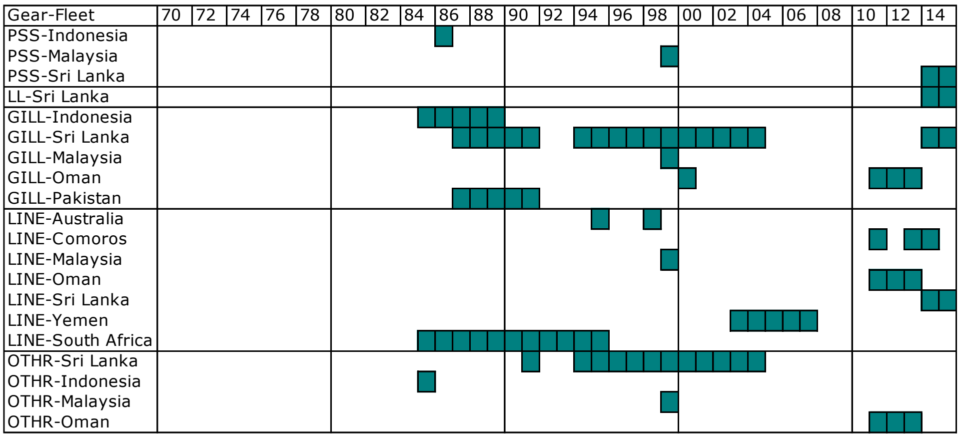


Fig.35. Narrow-barred Spanish mackerel: Availability of catches and effort series, by fishery and year (1970–2015)[38]. No catches and effort are available at for 1950–84, and 2008–10.

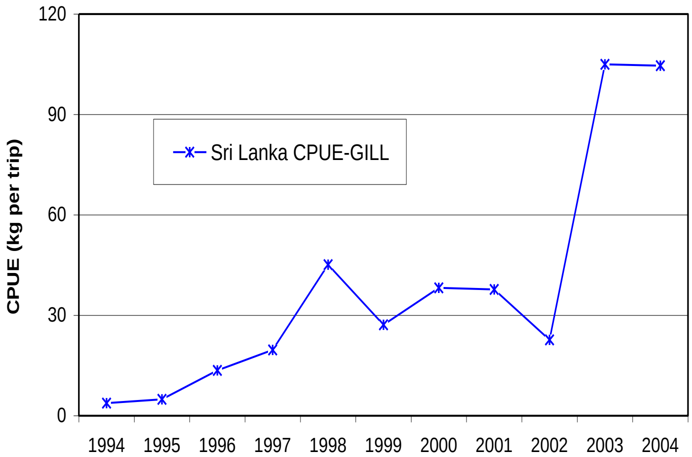


Fig.36. Narrow-barred Spanish mackerel: Nominal CPUE series for the gillnet fishery of Sri Lanka derived from the available catches and effort data (1994–2004). No data available since 2004.

Narrow-barred Spanish mackerel – Fish size or age trends (e.g., by length, weight, sex and/or maturity)

- Sizes: the sizes of narrow-barred Spanish mackerel taken by the Indian Ocean fisheries typically ranges between 30 and 140 cm depending on the type of gear used, season and location – with 32–119 cm fish taken in the Eastern Peninsular Malaysia area, 17–139 cm fish taken in the East Malaysia area and 50-90 cm fish taken in the Gulf of Thailand. Similarly, narrow-barred Spanish mackerel caught in the Oman Sea are typically larger than those caught in the Persian Gulf.[39]

[38] Note that the above list is not exhaustive, showing only the fisheries for which catches and effort are available in the IOTC database. Furthermore, when available catches and effort may not be available throughout the year existing only for short periods

[39] The IOTC Secretariat did not find any data in support of this statement.

- Size frequency data: highly incomplete data, available only for selected years and/or fisheries (**Fig.37**).

  Total numbers of samples, across all years, are also well below the minimum sampling standard of 1 fish per tonne of catch recommended by the IOTC Secretariat to reliably assess changes in average weight.
  Main sources for size samples: Sri Lankan (gillnet) (from late-1980s until early-1990s), and I.R. Iran (gillnet) (from the late-2000s) (**Fig.38b**). Length distributions derived from the data available for gillnet fisheries are shown in (**Fig.38a)**. No data are available in sufficient numbers for other fisheries.
- Catch-at-Size (Age) table: Not available, due to lack of size samples and uncertainty over the reliability of retained catch estimates.

- Sex ratio data: have not been provided to the Secretariat by CPCs.

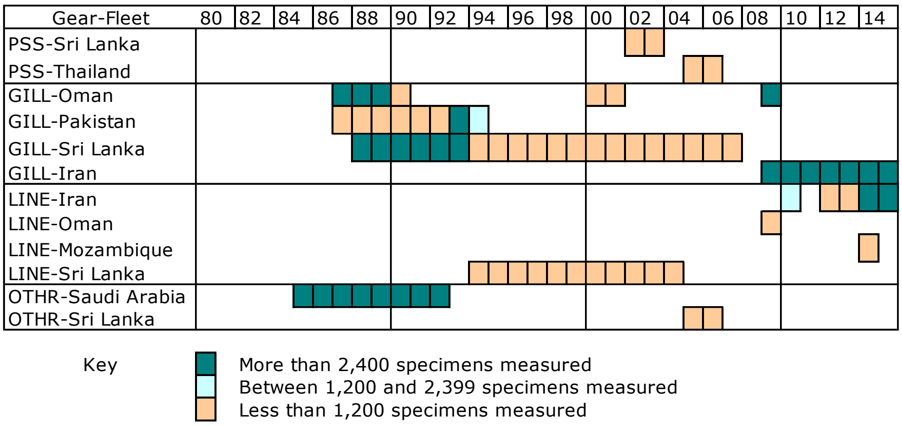


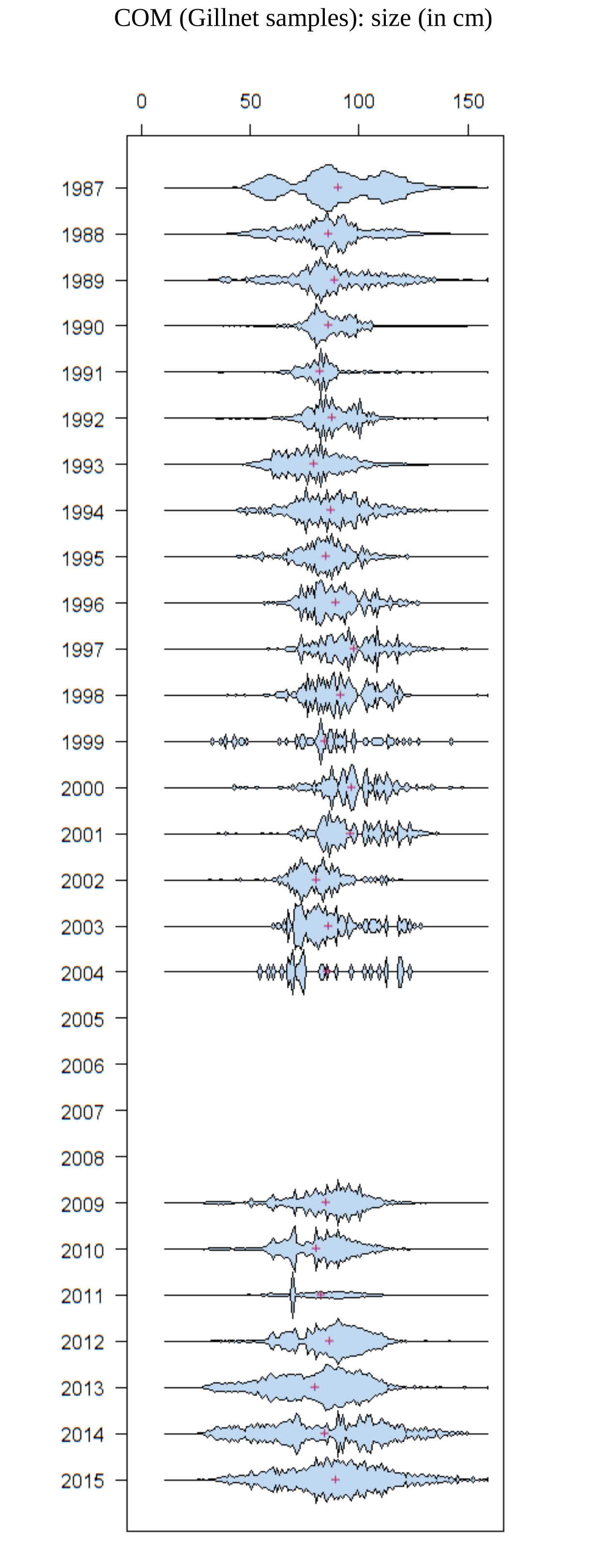
Fig.37. Narrow-barred Spanish mackerel: Availability of length frequency data, by fishery and year (1980–2015)[40]. Note that no length frequency data are available prior to 1984.

Other biological data: Equations available for Spanish mackerel are shown below:

Species	From type measurement – To type measurement	Equation	Parameters	Sample size	Length
Spanish mackerel	Fork length – Round Weight	RND=a*L^b	a= 0.00001176 b= 2.9002		Min:20 Max:200

Source: Data from North Indian Ocean: IPTP Sampling Programme in Sri Lanka (1989).

[40] Note that the above list is not exhaustive, showing only the fisheries for which size data are available in the IOTC database. Furthermore, when available size data may not be available throughout the year existing only for short periods.



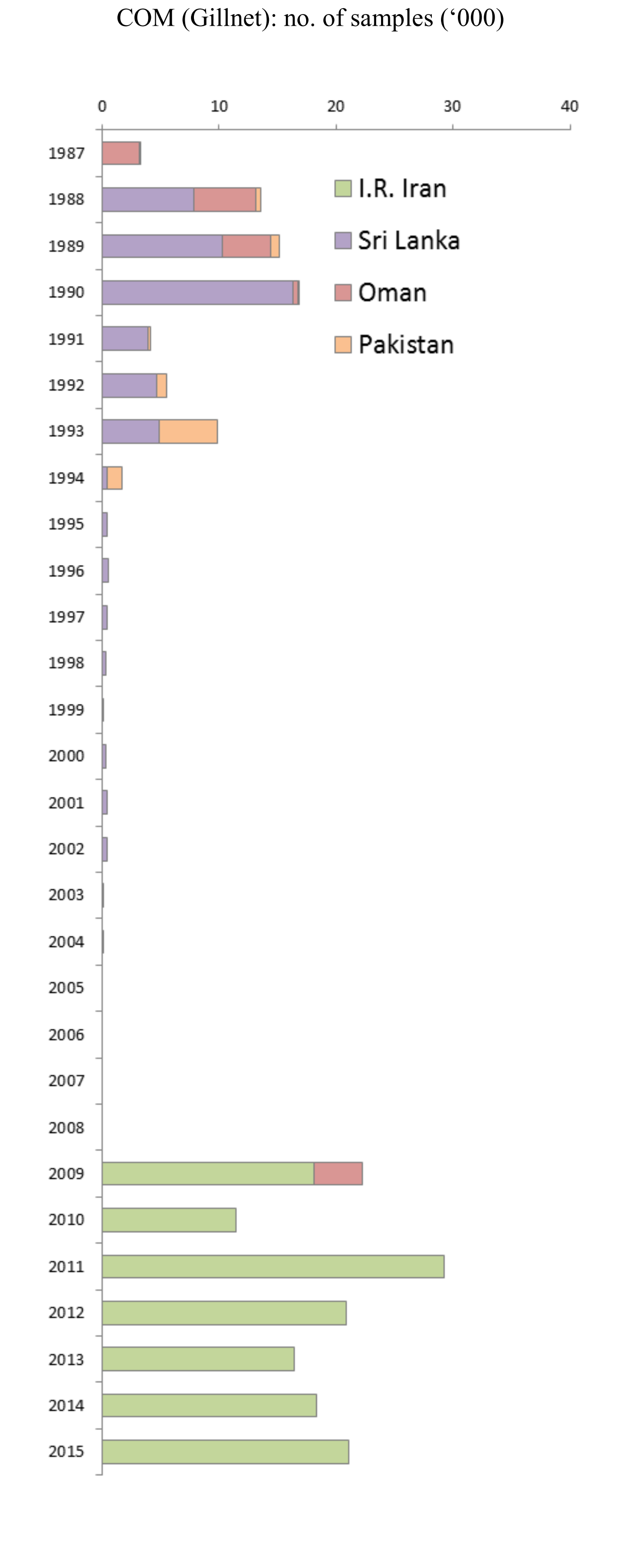


Fig.38a-b. Left: Narrow-barred Spanish Mackerel (gillnet fisheries): Length frequency distributions (by 1cm length class) derived from data available at the IOTC Secretariat, 1987-2015.

Right: Number of narrow-barred Spanish mackerel specimens (gillnet fisheries) sampled for lengths, by fleet and year.

APPENDIX V
MAIN ISSUES IDENTIFIED RELATING TO THE STATISTICS OF NERITIC TUNAS

Extract from IOTC–2017–WPNT07–07

Data type(s)	Fisheries	Issue	Progress
Nominal catch, catch-and-effort, size data	Coastal fisheries of Madagascar, Myanmar, and Yemen	Non-reporting countries Catches of neritic tunas 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: no regular data collection system exists for recording catches from coastal fisheries. Pilot sampling, funded by COI-SmartFish and assistance from the IOTC Secretariat, was conducted in selected provinces in 2013. Since then Smartfish have agreed to provide Madagascar with additional support for data collection and management. • Myanmar (non-reporting, non-IOTC member): no update. Catches in the IOTC database are based on estimates published by SEAFDEC and FAO FishStat (various years). • Yemen: no update. No catch information provided; catches estimated based on FAO FishStat.
Nominal catch, catch-and-effort, size data	Coastal fisheries of India, Indonesia, I.R. Iran, Kenya, Malaysia, Mozambique; Oman, Tanzania, and Thailand	Partially-reported data These fisheries do not fully report catches of neritic tunas by species and/or gear, as per the reporting standards of IOTC Res.15/02. For example: • Nominal catches may have been partially allocated by gear and species by the IOTC Secretariat, where necessary. • Catch and-effort and size data may also be missing, or not fully reported to Res.15/02 standards.	• India: no update. No catch-and-effort or size data reported for coastal fisheries. • Indonesia: No catch-and-effort, or size data, reported for coastal fisheries. • Kenya: data based on National Report submitted to SC. Kenya has recently undertaken a Catch Assessment Survey to improve catch estimates for artisanal fisheries; however, to date, no additional information has been submitted by Kenya to the IOTC Secretariat. Update: The IOTC Secretariat is continuing to work with Kenya to finalize the Catch Assessment Survey results for 2014-2016, and which will be reported to the IOTC in due course. • Mozambique: data based on National Report submitted to SC. A Data Compliance mission was conducted by the IOTC Secretariat in June 2014 to assess current levels of reporting and the status of fisheries data collection. Following the mission, Mozambique reported catch and effort data, however there are still issues on the classification of the different fleets. Size frequency data was also reported by species, for sport and recreational fisheries. • Oman: no update. No size data submitted, although data has been collected. • Sri Lanka: while catch-and-effort are submitted as offshore and within the EEZ, it is unclear whether catches within the EEZ refer to the semi-industrial/industrial fisheries. Catch-and-effort for coastal (artisanal) fisheries does not appear to have been reported. • Tanzania: a data compliance mission was conducted in February 2016, including a list of outstanding issues and recommendations to improve levels of compliance. Catch data (aggregated by species) are based on data from the National Report submitted to SC. Catches also appear to be underreported for some years (i.e., excluding catches from Zanzibar). • Thailand: has collected one of the longest time series of size data for neritic tunas (coastal purse seiners) (from 1980s; data in electronic format from 1994 onwards). However size data have only been reported to the IOTC Secretariat for 2005 and 2006. A follow-up data mining mission, funded by the IOTC-OFCF Project was conducted in 2015 to assist Thailand with the processing of the historical size data. Data for 2014 was received in 2015; data for earlier years is currently being processed and will be submitted to the IOTC Secretariat in due course.
	Coastal fisheries of Indonesia,	Reliability of catch estimates	• 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

	Malaysia, and Thailand	A number of issues have been identified for the following fisheries, which compromise the quality of the data in the IOTC database.	species reported as commercial category *tongkol*. The IOTC Secretariat is continuing to provide technical support for a pilot sampling project of artisanal fisheries in North and West Sumatra to improve estimates of neritic tunas and juvenile tuna species in particular. • 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). The upload of catch-and-effort data to the IOTC database remains pending until inconsistencies in the data are satisfactorily resolved. • Thailand (catch-and-effort): catch-and-effort shows large increases for longtail tuna in recent years, despite a *decrease* in effort. Clarification has been requested from Thailand by the IOTC Secretariat, but no response has been received as yet. The catch-and-effort data remain pending upload to the IOTC database until the inconsistencies with the level of fishing effort have been resolved.
Catch and effort, size data	(Offshore) Surface and longline fisheries: I.R. Iran and Pakistan	Non-reporting or partially-reported data A substantial component of these fisheries operates 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: no update. Catch-and-effort is not fully reported (i.e., no effort reported, only monthly catches by landing site). Update: The IOTC Secretariat has scheduled a Data compliance and support mission in September 2017 to review data reported by Iran, and in particular assist with reporting of catch-and-effort according to IOTC data requirements. • Pakistan – drifting gillnets: no update. No catch-and-effort or size data has been reported to date, due to deficiencies in the port sampling and absence of on-board logbooks. Update: WWF-Pakistan has been a coordinating a skipper-based observer programme for over two years, which includes information on total enumeration of catches, and fishing location (for sampled vessels) and could be used to estimate catch-and-effort for Pakistan gillnet vessels in the absence of a national logbook program. The IOTC Secretariat is currently liaising with WWF-Pakistan to evaluate the quality of the observer data collected.
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 and 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 2003-07. 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).
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 2003–07.

			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 species in the Indian Ocean, in particular basic data that can be used to establish length-weight-age keys, non-standard measurements-fork length keys and processed weight-live weight keys.	Collection of biological information, including size data, remains very low for most neritic species. Update: The IOTC is coordinating a Stock Structure Project, which commenced in 2016, and aims to supplement gaps in the existing knowledge on biological data, and in particular 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 (2018–2022)

The following is the Draft WPNT Program of Work (2018 to 2022) and is based on the specific requests of the Commission and Scientific Committee as well as topics identified during the WPNT07. 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	Sub-topic and project	Priority	Est. budget and/or potential source	Timing				
				2018	2019	2020	2021	2022
1. Data mining and collation	Collate and characterise 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.	High (1)	CPCs directly					
2. 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.	High (2)	CPUE Workshop (TBD)					
	➢ Longtail tuna. Priority fleets: Iran (gillnet), Indonesia (line and gillnet), Malaysia (coastal purse seine), Pakistan, Oman, Thailand (coastal purse seine) and India (all gillnet).		CPCs directly					
	➢ Spanish mackerel. Priority fleets: Gillnet fisheries of Indonesia, India, Iran, Pakistan and Oman.		CPCs directly					
	➢ Kawakawa. Priority fleets: Indonesia (purse seine/ line), Malaysia (coastal purse seine), Thailand (coastal purse seine), India (gillnet), Iran (gillnet) and Pakistan (gillnet).		CPCs directly					

	➢ Indo-Pacific king mackerel. Priority fleets: Gillnet fisheries of India, Indonesia, Pakistan (gillnet/troll) and Iran.		CPCs directly					
3. Stock assessment / Stock indicators	Develop and compare multiple assessment approaches to determine stock status for longtail tuna, kawakawa and Spanish mackerel (SS3, ASPIC etc). ➢ 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. ➢ The following data should be collated and made available for collaborative analysis: 1) catch and effort by species and gear by landing site; 2) operational data: stratify this by vessel, month, and year for the development as an indicator of CPUE over time; and 3) operational data: collate other information on fishing techniques (i.e. area fished, gear specifics, depth, environmental condition (near shore, open ocean, etc.) and vessel size (length/horsepower).	High (3)	IOTC Regular Budget					
4. Biological information (parameters for stock assessment)	Age and growth research; Age-at-Maturity 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, which will be fed into future stock assessments.	High (4)						

5. Stock structure (connectivity)	Genetic research to determine the connectivity of neritic tunas throughout their distributions	High (5)	1.3 m Euro: European Union					
	➢ Determine the degree of shared stocks for all neritic tunas under the IOTC mandate in the Indian Ocean, so as to better equip the SC in providing management advice based on unit stocks delineated by geographic distribution and connectivity. ➢ Genetic research to determine the connectivity of neritic tunas throughout their distributions: Table 2b should be used as a starting point for research project development to delineate potential stock structure for neritic tunas in the Indian Ocean. ➢ The IOTC Secretariat to coordinate a review of the available literature on neritic tuna stock structure across the Indian Ocean to assess the data already available such as the location of spawning grounds to identify potential sub-stocks.		TBD					

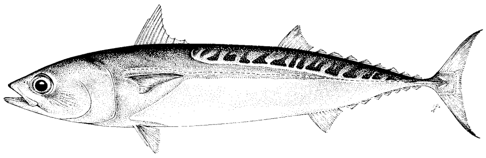
Table 2. Assessment schedule for the IOTC Working Party on Neritic Tunas 2018–2022

Working Party on Neritic Tunas					
Species	**2018**	**2019**	**2020**	**2021**	**2022**
Bullet tuna	Data-poor assessment	Indicators	Data-poor assessment	Indicators	Indicators
Frigate tuna	Data-poor assessment	Indicators	Data-poor assessment	Indicators	Indicators
Indo-Pacific king mackerel	Data-poor assessment *****	Indicators	Data-poor assessment	**Full assessment***	Indicators
Kawakawa	**Full assessment***	Data-poor assessment	Indicators	**Full assessment***	Indicators
Longtail tuna	Indicators	**Full assessment***	Indicators	Indicators	**Full assessment***
Narrow-barred Spanish mackerel	Indicators	Data-poor assessment	**Full assessment***	Indicators	Data-poor assessment

*Including data poor stock assessment methods; Note: the assessment schedule may be changed dependant 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



Status of the Indian Ocean bullet tuna (BLT: *Auxis rochei*) resource

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

Area[1]	Indicators		2017 stock status determination
Indian Ocean	Catch 2015[2]: Average catch 2011–2015:	10,582 t 9,008 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): F_{2015}/F_{MSY} (80% CI): B_{2015}/B_{MSY} (80% CI): B_{2015}/B_0 (80% CI):	unknown unknown unknown unknown unknown 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 2015: 26%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No quantitative stock assessment is currently available for bullet tuna in the Indian Ocean, and 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} target reference points remains uncertain (Table 1), indicating that a precautionary approach to the management of bullet tuna should be applied.

Outlook. Total annual catches for bullet tuna over the past six years have ranged from 8,200 t to 10,600 t (Fig.1). There is insufficient information to evaluate the effect that these levels of catches, or an increase in catches, may have on the resource. Research emphasis 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.) should be considered of high priority for the Commission.

Management advice. A precautionary approach to the management of bullet tuna should be considered by the Commission, by ensuring that future catches do not exceed 9037 t (average 2009–2015). This catch advice should be maintained until an assessment of bullet tuna is available. The reference period (2009-2015) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available (longtail tuna, kawakawa and narrow barred Spanish mackerel). For these species of neritic tunas in Indian Ocean, the MSY is estimated to have been reached between 2009 and 2015. 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 noted:

- The Maximum Sustainable Yield estimate for the whole Indian Ocean 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, and revised where necessary, based on expert knowledge of the history of the various fisheries or through statistical estimation methods.
- Research emphasis 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.) should be considered a high priority for the Commission.
- Species identification, data collection and reporting urgently need 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, the IOTC Secretariat is required to estimate 26% of the catches, which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.

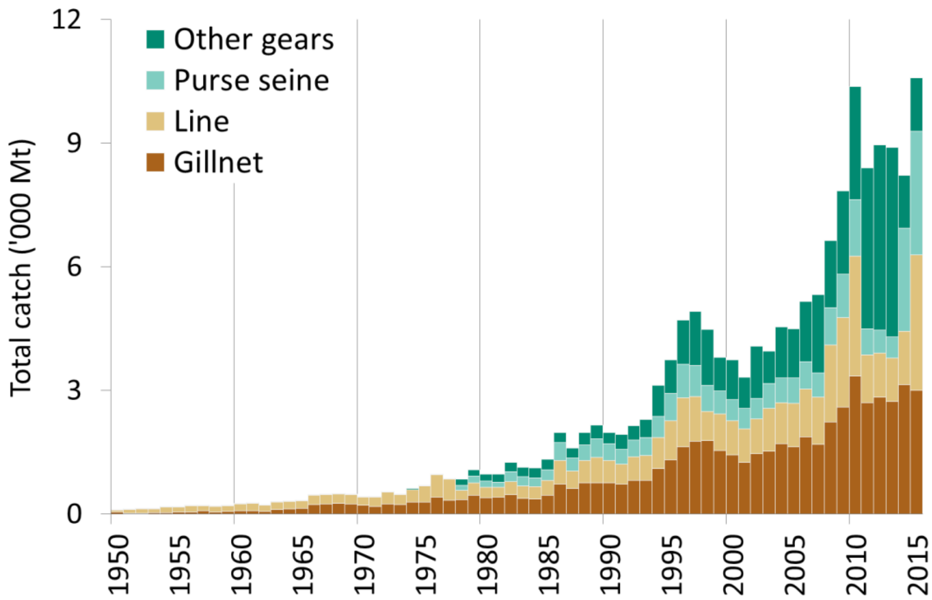
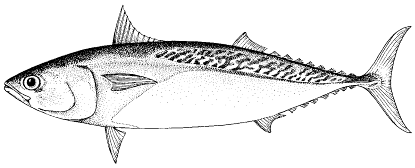


Fig. 1. Bullet tuna: Annual catches of bullet tuna by gear recorded in the IOTC Database (1950–2015) (data as of June 2017).

APPENDIX VIII
EXECUTIVE SUMMARY: FRIGATE TUNA

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



Status of the Indian Ocean frigate tuna (FRI: *Auxis thazard*) resource

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

Area[1]	Indicators		2017 stock status determination
Indian Ocean	Catch 2015[2]: Average catch 2011–2015:	84,237 t 95,218 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): F_{2015}/F_{MSY} (80% CI): B_{2015}/B_{MSY} (80% CI): B_{2015}/B_0 (80% CI):	unknown unknown unknown unknown unknown 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 2015: 73%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No quantitative stock assessment is currently available for frigate tuna in the Indian Ocean, and 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} target reference points remains **uncertain** (Table 1), indicating that a precautionary approach to the management of frigate tuna should be applied.

Outlook. Total annual catches for frigate tuna have increased substantially in recent years with peak catches taken in 2014 (~100,000 t) (Fig.1). 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 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.) should be considered of high priority for the Commission.
Management advice. A precautionary approach to the management of frigate tuna should be considered by the Commission, by ensuring that future catches do not exceed 94,607 t (average 2009-2015). The catch advice should be maintained until an assessment of frigate tuna is available. The reference period (2009-2015) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available (longtail tuna, kawakawa and narrow barred Spanish mackerel). For these species of neritic tunas in Indian Ocean, the MSY is estimated to have been reached between 2009 and 2015. 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 noted:

- The Maximum Sustainable Yield estimate for the whole Indian Ocean 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 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.) should be considered of high priority for the Commission.
- Species identification, data collection and reporting urgently need 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, the IOTC Secretariat is required make estimations for 73% catches, which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.

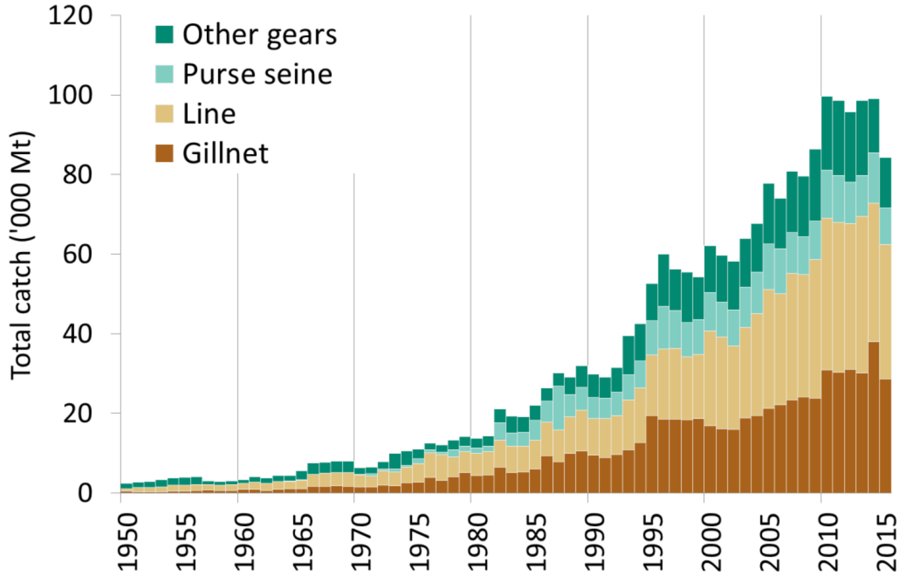
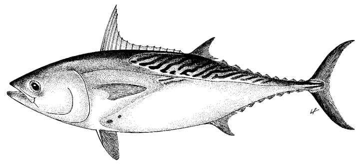


Fig. 1. Frigate tuna: Annual catches of frigate tuna by gear recorded in the IOTC Database (1950–2015) (data as of June 2017).

APPENDIX IX
EXECUTIVE SUMMARY: KAWAKAWA

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



Status of the Indian Ocean kawakawa (KAW: *Euthynnus affinis*) resource

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

Area[1]	Indicators		2017 stock status determination
Indian Ocean	Catch 2015[2]: Average catch 2011–2015:	154,427 t 159,145 t	
	MSY (1,000 t) [*] F_{MSY} [*] B_{MSY} (1,000 t) [*] F_{2013}/F_{MSY} [*] B_{2013}/B_{MSY} [*] B_{2013}/B_0 [*]	152 [125 –188] 0.56 [0.42–0.69] 202 [151–315] 0.98 [0.85–1.11] 1.15 [0.97–1.38] 0.58 [0.33–0.86]	

[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 2015: 42%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.
*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		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. A stock assessment was not undertaken for kawakawa in 2017 and the status is determined on the basis of the 2015 assessment, which used catch data from 1950 to 2013. Analysis using an Optimised Catch Only Method (OCOM) approach in 2015 indicates that the stock is near optimal levels of F_{MSY}, and stock biomass is near the level that would produce MSY (B_{MSY}). Due to the quality of the data being used, the simple modelling approach employed in 2015, and the large increase in kawakawa catches over the last decade (Fig. 1), measures need to be taken in order to slow the rate of increasing catch, though catches in 2014 and 2015 are lower than those estimated in 2013. Based on the weight-of-evidence available, the kawakawa stock for the whole 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 (42% estimated) 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. The continued increase in annual catches for kawakawa is likely to have further increased the pressure on the Indian Ocean stock as a whole resource. Research emphasis 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.) should be considered a high priority for the Commission. There is a high risk of exceeding MSY-based reference points by 2016 if catches are maintained at 2013 levels (96% risk that B_{2016}<B_{MSY}, and 100% risk that F_{2016}>F_{MSY}) or an even higher high risk if catches are increased further (120% of 2013 levels) (100% risk that SB_{2016}<SB_{MSY}, and 100% risk that F_{2016}>F_{MSY}) (Table 2).

Management Advice. Although the stock status is classified as not overfished and not subject to overfishing, the Kobe II strategy matrix developed in 2015 showed that there is a 96% probability that biomass is below MSY levels and 100% probability that F>F_{MSY} by 2016 and 2023 if catches are maintained at the 2013 levels. The modelled probabilities of the stock achieving levels consistent with the MSY reference points (e.g. SB > SB_{MSY} and $F<F_{MSY}$) in 2023 are 100% for a future constant catch at 80% of 2013 catch levels, thus if the Commission wishes to recover the stock to levels above the MSY reference points with a 50% probability by 2023, catches should be reduced by 20% based on 2013 levels (170,181 t)[41].

The following should be noted:

- The Maximum Sustainable Yield for the whole Indian Ocean is estimated to be between 125,000 and 188,000 t and so catch levels should be stabilised or 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, and revised where necessary, based on expert knowledge of the history of the various fisheries or through statistical estimation 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 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.) should be considered of high priority for the Commission.
- 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 is required to estimate 42% of the catches, which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.

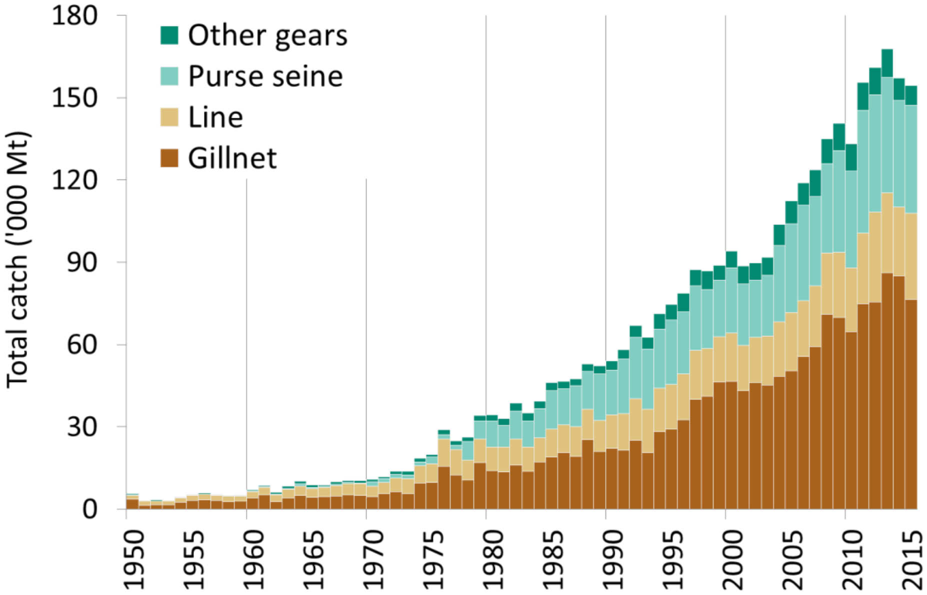


Fig. 1. Kawakawa: Annual catches of kawakawa by gear recorded in the IOTC database (1950–2016) (data as of June 2017).

[41] as estimated in 2015

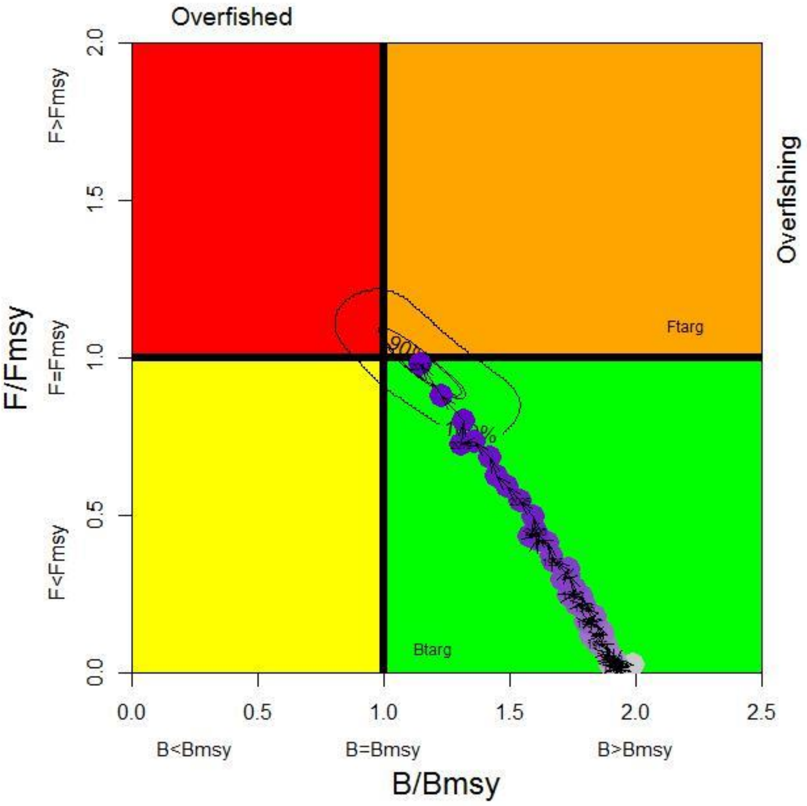


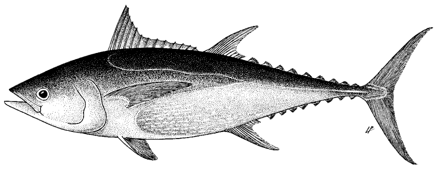
Fig. 2. Kawakawa. OCOM aggregated Indian Ocean assessment. Blue circles indicate the trajectory of the point estimates for the B ratio and F ratio for each year between 1950 and 2013 (the black lines represent all plausible model runs shown around 2015 estimate). Target reference points (B_{targ} and F_{targ}) are shown as B_{MSY} and F_{MSY}.

Table 2. Kawakawa: OCOM Aggregated Indian Ocean assessment Kobe II Management Strategy Matrix. Probability (percentage) of plausible models violating the MSY-based reference points for five constant catch projections (2013 catch level, -10%, -20%, -30%, +10% and +20%) projected for 3 and 10 years. Note: from the 2015 stock assessment using catch estimates (i.e. 1950-2013) at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2013) and weighted probability (%) scenarios that violate reference point**					
	70% (119,126 t)	**80%** (136,144 t)	**90%** (153,162 t)	**100%** (170,181 t)	**110%** (187,199 t)	**120%** (204,216 t)
$B_{2016} < B_{MSY}$	0	1	37	96	n.a.	100
$F_{2016} > F_{MSY}$	0	18	87	100	100	100
$B_{2023} < B_{MSY}$	0	0	55	100	100	100
$F_{2023} > F_{MSY}$	0	0	91	100	100	100

APPENDIX X
EXECUTIVE SUMMARY: LONGTAIL TUNA

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



Status of the Indian Ocean longtail tuna (LOT: *Thunnus tonggol*) resource

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

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2015[2]: Average catch 2011–2015:	136,849 t 157,496 t	**67%**
	MSY (1,000 t) (*): F_{MSY} (*): B_{MSY} (1,000 t) (*): F_{2015}/F_{MSY} (*): B_{2015}/B_{MSY} (*): B_{2015}/B_0 (*):	140 (103–184) 0.43 (0.28–0.69) 319 (200–623) 1.04 (0.84–1.46) 0.94 (0.68–1.16) 0.48 (0.34–0.59)	

[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 2015: 33%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.
*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)	67%	0%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	6%	27%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. Analysis using the Optimised Catch-Only Method (OCOM) indicates that the stock is being exploited at a rate that exceeded F_{MSY} in recent years, and the stock appears to be below B_{MSY} (67% of plausible models runs) (Fig. 2). Catches were above MSY between 2010 and 2014, however, catches decreased between 2012 and 2015 from 175,459 t to 136,836 t (Fig. 1). The F_{2015}/F_{MSY} ratio is slightly lower than previous estimates, reflecting the drop in catches reported in the last few years. Nevertheless, the estimate of the B_{2015}/B_{MSY} ratio (0.94) was also slightly lower than in previous years. An assessment using the revised Catch-MSY method was also undertaken in 2017 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 stock structure and the total catches in the Indian Ocean. The increase in annual catches to a peak in 2012 increased the pressure on the longtail tuna Indian Ocean stock as a whole, 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 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.) should be considered a high priority for the Commission.

Management advice. There is a substantial risk of exceeding MSY-based reference points by 2018 if catches are maintained at current (2015) levels (63% risk that $B_{2018}<B_{MSY}$, and 55% risk that $F_{2018}>F_{MSY}$) (Table 2). If catches are reduced by 10% this risk is lowered to 33% probability $B_{2018}<B_{MSY}$ and 28% probability $F_{2018}>F_{MSY}$). If the Commission wishes to recover the stock to levels above the MSY reference points with at least a 50% probability by 2025, catches should be capped at current (2015) levels (i.e. 136,849), which corresponds to catches somewhat below MSY in order to recover the status of the stock in line with the decision framework described in Resolution 15/10.

The following should be noted:

- The Maximum Sustainable Yield estimate of around 140,000 t was exceeded from 2010 - 2014. 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, and revised where necessary, based on expert knowledge of the history of the various fisheries or through statistical estimation methods.
- Improvements in data collection and reporting are required if the stock is to be assessed using integrated stock assessment models.
- Research emphasis on collating catch per unit effort (CPUE) time series for the main fleets (I.R.Iran, Indonesia, Pakistan, India and Oman), size compositions and life trait history parameters (e.g. estimates of growth, natural mortality, maturity, etc.) should be considered a high priority for the Commission.
- 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 is required make estimations for 33% of the catches, which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.

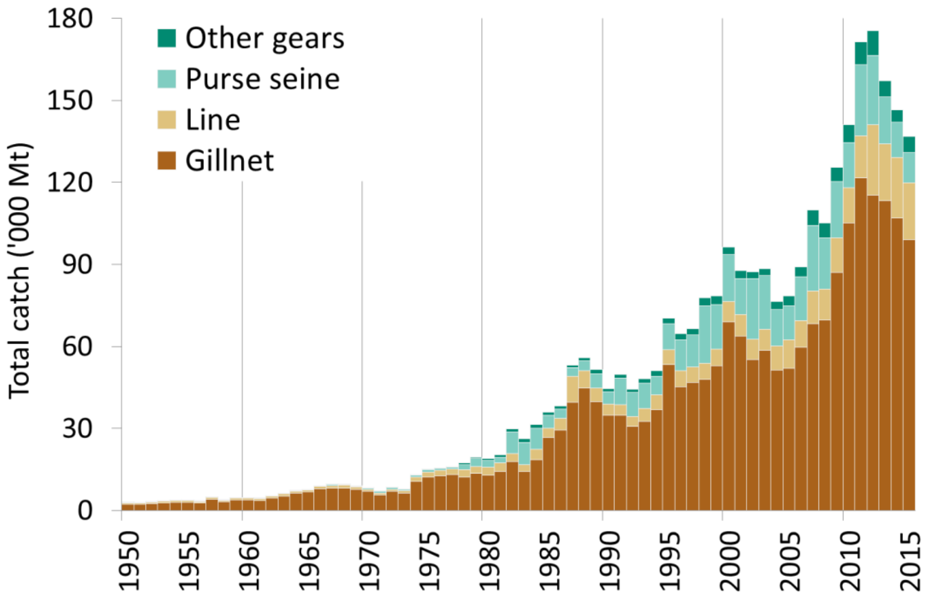


Fig. 1. Longtail tuna: Annual catches by gear recorded in the IOTC Database (1950–2015) (data as of June 2017).

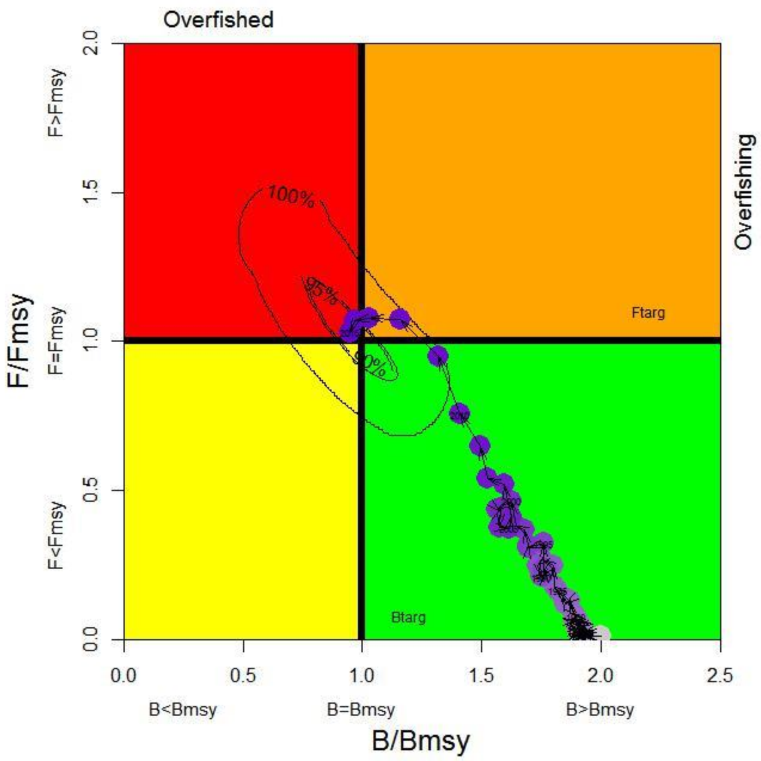


Fig. 2. Longtail tuna. OCOM Indian Ocean assessment Kobe plot. Blue circles indicate the trajectory of the point estimates for the B ratio and F ratio for each year between 1950 and 2015 (the black lines represent all plausible model runs shown around 2015 estimate). Target reference points (B_{targ} and F_{targ}) are shown as B_{MSY} and F_{MSY}.

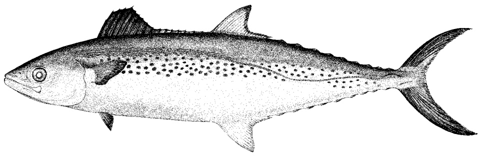
Table 2. Longtail tuna: OCOM aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based target for constant catch projections (2015 +20%,+10%, -10%, - 20%, -30% projected for 3 and 10 years). Note: from the 2017 stock assessment using catch estimates (i.e. 1950-2015) at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2015) and weighted probability (%) scenarios that violate reference points**					
	0.70 (95,794 t)	0.80 (109,479 t)	0.90 (123,164 t)	1.00 (136,849 t)	1.10 (150,534 t)	1.20 (164,219 t)
$B^{42}_{2018} < B_{MSY}$	4.00	9.00	33.00	63.00	92.00	99.00
$F_{2018} > F_{MSY}$	2.00	7.00	28.00	55.00	86.00	98.00
$B_{2025} < B_{MSY}$	0.00	0.00	1.00	48.00	100.00	100.00
$F_{2025} > F_{MSY}$	0.00	0.00	1.00	41.00	100.00	100.00

[42] Fishable biomass

APPENDIX XI
EXECUTIVE SUMMARY: INDO-PACIFIC KING MACKEREL

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



Status of the Indian Ocean Indo-Pacific king mackerel (GUT: *Scomberomorus guttatus*) resource

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

Area[1]	Indicators		2017 stock status determination
Indian Ocean	Catch 2015[2]:	46,403 t	
	Average catch 2011–2015:	45,575 t	
	MSY (1,000 t) [*]:	46 [38.9–54.4]	
	F_{MSY} [*]:	0.52 [0.40–0.69]	
	B_{MSY} (1,000 t) [*]:	66.0 [45.9–107.9]	
	F_{2014}/F_{MSY} [*]:	0.98 [0.85–1.14]	
	B_{2014}/B_{MSY} [*]:	1.10 [0.84–1.29]	
	B_{2014}/B_0 [*]:	0.55 [0.42–0.64]	

[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 2015: 41%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.
*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		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. The Indo-Pacific king mackerel was assessed using catch-only methods techniques (Catch-MSY and OCOM) in 2016. The OCOM model, which was considered the more robust of the two catch-only models in terms of assumptions and treatment of priors, indicated that overfishing was not occurring and the stock was not overfished (Fig. 2; Table 1). Moreover, the average catches (45,575 t) over the last 5 years have been slightly below the estimate of MSY of 46,000 t (Fig. 1). However, catches have increased in the last 3 years (2013-2015) and slightly exceeded MSY. The continuing uncertainty in catches (41% estimated) for this species, coupled with the highly variable and uncertain estimates of growth parameters used to estimate model priors, warrant caution in interpreting model results for Indo-Pacific king mackerel. Given that no new assessment was undertaken in 2017, the WPNT considered that stock status in relation to the Commission's B_{MSY} and F_{MSY} target reference points remains **uncertain,** as in 2016 (Table1), indicating that a precautionary approach to the management of Indo-Pacific king mackerel should be adopted.

Outlook. Total annual catches for Indo-Pacific king mackerel increased between 2012 and 2014 from 42,000 t to 48,000 t, however they decreased to ~46,000 t in 2015. There is considerable uncertainty about stock structure and total catches, on which the assessments have been based. 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 yet to be 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 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.) should be considered a high priority for the Commission.

Management advice. A precautionary approach to the management of Indo-Pacific king mackerel should be considered by the Commission, by ensuring that future catches do not exceed 46,222 t (average 2009-2015). The catch advice should be maintained until an assessment of Indo-Pacific king mackerel is available. The reference period (2009-2015) was chosen based on the most recent assessments of those neritic species in the Indian Ocean for which an assessment is available (longtail tuna, kawakawa and narrow barred Spanish mackerel). For these species of neritic tunas in Indian Ocean, the MSY is estimated to have been reached between 2009 and 2015. 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 noted:

- The Maximum Sustainable Yield estimate for the whole Indian Ocean is 46,000 t, and catches in the last 3 years have been around (or slightly in excess) of this level.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.
- Research emphasis 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.) should be considered of high priority for the Commission.
- Further work is needed to improve the reliability of the catch series. Reported catches should be verified, and revised where necessary, based on expert knowledge of the history of the various fisheries or through statistical estimation methods.
- Data collection and reporting urgently need 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, the IOTC Secretariat is required make estimations for 41% of the catches, which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.

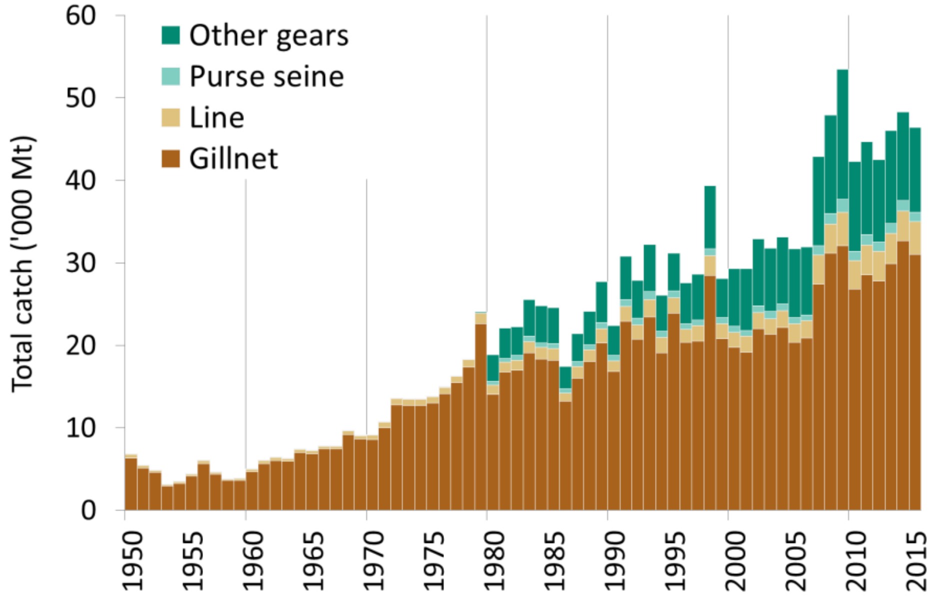


Fig. 1. Indo-Pacific king mackerel: Annual catches of Indo-Pacific king mackerel by gear recorded in the IOTC database (1950–2015) (data as of June 2017).

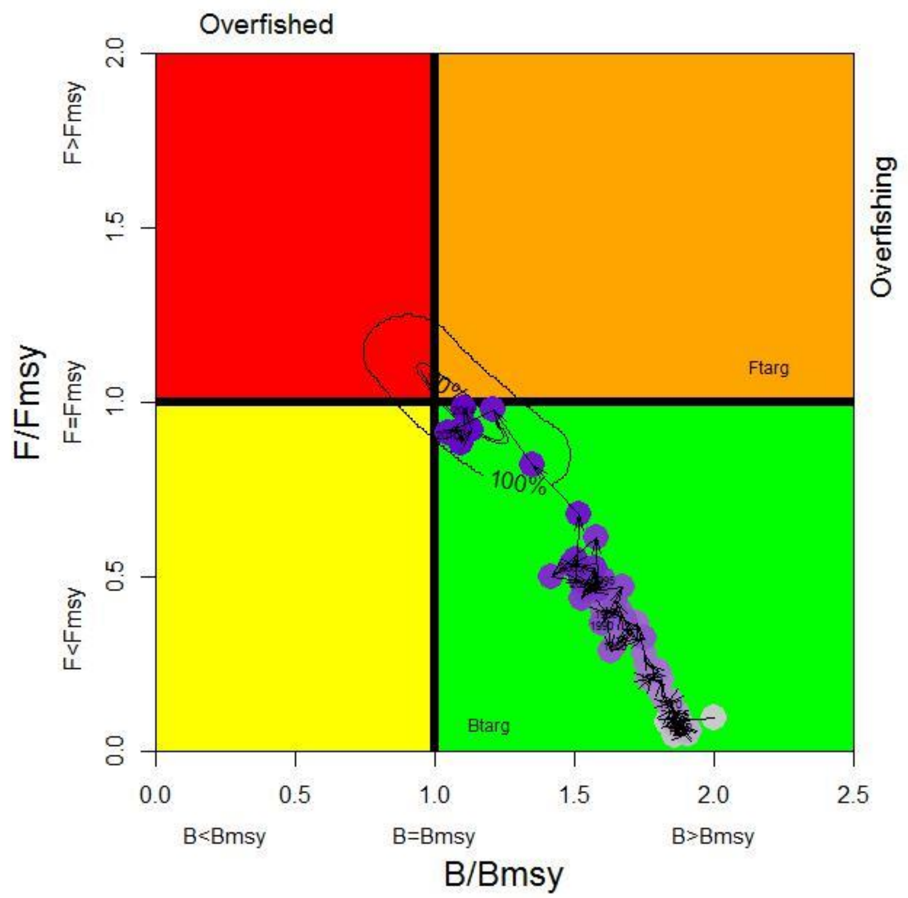
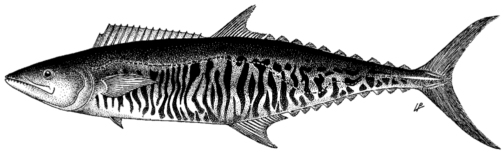


Fig. 2. Indo-Pacific king mackerel: OCOM Indian Ocean assessment Kobe plot. Blue circles indicate the trajectory of the point estimates for the B ratio and F ratio for each year between 1950 and 2014 (the black lines represent all plausible model runs shown around 2014 estimate). Target reference points (B_{targ} and F_{targ}) are shown as B_{MSY} and F_{MSY}.

APPENDIX XII
EXECUTIVE SUMMARY: NARROW-BARRED SPANISH MACKEREL

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



Status of the Indian Ocean narrow-barred Spanish mackerel (COM: *Scomberomorus commerson*) resource

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

Area[1]	**Indicators**		**2017 stock status determination**
Indian Ocean	Catch 2015[2]: Average catch 2011–2015:	154,177 t 151,501 t	**89%**
	MSY (1,000 t) [*]: F_{MSY} [*]: B_{MSY} (1,000 t) [*]: F_{2015}/F_{MSY} [*]: B_{2015} B_{MSY} [*]: B_{2015}/B_0 [*]:	131 [96–180] 0.35 [0.18–0.7] 371 [187–882] 1.28 [1.03–1.69] 0.89 [0.63–1.15] 0.44 [0.31–0.57]	

[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 2015: 51%
Nominal catches represent those estimated by the IOTC Secretariat. If these data are not reported by CPCs, the IOTC Secretariat estimates total catch from a range of sources including: partial catch and effort data; data in the FAO FishStat database; catches estimated by the IOTC from data collected through port sampling; data published through web pages or other means; data reported by other parties on the activity of vessels; and data collected through sampling at the landing place or at sea by scientific observers.
*Plausible ranges

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)	89%	11%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	0%	0%
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. Analysis using the Optimised Catch-Only Method (OCOM) 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[43], though the degree of connectivity of the stock remains unknown. Stock structure remains to be clarified for this stock. Based on the weight-of-evidence available, including the two different catch-only assessment approaches used in 2017, the stock appears to be **overfished** and **subject to overfishing** (Table 1, Fig. 2). Catches in 2015 and recent average catches are above the current MSY estimate (131,000 t) (Fig. 1).

Outlook. There is considerable uncertainty about stock structure and the estimate of total catches. The continue increase in annual catches in recent years has further increased the pressure on the Indian Ocean narrow-barred Spanish mackerel stock, and the stock is currently considered to be overfished and subject to overfishing. 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 (IOTC-2013-WPNT03-27). Research emphasis 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.) should be considered of high priority for the Commission. There is a very high risk of exceeding MSY-based reference points by 2018 and 2025 if catches are maintained at current (2015) levels (100% risk that $B_{2018}<B_{MSY}$, and 100% risk that $F_{2018}>F_{MSY}$) (Table 2).

[43] IOTC-2013-WPNT03-27

Management advice. There is a continued high risk of exceeding MSY-based reference points by 2025, even if catches are reduced to 80% of the 2015 levels (73% risk that $B_{2025}<B_{MSY}$, and 99% risk that $F_{2025}>F_{MSY}$). The modelled probabilities of the stock achieving levels consistent with the MSY reference levels (e.g. $B > B_{MSY}$ and $F<F_{MSY}$) in 2025 are 93% and 70%, respectively, for a future constant catch at 70% of current catch level. If the Commission wishes to recover the stock to levels above the MSY reference points with at least a 50% probability by 2025, catches should be reduced by 30% of current levels which corresponds to catches somewhat below MSY in order to recover the status of the stock.

The following should be noted:

- Maximum Sustainable Yield for the whole Indian Ocean was estimated at 131,000, while 2015 catches (154,177 t) are exceeding this 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, and revised where necessary, based on expert knowledge of the history of the various fisheries or through statistical estimation 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 (Table 2).
- Research emphasis 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.) should be considered of high priority for the Commission.
- 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 is required make estimations for 51% of the catches, which increases the uncertainty of the stock assessments using these data. Therefore the management advice to the Commission includes the need for CPCs to comply with IOTC data requirements per Resolution 15/01 and 15/02.

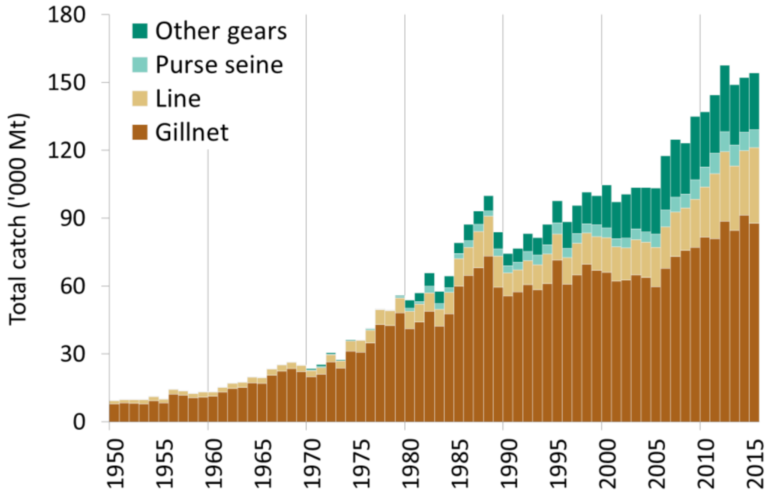


Fig. 1. Narrow-barred Spanish mackerel: Annual catches of narrow-barred Spanish mackerel by gear recorded in the IOTC database (1950–2015) (data as of June 2017).

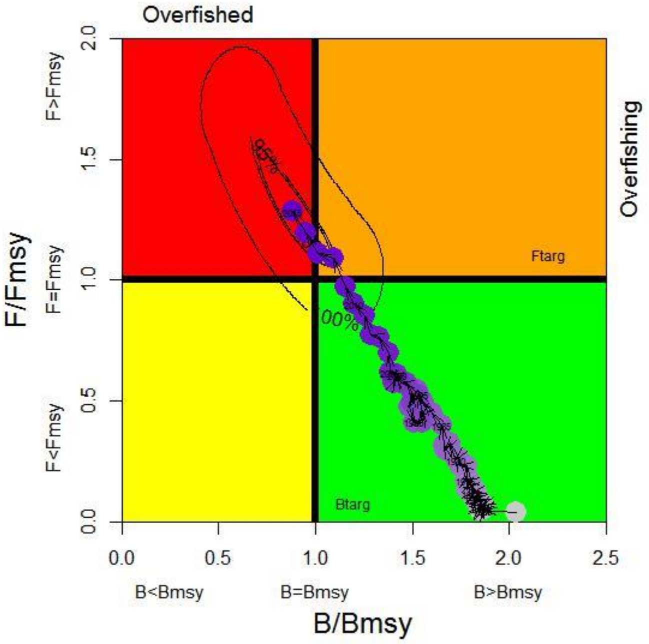


Fig. 2. Narrow-barred Spanish mackerel. OCOM Indian Ocean assessment Kobe plot. Blue circles indicate the trajectory of the point estimates for the B ratio and F ratio for each year between 1950 and 2015 (the black lines represent all plausible model runs shown around 2015 estimate). Target reference points (B_{targ} and F_{targ}) are shown as B_{MSY} and F_{MSY}.

Table 2. Narrow-barred Spanish mackerel: OCOM Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based reference points for five constant catch projections (2014 catch level, -10%, -20%, -30%, +10% and + 20%) projected for 3 and 10 years. Note: from the 2017 stock assessment using catch estimates (i.e. 1950-2015) at that time.

Reference point and projection timeframe	Alternative catch projections (relative to 2015) and weighted probability (%) scenarios that violate reference point					
	70% (107,924 t)	**80%** (123,342 t)	**90%** (138,759 t)	**100%** (154,177 t)	**110%** (169,595 t)	**120%** (185,012 t)
$B^{44}_{2018} < B_{MSY}$	71	90	99	100	100	100
$F_{2018} > F_{MSY}$	100	100	100	100	100	100
$B_{2025} < B_{MSY}$	7	73	100	100	100	100
$F_{2025} > F_{MSY}$	30	99	100	100	100	100

[44] Fishable biomass

APPENDIX XIII
CONSOLIDATED RECOMMENDATIONS OF THE 7TH SESSION OF THE WORKING PARTY ON NERITIC TUNAS

Note: Appendix references refer to the Report of the 7th Session of the Working Party on Neritic Tunas (IOTC‑2017‑WPNT07‑R)

The following are a subset of the complete recommendations from the WPNT07 to the Scientific Committee which are provided at Appendix XIII.

(para 24.) The WPNT **NOTED** that compliance with data reporting obligations is particularly low for neritic tuna species, despite the importance of scientific data for stock assessment, and **REQUESTED** CPCs do their best to collect data and comply with data reporting requirements adopted by the IOTC. The WPNT further **RECOMMENDED** that mechanisms are developed by the Commission to improve current scientific advice by encouraging CPCs to comply with their data recording and reporting requirements.

(para. 27) **NOTING** a number of long-standing data reporting or data quality issues that severely impact the assessment of neritic species, the WPNT **RECOMMENDED** that funds be made available to the IOTC Secretariat (either through the IOTC Regular Budget or from external sources) dedicated to capacity building activities, or data compliance and support missions, aimed at improving the availability of data for those countries identified as a priority for neritic species in terms of importance of catches. Specifically:

ix. that the IOTC Secretariat conducts a Data Compliance and Support mission to I.R. Iran to assess the status of data collection and reporting of IOTC datasets, notably catch-and-effort, and the availability of data that could be used as a basis of a future standardized CPUE series gillnet fleets;

x. when sufficient data is recovered, or made available, that the IOTC Secretariat allocates funds to assist with the development of a standardized CPUE series for gillnets, in collaboration with IOTC members, including organization of a joint-workshop or hiring of an international consultant;

xi. that the IOTC Secretariat formally communicates to India requesting the submission of mandatory datasets according to the requirements of IOTC Resolution 15/02 and, if necessary, conducts a Data Compliance and Support mission to facilitate the reporting of data to the IOTC;

xii. that the IOTC Secretariat continues to support the work of WWF-Pakistan and the Government of Pakistan in the evaluation and reporting of the crew-based observer program, and facilitate the reporting of length data and catch-and-effort collected by the observer log-books.

(para. 140) The WPNT **AGREED** that a new item on data mining and collation should be added as a fundamental piece of work to be undertaken as a priority and **RECOMMENDED** that this work is supported by the IOTC Secretariat. The WPNT further **AGREED** that data collation has been identified as the main priority of the group and allocated this the highest priority ranking.

(para. 141) **ACKNOWLEDGING** the importance of indices of abundance for future stock assessments, the WPNT **RECOMMENDED** that the development of standardised CPUE series is explored, with priority given to fleets which account for the largest catches of neritic tuna and tuna-like species (e.g., I.R. Iran, Indonesia, India, Pakistan, and Sri Lanka).

(para. 144) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2018–2022), as provided at Appendix VI.

(para. 147) The WPNT participants were unanimous in their thanks for the support for their participation in the meeting due to the MPF and **RECOMMENDED** that the Scientific Committee also consider the WPNT08 as a high priority meeting for MPF.

(para. 149) The WPNT **NOTED** that Kenya, Mozambique, and Pakistan have expressed interest in potentially hosting for the 8th Session of the WPNT and **RECOMMENDED** the SC consider the preferred dates of 4-7 April 2018.

(para. 151) The WPNT **RECOMMENDED** that the SC and Commission note the following:

1) The participation of developing coastal state scientists to the WPNT has been consistently high following the adoption and implementation of the IOTC Meeting Participation Fund adopted by the Commission in 2010 (Resolution 10/05 On the establishment of a Meeting Participation Fund for developing IOTC Members and Non-Contracting Cooperating Parties), now incorporated into the IOTC Rules of Procedure (2014), as well as though the hosting of the WPNT in developing coastal State Contracting Parties (Members) of the Commission (Table 8).

2) The continued success of the WPNT, at least in the short term, appears heavily reliant on the provision of support via the MPF which was established primarily for the purposes of supporting scientists to attend and contribute to the work of the Scientific Committee and its Working Parties.

3) The MPF should be utilised so as to ensure that all developing Contracting Parties of the Commission are able to attend the WPNT meeting, as neritic tunas are very important resources for many of the coastal countries of the Indian Ocean.

(para. 152) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT07, 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 2017 (Fig. 8):

- 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