Report of the 6th Session of the IOTC Working Party on Neritic Tunas

Mahé, Seychelles, 21–24 June 2016

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ACRONYMS

B	Biomass (total)
BLT	Bullet tuna
B_{MSY}	Biomass which produces MSY
BOBLME	Bay of Bengal Large Marine Ecosystem (project)
CMM	Conservation and Management Measure (of the IOTC; Resolutions and Recommendations)
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
PS	Purse-seine
ROS	Regional Observer Scheme
SAFE	Sustainability Assessment for Fishing Effect
SC	Scientific Committee of the IOTC
SB	Spawning biomass (sometimes expressed as SSB)
SB_{MSY}	Spawning stock biomass which produces MSY
SWIOFP	South West Indian Ocean Fisheries Project
SRA	Stock-reduction analysis
VB	Von Bertalanffy (growth)
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 6th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT06) was held in Mahe, Seychelles from 21–24 June 2016. A total of 20 participants (31 in 2015, 37 in 2014, 42 in 2013, 35 in 2012) 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 Shijie Zhou from CSIRO, Australia.

The following are a subset of the complete recommendations from the WPNT06 to the Scientific Committee which are provided at Appendix XIII.

Indonesia

WPNT06.01 (para. 105) **ACKNOWLEDGING** that OFCF are planning to follow-up the sampling project further, the WPNT **RECOMMENDED** that IOTC regular budget is allocated to support the extension of the Indonesia sampling project in both geographical scope and over time.

Selection of Stock Status indicators

WPNT06.02 (para. 144) The WPNT **NOTED** the importance of exploring alternative models or sources of information that can evidence results from data-poor assessments, and **RECOMMENDED** that other methods are explored based on different data sources, such as catch curve estimation of mortality from length-frequency data. A range of data sources should be explored, including data from observer programmes, the sport fisheries project, and non-state actor (e.g. WWF) projects for suitability.

WPNT06.03 (para. 148) The WPNT **RECALLED** the recommendation of the WPNT05 for the SC to request the Working Party on Methods evaluate a proposed alternative methodology for presenting management advice for data poor methods in 2016. The WPNT **RECOMMENDED** that the WPM evaluate the possibility of using different colours to distinguish between stocks which have not been assessed (e.g., white) and stocks which have been assessed but the status is considered to be uncertain (e.g., grey).

Revision of the WPNT Program of Work (2017–2021)

WPNT06.04 (para. 204) **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).

WPNT06.05 (para. 211) The WPNT **RECOMMENDED** that the SC request that the Commission further increases the IOTC Capacity Building budget line so that capacity building training on improved data collection and analysis can be carried out in 2017.

WPNT06.06 (para. 212) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2017–2021), as provided at Appendix VI.

Date and place of the 7th Working Party on Neritic Tunas

WPNT06.07 (para. 217) The WPNT **NOTED** the expression of interest from the Maldives to host the 7th Session of the WPNT. The IOTC Secretariat shall liaise with Maldives to confirm the expression of interest. Given that the dates proposed by the SC (3-6 March 2017) leave little time for the activities in the program of work to be carried out, the WPNT **RECOMMENDED** the SC consider pushing the dates back to July 2017.

Meeting participation fund (MPF)

WPNT06.08 (para. 219) 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 WPNT07 as a high priority meeting for MPF.

WPNT06.09 (para. 220) 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 21).
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.

Review of the draft, and adoption of the Report of the 6th Working Party on Neritic Tunas

WPNT06.10 (para. 221) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT06, 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 two species assigned a stock status in 2016 (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

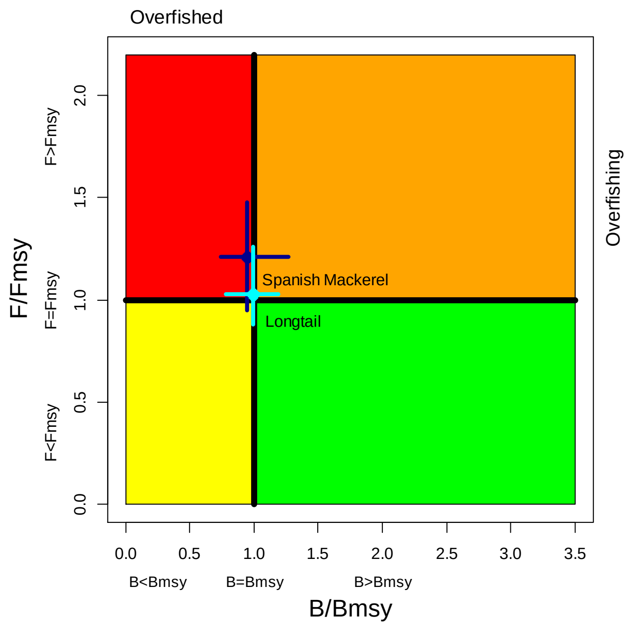

Fig. 8. Combined Kobe plot for longtail tuna and narrow-barred Spanish mackerel, showing the estimates of stock size (B) and current fishing mortality (F) in 2014 in relation to optimal spawning stock size and optimal fishing mortality using the OCOM modelling approach. Cross bars illustrate the range of uncertainty from the model runs.

WPNT06.11 (para. 222) Based on these stock status summaries (Fig. 8) and ongoing increasing catch and effort, the WPNT **RECOMMENDED** that current catch levels are not increased further by constraining catch and/or effort to no more than 2014 levels.

Table 1. Status summary for species of neritic tuna and tuna-like species under the IOTC mandate: 2016

Stock	Indicators	Prev[1]	2010	2011	2012	2013	2014	2015	2016	Advice to the Commission
		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 620,736 t being landed in 2014. 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.								
Bullet tuna *Auxis rochei*	Catch 2014: 8,352 t Average catch 2010–2014: 8,993 t MSY (1,000 t) (80% CI): unknown F_{MSY} (80% CI): unknown B_{MSY} (1,000 t) (80% CI): unknown F_{2014}/F_{MSY} (80% CI): unknown B_{2014}/B_{MSY} (80% CI): unknown B_{2014}/B_0 (80% CI): unknown									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 a more formal assessment, are a cause for considerable concern. Stock status in relation to the Commission's B_{MSY} and F_{MSY} target reference points remains uncertain, indicating that a precautionary approach to the management of bullet tuna should be applied. Click here for full stock status summary: Appendix VII
Frigate tuna *Auxis thazard*	Catch 2014: 102,586 t Average catch 2010–2014: 99,068 t MSY (1,000 t) (80% CI): unknown F_{MSY} (80% CI): unknown B_{MSY} (1,000 t) (80% CI): unknown F_{2014}/F_{MSY} (80% CI): unknown B_{2014}/B_{MSY} (80% CI): unknown B_{2014}/B_0 (80% CI): unknown									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 a more formal assessment are a cause for considerable concern. Stock status in relation to the Commission's B_{MSY} and F_{MSY} target reference points remains uncertain, indicating that a precautionary approach to the management of frigate tuna should be applied. Click here for full stock status summary: Appendix VIII
Kawakawa *Euthynnus affinis*	Catch 2014: 159,264 t Average catch 2010–2014: 155,511 t MSY (1,000 t) (80% CI): 152 [125 –188] F_{MSY} (80% CI): 0.56 [0.42–0.69] B_{MSY} (1,000 t) (80% CI): 202 [151–315] F_{2014}/F_{MSY} (80% CI): 0.98 [0.85–1.11] B_{2014}/B_{MSY} (80% CI): 1.15 [0.97–1.38] B_{2014}/B_0 (80% CI): 0.58 [0.33–0.86]									Analysis using a stock-reduction analysis, OCOM based approach in 2015 indicated 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 data-poor stock assessment method and the rapid increase in kawakawa catch in recent years, measures need to be taken to slow the increase in catches in the IOTC area of competence. Based on the weight-of-evidence available to the WPNT, the kawakawa stock for the whole Indian Ocean is classified as not overfished and not subject to overfishing. A separate analysis on a sub-population (north-west Indian Ocean region) in 2014 indicated that that stock may be experiencing overfishing, although spawning biomass is likely to be above the level to produce MSY. However, further analysis of the CPUE data should be undertaken so that other approaches for assessing stock status can be used. Click here for a full stock status summary: Appendix IX
Longtail tuna *Thunnus tonggol*	Catch 2014: 146,751 t Average catch 2010–2014: 158,495 t MSY (1,000 t) (80% CI): 143 (106–194) F_{MSY} (80% CI): 0.39 (0.29–0.54) B_{MSY} (1,000 t) (80% CI): 298 (197–545) F_{2014}/F_{MSY} (80% CI): 1.03 (0.88–1.26) B_{2014}/B_{MSY} (80% CI): 0.99 (0.78–1.19) B_{2014}/B_0 (80% CI): 0.50 (0.39-0.60)									Analysis using the 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} (Fig. 1). Although catches decreased between 2012 and 2014 from 175 459 to 146 751 t, catches have remained above all current (and previous) estimates of MSY since 2011. The F_{2014}/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_{2014}/B_{MSY} ratio (0.99) was also slightly lower than in previous years. An assessment using Catch-MSY was also undertaken in 2016 and results were consistent with OCOM in terms of status. Therefore, based

Stock	Indicators	Prev[1]	2010	2011	2012	2013	2014	2015	2016	Advice to the Commission
		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 620,736 t being landed in 2014. 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.								
										on the weight-of-evidence currently available, the stock is considered to be both overfished and subject to overfishing Click for a full stock status summary: Appendix X
Indo-Pacific king mackerel *Scomberomorus guttatus*	Catch 2014: 49,060 t Average catch 2010–2014: 44,930 t MSY (1,000 t) (80% CI): 46 [38.9–54.4] F_{MSY} (80% CI): 0.52 [0.40–0.69] B_{MSY} (1,000 t) (80% CI): 66.0 [45.9–107.9] F_{2014}/F_{MSY} (80% CI): 0.98 [0.85–1.14] B_{2014}/B_{MSY} (80% CI): 1.10 [0.84–1.29] B_{2014}/B_0 (80% CI): 0.55 [0.42–0.64]									Following a first data-poor assessment in 2015, Indo-Pacific king mackerel was again assessed using SRA techniques (Catch-MSY and OCOM) in 2016. The OCOM model, considered the more robust of the two SRA models applied in terms of assumptions and treatment of priors, indicates that overfishing is not occurring and the stock is not overfished (Fig. 1; Table 1). Moreover, the average catches (c. 45,000 t) over the last 5 years have been within the estimated MSY range (43,000 – 46,000 t). However, catches have increased in the last 2 years and in 2014 exceeded this MSY range. The continuing low levels of catch reporting for this species, coupled with the highly variable and uncertain estimates of growth parameters used to estimate model priors, prompted the WPNT to exercise caution in interpreting model results for king mackerel. Consequently, and similar to 2015, the WPNT considered that stock status in relation to the Commission's B_{MSY} and F_{MSY} target reference points remains uncertain, indicating that a precautionary approach to the management of Indo-Pacific king mackerel should be adopted Click for a full stock status summary: Appendix XI
Narrow-barred Spanish mackerel *Scomberomorus commerson*	Catch 2014: 154,723 t Average catch 2010–2014: 148,609 t MSY (1,000 t) (80% CI): 131.1 [98.7–178.8] F_{MSY} (80% CI): 0.34 [0.21–0.56] B_{MSY} (1,000 t) (80% CI): 326 [178–702] F_{2014}/F_{MSY} (80% CI): 1.21 [0.97–1.48] B_{2014}/B_{MSY} (80% CI): 0.95 [0.74–1.27] B_{2014}/B_0 (80% CI): 0.47 [0.37–0.63]									OCOM techniques indicate that the stock is being exploited at a rate exceeding F_{MSY} in recent years, and the stock appears to be below B_{MSY}. Northwest Indian Ocean (Gulf of Oman Sea countries) indicate that localised depletion may be occurring from an analysis undertaken in 2013, and overfishing is occurring in this area, though the degree of connectivity with other stocks remains unknown. Stock structure issues remain to be clarified for this stock. Based on the weight-of-evidence available, including the two different SRA approaches pursued in 2016, the stock appears to be overfished and subject to overfishing. Catches in 2014 and recent average catches are above the range in current MSY estimates (131,000 – 140,000 t). Click for a full stock status summary: Appendix XII

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 6th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT06) was held in Mahe, Seychelles from 21–24 June 2016. A total of 20 participants (31 in 2015, 37 in 2014, 42 in 2013, 35 in 2012) 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 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 WPNT06 are listed in Appendix III.

3. THE IOTC PROCESS: OUTCOMES, UPDATES AND PROGRESS

3.1 Outcomes of the 18th Session of the Scientific Committee

3. The WPNT **NOTED** paper IOTC–2016–WPNT06–03 which outlined the main outcomes of the 18th Session of the Scientific Committee (SC18), 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** that the SC provided endorsement for data on Indian Ocean neritic tuna stocks to be subject to a meta-analysis, which will be progressed in collaboration with WWF Pakistan.

5. The WPNT **NOTED** that the SC endorsed the need for CPUE standardisation in advance of the next assessments by WPNT, which will be progressed through budgeted consultancy, workshops and capacity building activities.

6. The WPNT **ACKNOWLEDGED** the request by the SC for translation of species identification cards pertaining to neritic tunas, and the prioritisation for translation among CPCs/languages according to the size of their catches of neritic tunas. The WPNT **ENCOURAGED** participants at the meeting to identify candidates or options for supporting this task.

7. The WPNT **RECALLED** that the SC has modified the process for applications to the Meeting Participation Fund, which has enabled significant participation to past meetings of the WPNT, and **NOTED** that the deadline for applications is now 60 days prior to the meeting while full papers must be submitted 45 days ahead of the meeting.

8. The WPNT **ACKNOWLEDGED** the changes to the MPF rules and procedures and **ENCOURAGED** CPCs to submit timely applications to make the most of this opportunity and to support good meeting attendance.

3.2 Outcomes of the 20th Session of the Commission

9. The WPNT **NOTED** paper IOTC–2016–WPNT06–04 which outlined the main outcomes (provisional, while the report is adopted by correspondence) of the 20th Session of the Commission, specifically related to the work of the WPNT.

10. The WPNT **NOTED** the 12 Conservation and Management Measures (CMMs) adopted at the 20th Session of the Commission (consisting of 12 Resolutions and 0 Recommendations) which will come into force on 27th September 2016:

- Resolution 16/01*On an interim plan for rebuilding the Indian Ocean yellowfin tuna stock*
- Resolution 16/02 *On harvest control rules for skipjack tuna in the IOTC area of competence*
- Resolution 16/03 *On the second performance review follow-up*
- Resolution 16/04 *On the implementation of a Pilot Project in view of Promoting the Regional Observer Scheme of IOTC*
- Resolution 16/05 *On vessels without nationality*

- Resolution 16/06 *On measures applicable in case of non-fulfilment of reporting obligations in the IOTC*
- Resolution 16/07 *On the use of artificial lights to attract fish*
- Resolution 16/08 *On the prohibition of the use of aircrafts and unmanned aerial vehicles as fishing aids*
- Resolution 16/09 *On establishing a Technical Committee on Management Procedures*
- Resolution 16/10 *To promote the implementation of IOTC Conservation and Management Measures*
- Resolution 16/11 *On port state measures to prevent, deter and eliminate illegal, unreported and unregulated fishing*
- Resolution 16/12 *Working Party on the Implementation of Conservation and Management Measures (WPICMM)*

11. Participants to WPNT06 were **ENCOURAGED** to familiarise themselves with the adopted Resolutions, especially those most relevant to the WPNT.

12. The WPNT **ACKNOWLEDGED** that the report of the 20th Session of the Commission is not yet finalised for download, pending agreement by correspondence.

3.3 Review of Conservation and Management Measures relevant for neritic tunas

13. The WPNT **NOTED** paper IOTC–2016–WPNT06–05 which aimed to encourage participants at the WPNT06 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–2016–WPNT06–04.

14. The WPNT **NOTED** that the 20th Session of the Commission considered two proposals specific to the conservation and management of neritic tunas, namely IOTC-2016-S20-Prop E and IOTC-2016-S20-Prop G (revised as IOTC-2016-S20-Prop-G-C for neritic tunas) that were *not* adopted. Given that IOTC-2016-S20-Prop G was deferred until the next session of the Commission, participants to the WPNT06 were **ENCOURAGED** to review the proposal.

15. The WPNT **NOTED** the new Resolutions will come into effect 120 days from the IOTC circular, i.e. 27 September 2016.

3.4 Progress on the Recommendations of WPNT05 and SC18

16. The WPNT **NOTED** paper IOTC–2016–WPNT06–06 which provided an update on the progress made in implementing the recommendations from the 5th Session of the WPNT for the consideration and potential endorsement by participants.

17. The WPNT participants were **ENCOURAGED** to review IOTC-2016-WPNT06-06 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 (WPNT07).

18. The WPNT participants **NOTED** that CPCs need to increase their efforts to ensure inter-sessional progress on recommendations from WPNT meetings, especially where recommendations pertain to data collection and submission. The IOTC Secretariat highlighted efforts that are being made to improve data availability through Data Compliance Missions to CPCs and capacity building on data collection for small-scale fisheries.

19. 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.

20. The WPNT **NOTED** that the data problems identified are long term issues and that although it takes time for substantial improvements to be made, gradual progress is being made.

21. The WPNT **NOTED** the work done to translate the cards for the *Identification of tuna and tuna-like species in the Indian Ocean fisheries* into priority languages identified by the Scientific Committee (SC18 para. 101) including Urdu, Bahasa-Indonesian (OFCF, DGCF), Farsi, Arabic and Hindi.

22. The WPNT **REQUESTED** other CPCs with priority languages (notably Malaysian and Sinhala) to facilitate translations of the cards for the *Identification of tuna and tuna-like species in the Indian Ocean fisheries.*

23. The WPNT **NOTED** the offer of WWF-Tanzania to translate the cards for the *Identification of tuna and tuna-like species in the Indian Ocean fisheries* into Kiswahili.

24. 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

25. The WPNT **NOTED** paper IOTC–2016–WPNT06–07 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 1950–2014. A summary is provided at Appendix IVa–IVf.

26. The WPNT **NOTED** that data reporting is particularly low for neritic tuna species, despite the importance of scientific data for stock assessment. The WPNT **REQUESTED** CPCs improve the reporting of mandatory datasets to the IOTC Secretariat, particularly I.R. Iran, Indonesia, India, and Pakistan, which account for over 70% of total catches of IOTC neritic species.

27. The WPNT **RECALLED** the current minimum data recording and reporting requirements that were adopted by the Members of the Commission under Resolution 15/01 and Resolution 15/02. All participants of the WPNT06 were asked to ensure that their national data collection and reporting organisation/s make efforts to improve their data collection and reporting for these species as per IOTC requirements detailed in Resolution 15/01 and Resolution 15/02.

28. The WPNT **NOTED** that the IOTC Secretariat estimates that only 55% of catches are reported, while the remainder of the nominal catch include estimates by the IOTC Secretariat based on the best available data sources.

29. 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 further 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.

30. The WPNT **ACKNOWLEDGED** the large amount of work the data section of the IOTC Secretariat is doing to refine and improve the data for use in stock assessments.

31. 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.

32. The WPNT **AGREED** that catch and effort data are the most important fisheries information, particularly catch data, given the recent focus on catch-only assessments, these should be the priority area for improvements in data collection.

33. The WPNT **NOTED** the distribution of catches are not equal across the Indian Ocean but the largest fisheries for neritic tunas are concentrated in Indonesia, I.R. Iran, India, and Pakistan and these are the countries where the effort to improve data collection and reporting have been prioritised by the IOTC Secretariat.

34. The WPNT **NOTED** the high catches of bullet tuna from 'other' gear types which is mostly from longlines associated with gillnets.

35. The WPNT **NOTED** the lack of size data for frigate tuna and **ENCOURAGED** the major fishery of Indonesia to collect and report size data.

36. The WPNT **NOTED** that Indonesian purse seiners are classified as artisanal but there are some that are actually large scale purse seiners which target skipjack but also catch some neritic tunas as bycatch.

37. **NOTING** that the neritic tuna and tuna-like species under the IOTC mandate continue to be as important or more important than the three tropical tuna species (bigeye tuna, skipjack tuna and yellowfin tuna) to most IOTC coastal states; with a total estimated catch of 620,736 t being landed in 2014 (625,268 t in 2013; 636,771 t in 2012) the WPNT **AGREED** that neritic tunas should receive appropriate management resources from the IOTC, and additional support from the IOTC Secretariat.

38. The WPNT **REQUESTED** that data on neritic tunas, including detailed 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.

39. **NOTING** that some CPCs, India in particular, have collected large data sets on neritic tuna species over long time periods, the WPNT **RECALLED** that this data, as well as data from other CPCs, should be 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.

40. The WPNT **RECALLED** that WWF-Pakistan has established data collection systems including log book recording, and deployment of Regional Observers, but has not reported the data officially to the IOTC Secretariat. The WPNT also **NOTED** that possible transhipment from Pakistan to I.R. Iran may potentially lead to double-counting of catches by both of these countries.

41. The WPNT **RECALLED** the lack of historical size data collected by CPCs, particularly from Sri Lanka which are available but have not been submitted to IOTC which has received data for skipjack and yellowfin over the last five years, but no size data from neritic species and **REQUESTED** that Sri Lanka submit historical size data in the required format and spatial resolution so that the data can be used in future stock assessments.

42. The WPNT **NOTED** that I.R. Iran currently reports incomplete catch-and-effort data due to issues of collecting accurate information on units of effort for gillnet fisheries (i.e., number of panels, rather than fishing days), and strongly **REQUESTED** that effort as number of fishing days be reported to the IOTC Secretariat, in the absence of other units of effort.

43. The WPNT **NOTED** paper IOTC–2016–WPNT06–09 which provided an overview of changes that have been made to the IOTC data and implications for neritic tuna species with the following abstract provided by the authors:

"The current state of the art related to the internal IOTC core data management processes is described, depicting benefits and shortcomings as they emerged after more than one decade of adoption. Reasons for a radical change in the process implementation are listed, together with the improvements that the envisaged changes will bring to the internal data flow (as part of the Secretariat's daily operations) and outside its boundaries (targeting mostly scientists, data analysts, policy makers, country-level focal points as well as national and regional management bodies). The proposed changes aim at rationalizing the entire data management chain, all the way up from the data ingestion to the data dissemination steps, at the same time enabling data consumers to have a simpler and more effective way to get access to the data while still enforcing the confidentiality policies currently adopted by the Commission. The most ambitious goal of this exercise is to increase the overall value of the data, transforming raw information into a valuable asset from the very first stages of the process, at the same time reducing the time-to-market prior to the final dissemination of regular information updates…" – See paper for full abstract.

44. The WPNT **NOTED** that the aim of this is for users outside the Secretariat to be able to use the database and filter data in real-time and that an interface for this will be made available as the project is completed based on the data confidentiality agreements specified in Resolution 12/02.

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

46. The WPNT further **NOTED** 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.

47. While data is currently accepted in any format, the WPNT **ENCOURAGED** CPCs to submit data based on the standard templates provided so that the data can be processed more easily and therefore made available to users in a more timely fashion.

48. The WPNT **NOTED** that additional information can be added to the system at a later date such as socioeconomic indicators.

IOTC Capacity building activities: Data

49. The WPNT NOTED the capacity building projects planned for 2016–17 by the IOTC Secretariat, in collaboration with the IOTC-OFCF Project, national fisheries organizations, and also funding from EU-DG Mare, with particular emphasis on improving the collection and reporting of fisheries data to the IOTC Secretariat. A number of the activities (i.e., Indonesia sampling, data compliance missions) consolidate, or are a continuation of, technical assistance provided by the Secretariat in 2015 and are likely to have implications on current and historical catch estimates of neritic tuna species:

- *Sport fisheries data collection: pilot project*. The project aims to improve the data reporting coverage of sports and recreational fisheries in the western Indian Ocean. The activities include compiling a directory of sport fishing centres in the western Indian Ocean region, development of a database and standardised reporting forms adapted to Sport Fishing Centres in the western Indian Ocean region, and deliver training materials to Sports Fishing Centres to improve the reporting of sports fisheries data to the IOTC Secretariat. While the data collection is focused largely on billfish species, sports and recreational fisheries are also important for catches of neritic tunas and tuna-like species – particularly for CPCs with fisheries in the Arabian Sea.

- *Indonesia: Support for sampling and data reporting for coastal fisheries (IOTC-OFCF Project) (TBC):* The activity is the continuation of support for the 2014-2015 IOTC-OFCF-BOBLME funded pilot project in the Provinces of West Sumatra and North Sumatra to assess the species composition of catches of neritic tuna species, in commercial categories containing more than one species, in particular the categories Tongkol (Longtail tuna: Thunnus tonggol) and juvenile tunas. This project addresses recommendations from the SC concerning catches of juvenile tunas in Indonesia and verification of neritic tuna species not reported by species in Indonesia. In 2016, proposed activities include the extension of sampling to additional landing sites and gears, training of additional enumerators, and training of Indonesia DGCF staff in the extraction and analysis of results of the sampling.

- *Development of artisanal data collection protocols:* The project aims to develop minima data requirements for the routine collection of data at the landing place, through sampling by enumerators, including development of a set of indicators to be used to assess the quality of data collection and management systems for artisanal fisheries.

- *IOTC Data Compliance missions:* A number of additional technical assistance activities have been scheduled for 2016-17, aimed at improving levels of data compliance of CPC's in the IOTC region and also the assessment of the status of current data collection and reporting systems. At the time of writing the following missions have been conducted/proposed for 2016-17:

  - Tanzania: requested assistance in IOTC data reporting requirements, including the submission of Regional Observer data. A mission was conducted in February 2016 and also included an evaluation of current status of data reporting, recommendations and plan of action to improve future data compliance levels.
  - I.R. Iran: accounts for the second largest catches of neritic species in the Indian Ocean, but has only reported partial catch-and-effort according to the reporting standards of Resolution 15/02 (i.e., catches are not fully reported by area). A data compliance and support mission is proposed to evaluate the current catch-and-effort data (e.g., using fishing days as a substitute for gear-specific units of effort) and also the availability of datasets for standardization of a CPUE series (for gillnet fisheries).

- Regional Observer Scheme E-Reporting and E-monitoring:
  - E-Reporting: Regional Observer Scheme (ROS) data is currently submitted to the IOTC Secretariat in a number of formats, including data tables embedded within .pdf, .doc, and scanned hard-copy forms. The project aims to facilitate improvements in the data capture, processing and reporting of ROS data to the IOTC Secretariat by the development of electronic data entry interface, national database for storage and processing of data, and regional ROS database hosted by the IOTC Secretariat.
  - E-monitoring: The project is aimed at improving the quality of data collection and coverage of fisheries where there are practical difficulties placing regional observers on-board vessels (e.g., due to safety issues, lack of space, logistics, etc.) – particularly in the case of the artisanal gillnet fleets.

50. The WPNT **NOTED** the proposed project on *the development of artisanal data collection protocols* and **AGREED** that a statistically sound sampling system is needed across all CPC countries for estimating the total catch, fishing effort, and fish size. The WPNT **REQUESTED** that CPCs determine appropriate sampling rates through statistical methods and in cases where sampling rates have been determined somewhat arbitrarily, ENCOURAGED CPCs to verify the accuracy of the estimates based on such a sampling rate.

51. The WPNT **REQUESTED** that training in sampling design is included in the proposed project on *the development of artisanal data collection protocols* and that the IOTC recommendation for the sampling of one fish per metric tonne is re-examined in terms of its universal applicability.

52. The WPNT **REQUESTED** the IOTC Secretariat work closely with Tanzania on the new data reporting system that is being implemented.

53. The WPNT **REQUESTED** WWF-Pakistan support the proposed activities taking place in the north western Indian Ocean region.

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

Maldives neritic tuna fisheries

54. The WPNT **NOTED** paper IOTC–2016–WPNT06–11 Rev_1 which provided a review of neritic tuna in the Maldives, including the following abstract provided by the authors:

"Indian Ocean tuna fisheries exploit a number of neritic tuna species, including bullet tuna (Auxis rocheii), frigate tuna (Auxis thazard), kawakawa (Euthynnus affinis) and longtail tuna (Thunnus tonggol). Of these, kawakawa and frigate tuna are caught in the Maldives fisheries using pole-and-line, handline and trolling and form minor proportions of total tuna landings. Throughout history, pole-and-line vessels landed the bulk of frigate tuna while trolling vessels dominated the kawakawa catch prior to mechanization of the fleet. Catches for both species have shown irregular trends influenced by fishery, environmental and socioeconomic related factors. Highest recorded catch of frigate tuna was observed in 1973 reaching over 6,000 tons, with similar catches being observed in 1996 (6,485 t) and 1995 (5,456 t). Kawakawa catch has shown less variations, peaking during period 1993-1998 with an average of roughly 3,000 t. Catch of both species has seen prominent declines from 2010 onwards coinciding with the introduction of fishery logbooks. Based on catch rates, frigate tuna has been suggested to show east-west migration within the atolls, in phase with the oscillating monsoon currents (Anderson, Waheed and Nadheeh, 1998). No such movement was observed for kawakawa. Studies on stock structure and estimates of abundance are virtually non-existent for both species. Despite availability of a continuous CPUE data series on the Maldives PL fleet, which was used for stock assessment of Indian Ocean kawakawa, the results so far have been dubious due to low level of information on exchange between different components and non-representativeness of the Maldives CPUE series for the whole Indian Ocean kawakawa catch".

55. The WPNT **NOTED** that the pole and line fishery targets skipjack tuna and yellowfin tuna, whereas the handline target the larger yellowfin tunas now there is a market for them. The increase in handline catches corresponds to a decline in catches from the pole and line fishery.

56. The WPNT **NOTED** the decline in catches of frigate tuna and **REQUESTED** that the authors investigate catch rates in future to evaluate whether the decline in catches is due to a decline in effort.

57. The WPNT **NOTED** the lack of reported catches of longtail tuna from the Maldives and very low catches of narrow-barred Spanish mackerel as these are not commonly found in Maldivian waters.

58. The WPNT **NOTED** the socioeconomic factors indirectly affecting the catches of neritic species as the export markets for skipjack and yellowfin increased demand for these species, whereas neritic species are not targeted directly due to their lower prices.

I.R. Iran neritic tuna fisheries

59. The WPNT **NOTED** paper IOTC–2016–WPNT06–12 Rev_1 which provided an overview of the social issues associated with neritic tuna fishing in I.R. Iran, including the following abstract provided by the author:
"Marine aquatic species in Iran consists of two parts: aquaculture activities and marine fisheries activities. Each part of the activities appropriate to their specific requirements has social and technical

considerations of its own. People involving with fishing community including a large percentage of the population in coastal areas of the Persian Gulf, Oman Sea and the Caspian Sea which has always been the focus of attention and sensitivity in fishing management plan. Total volume of national aquatic production in 2014 was 947 thousand tonnes, of which 371 thousand tonnes belong to aquaculture production and around 576 thousand tonnes attributed to marine capture fisheries. Large pelagic catch volume was around 279 thousand tonnes, of which around 139 thousand tonnes belong to neritic tuna. The main neritic tuna species comprised of: longtail tuna, Kawakawa, frigate tuna, Narrow-barred Spanish Mackerel and indo-pacific king mackerel. According to estimates, about 6120 fishing vessels (boats and dhows) are engaged in Neritic tuna fishing activities which led to creating 165184 direct and indirect job opportunity and their activities are distributed along coastal areas of Persian Gulf and Oman Sea. The livelihood of major coastal communities in regard to neritic tuna fishing activities has been noteworthy in recent years and in addition to technical considerations related to fish stocks, measures has been taken to establish a balance in related social conditions".

60. The WPNT **CONGRATULATED** I.R. Iran on the 30,000 person training days organised for fishers in 2014.

61. The WPNT **NOTED** that national management measures have been implemented for restricting catches of longtail tuna in the form of effort restrictions such as the numbers of vessels and number of net panels.

62. The WPNT **NOTED** the increasing catches and lack of corresponding information on trends in effort.

63. The WPNT **NOTED** the plans to develop standardised CPUE series for longtail from gillnet fisheries as outlined in the programme of work and **ACKNOWLEDGED** that while the detailed information on effort needed for this work to take place (such as the type of vessels used, number of net panels, time of net setting and location of setting, etc.), a variety of proxies might potentially be used such as size of vessel which may be linked to the net size and fishing location on a broader scale.

64. The WPNT **NOTED** that WWF-Pakistan has begun to collect data of a sufficient resolution for CPUE standardisation in the future for 6 - 7% of the Pakistani fleet (4 years so far).

65. The WPNT **NOTED** that WWF-Pakistan have implemented onboard scientific observers on 32 vessels and plan to increase this to approximately 60 in the near future.

66. The WPNT **ACKNOWLEDGED** the work that WWF-Pakistan has done alongside the government and **ENCOURAGED** these data to be submitted formally to the IOTC Secretariat asper Resolution 15/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPCs).*

67. The WPNT **NOTED** that while the decline in the threat of piracy has resulted in an increase in catches of tropical tunas as fleets move back into tropical waters again, catches of neritic tunas from coastal areas have shown a corresponding decline.

68. The WPNT **NOTED** that Pakistani fleets moved to operate near the Indian border due to the threat of piracy and have since adapted to these fishing areas, so while some have returned, not all vessels have returned to the previously fished areas.

Thailand neritic tuna fisheries

69. The WPNT **NOTED** paper IOTC–2016–WPNT06–13 which provided an overview of data collection in the Andaman Sea, including the following abstract provided by the authors:

"The data collection of marine fisheries in Thailand has conducted by two responsible units , namely Fishery Statistics Analysis and Research Group and Marine Fisheries Division. The purse seine is the main fishing gear for pelagic species, especially neritic tuna in the Andaman Sea. The previous sampling data were collection data from port sampling in catch and size by Research group and logbook in catch (voluntary basic) from Fishery Division. In 2016 the sampling method reforms such as sampling frequency increased from 1-2 to 4-6 times per boat per trip, target species, etc. Other information will be collected and complied from Vessel Monitoring System (VMS), logbook, record fish unload and Port in-Port out data. All information will be gathering together, then will be analysed the result for calculation the Maximum Sustainable Yield in 2017".

70. **NOTING** the importance of sampling design and that the sampling rate was not clear in this study, the WPNT **REQUESTED** Thailand clarify this in future.

71. The WPNT **NOTED** that there is 100% VMS coverage for large scale vessels in Thailand which could be used for CPUE standardisation.

72. The WPNT **NOTED** that VMS has been established in some fleets and **REQUESTED** that CPCs consider how the data collected might be used for scientific purposes such as CPUE standardisation.

Kenya neritic tuna fisheries

73. The WPNT **NOTED** paper IOTC–2016–WPNT06–14 which provided an overview of the improvements in data collection in the Kenyan fisheries, including the following abstract provided by the authors:

"The State Department of Fisheries (SDF) in Kenya in 2013 started collecting data on Catch Assessment Sampling as an improvement to the previous total enumeration previously undertaken by the department. 22 primary and secondary landing sites were selected where all the catches including neritic tunas were sampled. The paper looks at the results of the first two years of sampling, challenges encountered and proposes ways that can be used to improve on the capture of neritic tuna data. The main challenges were identification to the species level, use of similar local names for several species, wrong data entries and lack of a database. During the second year of sampling, more training was undertaken and the data collectors improved in data capture and better recording. The length frequency data received for each species was now more reliable after the identification and sampling improved. The need for constant training was found necessary to improve the quality of the data reporting. Neritic species identified to species level were Scomberomorous commerson, Scomberomorous plurilineatus, Auxis rochei and Euthynus affinis. A sizeable amount of tuna was lamped together as tuna which was hard to identify. Though the first year data had identification problems, 80% of the catch in the second year was identifiable to species level when the use of local languages was harmonized. Closer monitoring of the sampling program and use of local languages are important ingredients in realising more accurate fisheries data".

74. The WPNT **NOTED** that this is a new initiative by the government which is complemented by sampling efforts by external research projects.

75. The WPNT **NOTED** that there are 22 landing sites with data collectors along the Kenyan coast which are being monitored and as these have different fisheries operating out of them, sampling could also be stratified by fishery typed.

76. The WPNT **REQUESTED** that Kenya works with the IOTC Secretariat to continue making improvements to the system.

Malaysia neritic tuna fisheries

77. The WPNT **NOTED** paper IOTC–2016–WPNT06–15 which provided an overview of catches of neritic tuna by the Malaysian fleet, including the following abstract provided by the authors:

"Neritic tuna species in Malaysia were longtail tunas, frigate tunas and kawakawa. Neritic tuna contribute 4.5% of Malaysia's marine fish landings in 2015. 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 82% of the annual catches of neritic tuna in Malaysia. In Kuala Perlis, neritic tuna species are the second most abundant (13%) landed by purse seines after scad (16%), with longtail tuna dominated the landings followed by kawakawa and frigate tuna. Monthly length weight measurement of the three species of neritic tuna showed a relationship of W = 0.000062 L 2.7759 for kawakawa W = 0.000013 L 3.0580 . Age and growth were estimated using length based methods. The von Bertalanffy growth parameters estimated for kawakawa were L∞ = 60.43 cm, annual K = 0.26 and to = -0.55 years. Mortality estimated were M = 0.33, Z = 0.80 and F = 0.47 with the exploitation rate E = 0.59".

78. The WPNT **NOTED** that the high proportion of catches were juveniles in this study and so this could be the reason for the low asymptotic length and the very low estimated natural mortality.

79. The WPNT **NOTED** the lack of any mature individuals in May determined by the maturity analysis. As the spawning season starts when the temperature begins to increase, there would be expected to be mature

individuals at this time, so the WPNT **SUGGESTED** that sampling is undertaken across a greater number of months to fully explore the seasonality and that results are presented separated by sex.

80. The WPNT **RECALLED** the planned project to conduct a meta-analysis of biological data including population parameters such as growth and maturity and that this would address these issues to improve the consistency of estimates of biological parameters in studies across the Indian Ocean (WPNT05 para. 83).

Artisanal fisheries in coastal East Africa

81. The WPNT **NOTED** paper IOTC–2016–WPNT06–23 which provided a review of data collection systems for artisanal fisheries in coastal east Africa, including the following abstract provided by the authors:

"Collection of fisheries statistics forms an important step towards proper management of fish stocks. Data collection in most developing countries especially for artisanal fisheries, it is a challenge let alone statistics of particular fishery of interest like tuna and tuna like. The current analysis, assessed the situation in fisheries data collection system in Coastal East Africa countries (specifically in Tanzania and Kenya) and suggest ways for improvement in the context of neritic tuna.Two approaches were employed; a review of available reports and literatures, followed by a field visit to the respective Fisheries Departments in Kenya and Tanzania (both the Mainland and Zanzibar Islands). Literature review was mainly conducted through a desktop study whereby published and grey documents were accessed on the internet while other documents were provided by the fisheries authorities in Kenya and Tanzania as well as WWF Office in Tanzania. Over 50 documents were accessed and evaluated in terms of their relevance to the assignment. Findings, indicate there is level of similarity in the data collection system across CEA and the routine data collection form has been harmonized to some level. Fisheries data is being collected by designated fisheries officers where available and members of the Beach Management Unit (BMUs)"- See paper for full abstract.

82. The WPNT **NOTED** the difficulties in engaging with fishers when it may lead to legislation that negatively impacts them, however there is a good level of trust and engagement in the BMUs that have been established which may be partly due to the requirement that 60% of the BMU must have been involved in fisheries.

83. The WPNT **NOTED** the this system of data collection facilitates the process given that there are not enough fisheries officers for full enumeration by officials alone.

84. The WPNT **NOTED** the pilot activities for the introduction of mobile based systems to collect information electronically and the contingencies developed so that when there is no network coverage, data are stored until it is available again.

85. The WPNT **NOTED** a set of recommendations towards the improvement of data collection related to tuna and tuna-like species, and **ENCOURAGED** the adoption of these, including the collection of species specific data for both neritic and tropical tunas.

Pakistan neritic tuna fisheries

86. The WPNT **NOTED** paper IOTC–2016–WPNT06–24 which provided an overview of the changes in the landings of neritic tuna and tuna like species in Pakistan including the following abstract provided by the authors:

"Neritic tuna is of immense importance for Pakistan as it contribute about 50 % in the total tuna landings. Five species of tuna are represented in catches in the neritic waters along Pakistan coast. Of these longtail tuna (Thunnus tonggol) and kawakawa (Euthynnus affinis) are main neritic tuna species whereas frigate tuna (Auxis thazard thazard), bullet tuna (Auxis rochei rochei) and striped bonitos (Sarda orientalis) are also found in the landings but their combined contribution is less than 1 % of the total landings of neritic tuna. Contribution of longtail tuna in the total landings of neritic tuna ranges between 67.40 % in 2008 and 79.10 % in 2003. Contribution of kawakawa was observed to be between 20.32 % in 2003 and 31.82 % in 2008. Data collected by observers deputed by WWF-Pakistan reveals that the contribution of neritic tuna species depends mainly on the area of operation of the fishing vessels. Tuna gillnets vessels operating on the eastern coast of Pakistan (Sindh and Sonmiani area) which has broader continental shelf show higher catches of neritic tuna as compared to vessels operating along Makran coast known for its narrower continental shelf".

87. The WPNT **NOTED** that there are major differences in government reported statistics and the data collected by the WWF observer scheme. Data held by the government are mostly estimates based on extrapolations from previous data collected and do not cover smaller tunas adequately.

88. The WPNT **NOTED** that the only management measure in place is the voluntary closed season for neritic tunas from June – July and limited catches in August which is a tradition rather than a government imposed initiative.

89. The WPNT **NOTED** that bullet and smaller frigate are not retained, and thus are not observed at landing sites.

90. The WPNT **NOTED** the ban on landing fish, including tunas, which are under 15cm total length.

91. The WPNT **NOTED** the pilot project established by WWF-Pakistan plans to put cameras on vessels; AIS and VMS are now in place on 4 vessels so far and the data collected to date corresponds well to the data reported through the WWF-Pakistan crew-based observer scheme.

92. The WPNT **NOTED** the e-reporting and e-monitoring projects currently taking place by the IOTC Secretariat with which the government of Pakistan will be engaged, based on their commitments expressed during the meeting.

93. The WPNT **NOTED** that at-sea transhipment from Pakistan to I.R. Iran may contribute to inaccuracy in recording, potentially leading to double-registration (>300 vessels) and double-reporting of catches by these countries.

94. The WPNT **CONGRATULATED** WWF-Pakistan for the progress made with data collection so far and **ENCOURAGED** them to continue collaborating with the Ministry so that these data may be officially reported to the IOTC in the near future.

Indonesia

95. The WPNT **NOTED** paper IOTC–2016–WPNT06–INF01 which provided a description of the BOBLME, DGCF, IOTC-OFCF pilot project in Indonesia including the following abstract provided by the author:

"The purpose of this workshop was to assist the Directorate General for Capture Fisheries (DGCF) in improving fisheries data collection and monitoring activities based on the results of the OFCF-IOTC-BOBLME Pilot Project entitled, "Collection of Data from Tuna Fisheries in the Provinces of West Sumatra and North Sumatra, Indonesia", which was implemented during the period June 2014 to December 2015. The workshop was officially opened by Mr. Koichi Sakonju, IOTC-OFCF project manager, who described the objectives of the workshop including a dissemination and discussion of the pilot project results, difficulties encountered, and an introduction of the participants (Annex 1), including a mission from OFCF headquarters and Mr. Craig Proctor, manager of the ACIAR-CSIRO project on, "Developing research capacity for management of Indonesia's pelagic fisheries resources".

96. The WPNT **THANKED** the IOTC-OFCF Project for its continued support to the enhancement of data collection and processing systems in developing countries of the IOTC and **ENCOURAGED** the OFCF to extend support in the future.

97. The WPNT **NOTED** the Leadership Training Course on Fisheries Resource Management 2016 hosted by the Overseas Fishery Cooperation Foundation of Japan and **ENCOURAGED** interested participants to apply before the deadline (July 31, 2016).

98. The WPNT **NOTED** paper IOTC–2016–WPNT06–10 which provided an overview of the Indonesia pilot sampling project including the following abstract provided by the author:

"For a number of years the IOTC Secretariat, the IOTC-OFCF Project, BOBLME, and other stakeholders in the region have actively engaged with Indonesia to provide technical assistance and build capacity in the fisheries data collection and reporting systems, including the development of logbooks for the industrial fleet, species identification training, and data collection and management workshops. The following paper presents an overview of a pilot sampling Project in North and West Sumatra, conducted by the IOTC Secretariat and Indonesia's Directorate of General Capture Fisheries (DGCF) since 2014[1]*. The Project aims to pilot a methodology for sampling at landing sites, targeting Indonesia's small scale fisheries to improve the estimates of total catches, and particularly catches by species, for Indonesia's coastal fisheries. Preliminary results of the pilot project are presented, and implications for IOTC's current estimates of catches of neritic species for Indonesia – with particular reference to longtail tuna (Thunnus tonggol").*

[1] Funded by the IOTC Secretariat, BOBLME, and IOTC-OFCF Project.

99. The WPNT **NOTED** the importance of the Indonesian fisheries in the Indian Ocean in terms of contribution to total catches and the importance of this study for improving data for regional stock assessments.

100. The WPNT **NOTED** that the Indonesian fisheries are complex from both a geographical and institutional perspective and so a variety of methods are used forthe raising of catch data. This takes place at the district level which operates fairly autonomously from the DGCF.

101. The WPNT **NOTED** that total catches in the IOTC database are taken as reported by Indonesia and the only estimations made by the IOTC Secretariat are disaggregations of these data.

102. The WPNT **NOTED** that the project has a finite lifetime, but was intended to simply test the methodologies which can then be used as a method to continue estimating the catches in future. The WPNT **ENGOURAGED** Indonesia to take this method and roll it out across the country to improve the accuracy of future statistics reported to IOTC.

103. The WPNT **NOTED** that the project also collects data on effort but as many of the fisheries are not directly targeting tunas, this is more complex to extract and **AGREED** that this is almost as important as catch data and **REQUESTED** the Secretariat also analyse these data.

104. The WPNT **THANKED** OFCF and BOBLME for collaborating with IOTC on this project.

105. **ACKNOWLEDGING** that OFCF are planning to follow-up the sampling project further, the WPNT **RECOMMENDED** that IOTC regular budget is allocated to support the extension of the Indonesia sampling project in both geographical scope and over time.

106. The WPNT **AGREED** that it is important that the DGCF commit to continue the sampling activities and do not discontinue the work on completion of the project.

107. The WPNT **REQUESTED** WWF-Pakistan establish similar projects in the northwest Indian Ocean.

108. The WPNT **NOTED** that there is a declining trend in the catches of longtail tuna from 2012 to 2014 in many fleets across the Indian Ocean, however, while for many CPCs this is likely to be reflecting the return to fishing in inshore areas due to the reduced risk of piracy.

109. The WPNT **AGREED** on the importance of establishing whether these are actual trends or reporting trends given that the data are currently being used for catch-only stock assessments.

110. The WPNT **NOTED** that the word 'tongkol' is used as a prefix for some small tuna species in Indonesia, not just longtail tuna, and so this is likely to be the cause of some confusion around species identification.

111. The WPNT **NOTED** paper IOTC–2016–WPNT06–16 which provided the first part of a Productivity Susceptibility Analysis for neritic tuna species in the Indian Ocean including the following abstract provided by the author:

"Neritic tunas in the Indian Ocean are primarily exploited by coastal fleets operating in the Exclusive Economic Zones (EEZs) of coastal states. Many of these fleets are artisanal and small-scale. Neritic tunas are also taken in industrialised fisheries, including a portion as bycatch by industrial fleets in areas beyond national jurisdiction. As a result, neritic tuna populations and their fisheries are notoriously data-deficient, with the limited data on catch, effort, catch-at-size (age), biology, and population status posing significant challenges for management. In such contexts, Ecological Risk Assessment (ERA) offers an opportunity for systematic examination of population vulnerability to specific gears and fleets, enabling prioritisation for targeted data collection, assessment and research").

112. The WPNT **AGREED** that the process of compiling this information is a valuable exercise for this and future analyses based on alternative methods and **RECALLED** the papers providing a review of the populations parameters available for neritic species in the Indian Ocean (IOTC–2015–WPNT05–DATA12, IOTC–2015–WPNT05–DATA13, IOTC–2015–WPNT05–DATA14, IOTC–2016–WPNT06–DATA12, IOTC–2016–WPNT06–DATA13, IOTC–2016–WPNT06–DATA14).

113. The WPNT **NOTED** a recent ICES paper[2] on MSY reference points highlighting that stocks with high asymptotic length, which would be categorised as having low productivity using PSA, are less sensitive to the effects of poor recruitment years since several cohorts contribute to the spawning stock biomass. By contrast, stocks with smaller asymptotic length can be more sensitive to fishing pressure.

[2] Rindorf et al. (*In Press).* Fishing for MSY: can 'pretty good yield' ranges be used without impairing recruitment? ICES Journal of Marine Science.

114. The WPNT **NOTED** that this study highlights that there may be potential issues with the PSA and SAFE methods based on the productivity component. However, as the neritic species are similar to each other in terms of their productivity scores, this should not have a large impact on the results of the PSA or SAFE analyses.

115. The WPNT **NOTED** paper IOTC–2016–WPNT06–INF02 which provided a comparison of Productivity Susceptibility Analysis (PSA) and Sustainability Assessment for Fishing Effect (SAFE) risk assessment methods including the following abstract provided by the author[3]:

"Two alternative tools to assess impacts of fisheries on fish species have been developed for use as part of the Ecological Risk Assessment for the Effects of Fishing (ERAEF) toolbox, namely, the Productivity and Susceptibility Analysis (PSA) and the Sustainability Assessment for Fishing Effect (SAFE). Both have been applied to major Australian Commonwealth fisheries and, with various modifications, adopted internationally. However, there has been no formal comparison between the two approaches and no validation against other data-rich methods. Here, we conduct three comparisons: between PSA and SAFE, between PSA, SAFE and Fishery Status Reports (FSR), and between PSA, SAFE and data-rich quantitative stock assessments. The comparison between PSA and SAFE explains many similarities. Both methods use similar data. PSA typically downgrades quantitative information into an ordinal scale between 1 and 3, whereas SAFE uses the quantitative information as continuous numerical variables in equations at each assessment step. As intended in its original design, PSA is more precautionary, classifying many more species at medium or high risk than SAFE. A comparison with FSR for overfishing classification shows an overall misclassification rate of 50% by PSA (overestimating risk in all these cases) and 8% by SAFE (overestimating risk in 3% and underestimating risk in 5% of cases). A comparison with Tier 1 stock assessments shows an overall misclassification rate of 89% by PSA and 11% by SAFE (all overestimating risk). These comparisons show that performance of these two ERA tools may deliver the expected benefits in terms of prioritizing high risk species, but, in the case of PSA, the screening may be too precautionary. Validation with more quantitative methods is an important step to guide the further improvement of these important tools)".

116. The WPNT **NOTED** the development of the Sustainability Assessment for Fishing Effect as an intermediary step between the semi-quantitative PSA and the fully quantitative stock assessment.

117. The WPNT **REQUESTED** that a Sustainability Assessment for Fishing Effect (SAFE) analysis is carried out next year to compare with the results of the PSA.

118. The WPNT **NOTED** there are a number of advantages in the use of real data in the SAFE method rather than an ordinal rank scale of the PSA meaning that uncertainty can be quantified, accumulated risk across fisheries is straight forward to estimate and relatively arbitrary cut-off points are not used.

119. The WPNT **NOTED** the lower sensitivity of the PSA at higher levels of productivity because of the linear relationship that is used, whereas many of the life history invariant relationships are non-linear. The SAFE method overcomes this problem.

120. The WPNT **NOTED** that PSA compared poorly with data intensive stock assessments with a bias towards ranking lower risk stocks as higher risk in the PSA method (i.e. is overly conservative and biased towards false positives). SAFE did not predict the stock assessment results without error, but there was less inherent bias in the outcomes.

121. The WPNT **NOTED** the improvements in results from the alternative, enhanced version of the SAFE method, but the drawback that this is a more data intensive method.

122. The WPNT **NOTED** that both PSA and SAFE are F-based methods, centred on unknown biomass on the premise that if the F indicator is kept low enough for a long period of time then the stock status will improve.

[3] Shijie Zhou, Alistair J. Hobday, Cathy Dichmont, and Anthony D.M. Smith *(In Review)*. Ecological risk assessments for the effects of fishing: a comparison and validation of PSA and SAFE

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

123. The WPNT **NOTED** paper IOTC–2016–WPNT06–07 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 1950–2014. A summary is provided at Appendix IVd.

124. 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.

125. The WPNT **NOTED** that the number of size-frequency samples (~20,000 fish) for longtail tuna is relatively high compared to some other fisheries globally, although this may be low relative to the catch size (the IOTC recommends 1 fish is sampled per metric tonne).

126. The WPNT **NOTED** that reported longtail catches from a number of CPCs have declined in recent years, particularly from I.R. Iran, however, the reasons for this are unclear.

5.2 Data for input into stock assessments

No papers provided.

5.3 Stock assessment updates – Summary

Indian Ocean longtail tuna assessment using catch-based methods

127. The WPNT **NOTED** paper IOTC-2016-WPNT06-17 that details a stock assessment for longtail tuna using catch-only methods, including the following abstract provided by the authors:

128. "*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 were conducted for Longtail tuna (Thunnus tonggol) in 2013 (Zhou and Sharma, 2013), 2014 (Zhou and Sharma, 2014) and 2015 (Martin and Sharma, 2015). This paper provides an update to these assessments based on the recent new catch information, using two methods to assess the status of T. tonggol: (i) Stock reduction analysis or Catch-MSY method (Kimura and Tagart 1982; Walters et. al. 2006; Martell and Froese 2012) and (ii) a posterior-focussed catch method, OCOM (Zhou et al., 2013)".* See paper for full abstract.

Indian Ocean longtail tuna assessment using a Catch-MSY Method

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

Table 2. Longtail tuna: Key management quantities from the Catch-MSY used in 2016.

Management Quantity	Aggregate Indian Ocean
Most recent catch estimate (year)	146 750 t (2014)
Mean catch – most recent 5 years[4]	158 495 t (2010 - 2014)
MSY (plausible range)	142 407 (110 547 to 193 847)
Data period used in assessment	1950 – 2014
F_{MSY} (plausible range)	0.41 (0.29 - 0.62)
B_{MSY} (plausible range)	280 620 (163 893 – 332 694)
$F_{current}/F_{MSY}$ (plausible range)	1.07 (0.60 – 1.91)
$B_{current}/B_{MSY}$ (plausible range)	0.94 (0.60 – 1.40)
$SB_{current}/SB_{MSY}$ (80% CI)	n.a
$B_{current}/B_0$ (plausible range)	0.47 (0.30 - 0.70)
$SB_{current}/SB_0$ (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.

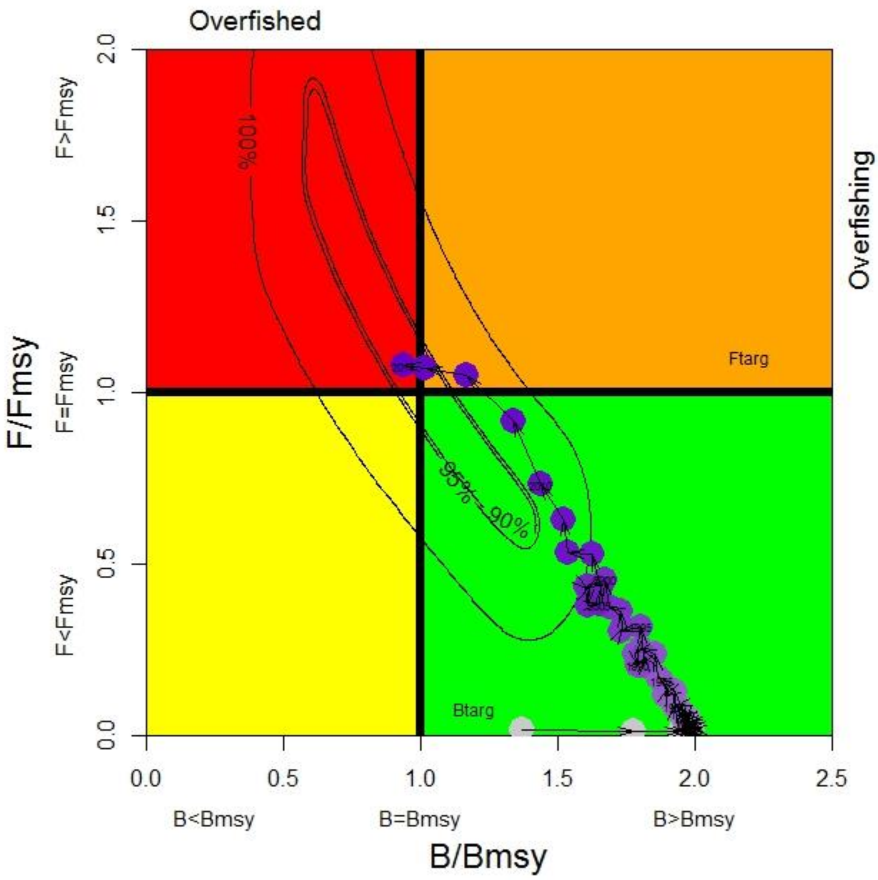

Fig. 1. Longtail tuna. Catch-MSY Indian Ocean assessment Kobe plot for longtail tuna. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also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

[4] Data at time of assessment

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

130. 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 2016.

Management Quantity	Indian Ocean
Most recent catch estimate	146 751 t
Mean catch over last 5 years[5]	158 495 t
MSY (plausible range)	143 153 t[6] (105 604-193 762)
Data period used in assessment	1950 – 2014
F_{MSY} (plausible range)	0.39 (0.29 – 0.54)
B_{MSY} (plausible range)	297 689 (196 714 -545 071)
$F_{current}/F_{MSY}$ (plausible range)	1.03 (0.88-1.26)
$B_{current}/B_{MSY}$ (plausible range)	0.99 (0.78-1.19)
$SB_{current}/SB_{MSY}$ (80% CI)	n.a.
$B_{current}/B_0$ (plausible range)	0.50 (0.39-0.60)
$SB_{current}/SB_0$ (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.

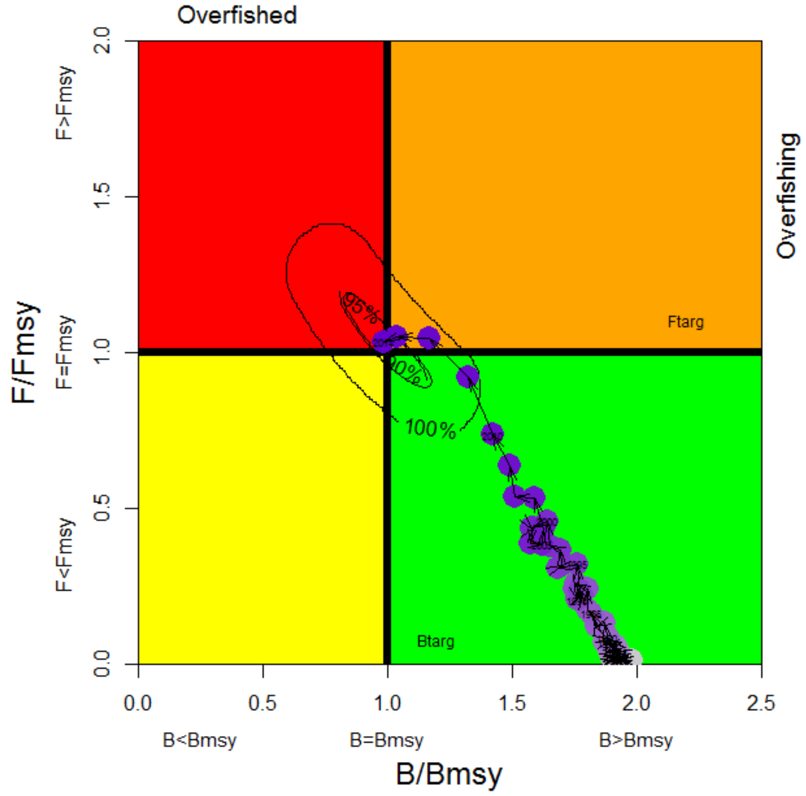

Fig. 2. Longtail tuna OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

[5] Data at time of assessment

[6] median = 140 326

131. The WPNT **COMMENDED** the work undertaken by the Secretariat in updating the OCOM and Catch-MSY models, **NOTING** the examination of alternative assumptions regarding estimation of priors in the OCOM method.

132. The WPNT **NOTED** the consistency in the assessment results between models and alternative model runs 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.

133. The WPNT **NOTED** that the change in stock status is due to the continued catches above MSY levels.

134. The WPNT **NOTED** that model results suggest that fishing mortality has declined in the last two years and that catches in the most recent year of data (2014) have fallen to levels close to the estimated MSY.

135. 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.

136. The WPNT **NOTED** that new methods are currently being explored for improved estimation of depletion in OCOM based on information in the RAM Legacy Database, which could be applied to assessments in 2017. The WPT **NOTED** the preliminary runs by the invited expert which predicted depletion levels which corresponded well to the results presented based on the default ranges.

137. The WPNT **NOTED** the use of alternate prior range for r based on a new method (Then et al., 2014) resulted in lower growth estimates and therefore more pessimistic results.

138. The WPNT **NOTED** the sensitivity of the OCOM results to estimates of life history parameters used in empirical methods to define prior ranges for the intrinsic population growth rate, r and **REQUESTED** CPCs to carry out further empirical growth studies to improve these estimates and narrow the prior interval ranges.

139. The WPNT **AGREED** that in addition to starting and final depletion levels based on catch relative to maximum catch in the series, it may be beneficial to explore options for using other features of the catch series to estimate trajectories of depletion.

140. The WPNT further **NOTED** that the presentations of the models could be improved by providing further details on the methods, especially where there is room for some subjectivity such as the selection of prior ranges.

141. The WPNT **NOTED** recommendations for the next steps in assessments for neritic tunas, which included requesting guidance from the Working Party on Methods for setting advice from data-poor assessments, further refinement of catch-only methods (e.g. setting depletion levels), standardising CPUE series to broaden the range of indicators and models available to the WPNT, and the exploration of alternative assessment methods.

142. The WPNT **REVIEWED** the management advice for longtail tuna adopted by the Scientific Committee in 2015, **NOTING** that the recommended reductions in catch levels (20-30%) were highly conservative with respect to reducing catches below MSY based on the catch information from 2014.

5.4 Selection of Stock Status indicators

143. The WPNT **REVIEWED** how management advice was selected for neritic tunas assessed by data-poor methods in 2015 and **AGREED** that OCOM should remain as the main catch-only model for setting advice given its use of more informative priors and fewer assumptions about the final depletion levels compared to the Catch-MSY method.

144. The WPNT **NOTED** the importance of exploring alternative models or sources of information that can evidence results from data-poor assessments, and **RECOMMENDED** that other methods are explored based on different data sources, such as catch curve estimation of mortality from length-frequency data. A range of data sources should be explored, including data from observer programmes, the sport fisheries project, and non-state actor (e.g. WWF) projects for suitability.

145. The WPNT **NOTED** the inherent constraints of the Kobe plot in defining a singular management target that, when achieved, allows for rapid shifts in status with only minor changes in F- and B-ratios. This problem is especially acute for data-poor assessment results for neritic tunas in recent years, where F- and B-ratios are often borderline in terms of status.

146. The WPNT **NOTED** that while KOBE plots are useful from a conservation perspective, the goal of fisheries management is to ensure the sustainability of stocks and ensure the fisheries have maximum benefit for society, which is fishing at the target, MSY. The centre of the KOBE plot is therefore considered to be the target but the colouring of the plot does not really reflect this.

147. The WPNT **AGREED** that where data poor methods are used and stock status is highly uncertain but target yield can be estimated fairly robustly, alternative methods of providing management advice should be used.

148. The WPNT **RECALLED** the recommendation of the WPNT05 for the SC to request the Working Party on Methods evaluate a proposed alternative methodology for presenting management advice for data poor methods in 2016. The WPNT **RECOMMENDED** that the WPM evaluate the possibility of using different colours to distinguish between stocks which have not been assessed (e.g., white) and stocks which have been assessed but the status is considered to be uncertain (e.g., grey).

149. **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.

150. The WPNT also **DISCUSSED** the possibility of using FAO terminology on exploitation status in the advice (e.g. fully exploited) as an alternative.

5.5 Development of technical advice on the status of longtail tuna

151. 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 2015 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

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

152. The WPNT **NOTED** paper IOTC–2016–WPNT06–07 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 1950–2014. A summary is provided at Appendix IVf.

153. The WPNT **NOTED** the trend of increasing catches to a peak in 2012 but **RECOGNISED** that a significant portion (>50%) of the catch has to be estimated by the Secretariat, partly due to species aggregation with Indo-Pacific king mackerel. Catches remain highly concentrated in Indonesia and India. Clarification was sought by participants to confirm that the procedures for splitting the catches among gears were consistent between years. The WPNT also discussed the availability of catch information from EU purse seine fishery observer data and from fisheries for Spanish mackerel in northern Australia, where it forms an important target species.

154. The WPNT **NOTED** the high concentration of catches of in the Bay of Bengal area around India and Indonesia

155. The WPNT **NOTED** that the data submitted by Australia are not spatially disaggregated, but simply grouped as inside or outside the EEZ.

156. The WPNT **NOTED** that no catch data are submitted by non-CPCs in the north-west Arabian Sea, and that the IOTC Secretariat therefore estimates catches based on information from FAO.

157. The WPNT **NOTED** inconsistencies with the data by gear reported by India, and **REQUESTED** that India submit the corrected data in the future**.**.

158. The WPNT **NOTED** that the catch data of all neritic tuna species are associated with a higher uncertainty than tropical tunas and that this should be acknowledged when presenting results.

6.2 Data for input into stock assessments

No papers provided.

6.3 Stock assessment updates

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

159. The WPNT **NOTED** paper IOTC-2016-WPNT06-18 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 lack of available data. This includes limited information on stock structure, a lack of standardised CPUE series and biological information. In 2014 and 2015, data-poor approaches using basic catch information were used to assess the status of Indian Ocean narrow-barred Spanish mackerel (Scomberomorus commerson) (IOTC–2014–WPNT04–26; IOTC-2015-WPNT05-23). These approaches are updated here based on the recent new catch information. This paper uses two methods were used to assess the status of S. commerson: (i) Stock reduction analysis or Catch MSY method (Kimura and Tagart 1982; Walters et. al. 2006; Martell and Froese 2012) and (ii) a recently developed posterior-focussed catch method OCOM (Zhou et al., 2013). The other neritic species investigated using the same methods in 2016, as requested by the Scientific Committee, was Longtail tuna (Thunnus tonggol) (IOTC-2016-WPNT06-17)".

160. The WPNT **NOTED** that both models suggest that, on the basis of point estimates, narrow-barred Spanish mackerel is likely being fished above optimal levels while, based on the Catch-MSY model results, biomass is still just above B_{MSY} levels and based on the OCOM results, the biomass has fallen below B_{MSY} levels. However considering the uncertainty in the data-poor methods and results, the point estimates should be interpreted with caution.

161. The WPNT **NOTED** that the lower r prior range used for the OCOM assessment based on empirical estimates from the literature (IOTC–2015–WPNT05–DATA14 – COM) contributes to the lower biomass estimates.

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

162. The WPNT **NOTED** the results from the Catch-MSY assessment method (Table 4, Fig. 3).

Table 4. Narrow-barred Spanish mackerel: Key management quantities from the Catch-MSY used in 2016. Geometric means and plausible ranges across all feasible model runs.

Management Quantity	Aggregate Indian Ocean
Most recent catch estimate (2014)	154 723 t (2014)
Mean catch 2010–2014	148 610 t (2010 – 2014)
MSY (plausible range)	140 638 (110 984 to 179 090)
Data period used in assessment	1950 – 2014
F_{MSY} (plausible range)	0.43 (0.28 - 0.64)
B_{MSY} (plausible range)	260 084 (145 764 – 339 410)
F_{2014}/F_{MSY} (plausible range)	1.06 (0.67 – 1.98)
B_{2014}/B_{MSY} (plausible range)	1.02 (0.60 – 1.40)
SB_{2014}/SB_{MSY} (80% CI)	n.a
B_{2014}/B_0 (plausible range)	0.51 (0.30 - 0.70)
SB_{2014}/SB_0 (80% CI)	n.a
$B_{2014}/B_{0,\ F=0}$ (80% CI)	n.a
$SB_{2014}/SB_{0,\ F=0}$ (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.

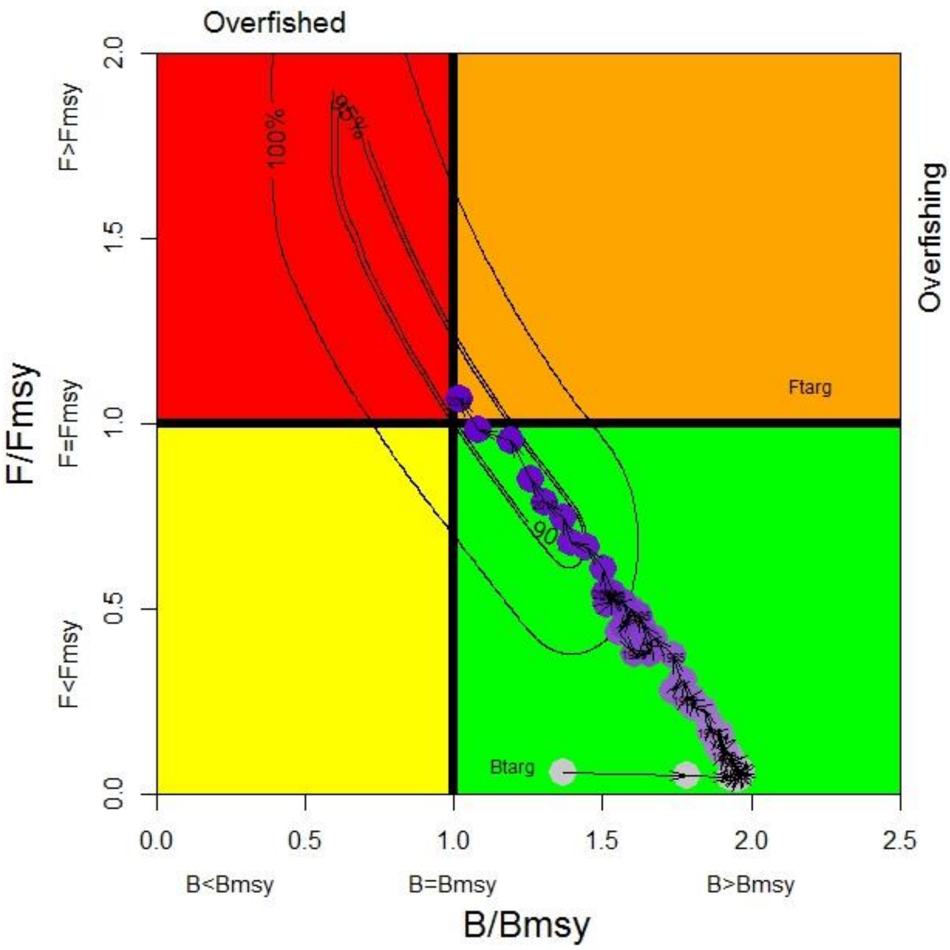

Fig. 3. Narrow-barred Spanish mackerel. Catch-MSY Indian Ocean assessment for *S. commerson.* The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

Indian Ocean Narrow-barred Spanish mackerel: assessment using OCOM

163. The WPNT **NOTED** that the OCOM method would be used for stock status advice (Table 5, Fig. 4).

Table 5. Narrow-barred Spanish mackerel: Key management quantities from the OCOM used in 2016.

Management quantity	**Indian Ocean Region**
Most recent catch estimate (2014)	154 723 t (2014)
Mean catch 2010–2014	148 610 t (2010 – 2014)
MSY (plausible range)	131 053 t (98 717 – 178 800)
Data period used in assessment	1950 - 2014
F_{MSY} (plausible range)	0.34 (0.21 – 0.56)
B_{MSY} (plausible range)	326 217 (178 122 – 702 344)
F_{2014}/F_{MSY} (plausible range)	1.21 (0.95 – 1.48)
B_{2014}/B_{MSY} (plausible range)	0.95 (0.74 - 1.27)
SB_{2014}/SB_{MSY} (80% CI)	n.a
B_{2014}/B_0 (plausible range)	0.47 (0.37 – 0.63)
SB_{2014}/SB_0 (80% CI)	n.a
$B_{2014}/B_{0, F=0}$ (80% CI)	n.a
$SB_{2014}/SB_{0, F=0}$ (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.

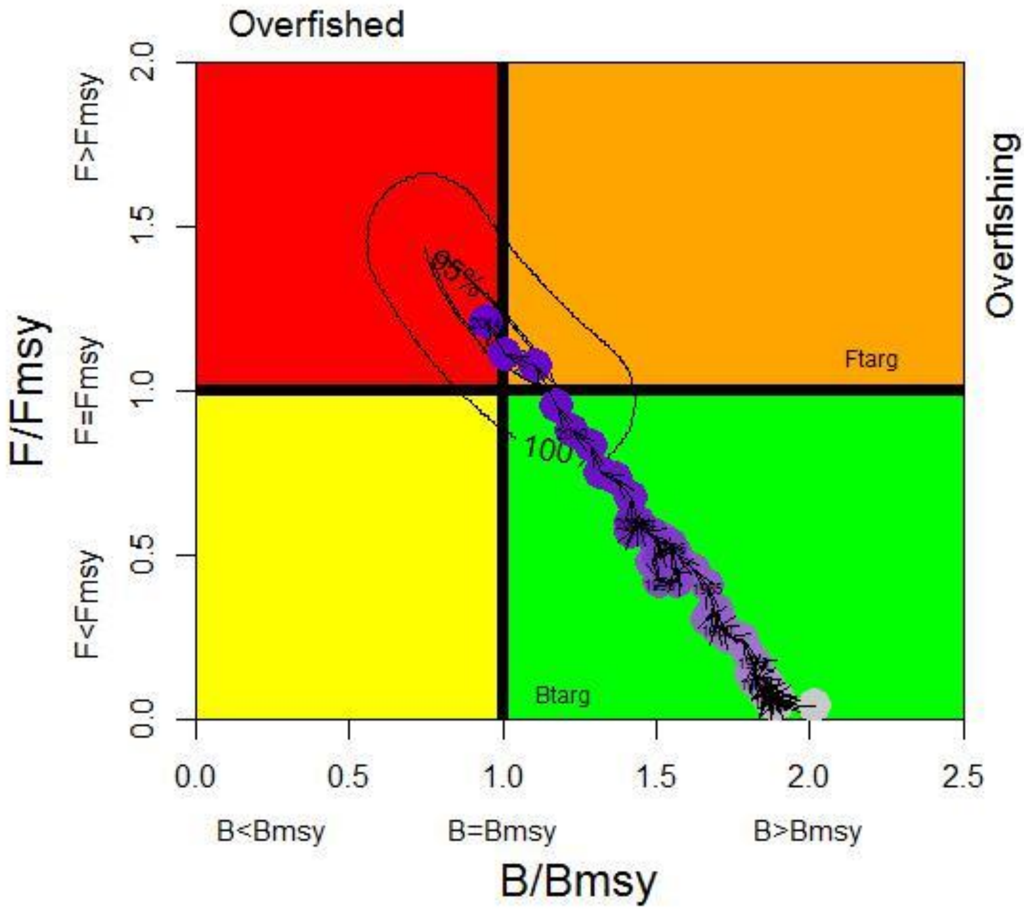

Fig. 4. *S. commerson* OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

6.4 Selection of Stock Status indicators

164. **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.

165. The WPNT **NOTED** that the result from both models were very similar, suggesting the stock status is close to the management target. Based on the preferred methodology as outlined above and taking a precautionary approach, the WPNT **AGREED** that stock status management advice for narrow-barred Spanish mackerel should be based on the OCOM model.

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

166. The WPNT **ADOPTED** the management advice developed for narrow-barred Spanish mackerel (*Scomberomorus commerson*) as provided in the draft resource stock status summary – Appendix XII and **REQUESTED** that the IOTC Secretariat update the draft stock status summary for narrow-barred Spanish mackerel with the latest 2015 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

167. The WPNT **RECALLED** paper IOTC–2016–WPNT06–07 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 1950–2014. Summaries are provided at Appendix IVa, b and e.

Indonesia neritic tuna fisheries

168. The WPNT **NOTED** paper IOTC–2016–WPNT06–19 which provided an analysis of size of Auxis Spp. from the west coast of Sumatra, including the following abstract provided by the authors:

> *"Auxis spp was the third largest catch of tuna fishing off the Sumatran West Coast after skipjack tuna (Katsuwonus pelamis) and scads (Decapterus spp). Two species were identified as frigate tuna (Auxis thazard Lacepede 1800) and bullet tuna (Auxis rochei Risso 1810). Both were extensively commercialized and exploited using gears such purse seine, troll line and lift net. The study of Auxis spp regarding the fish distribution and reproductive aspect were carried out based on the data of landed catch by purse seiner and lift netter. The samples were then measured and analyzed further during the period of January - December 2015 in three locations: Lampulo, Sibolga and Bengkulu. Results show that the size range of A. thazard and A. rochei were 19-65 cmFL and 15-39 cm FL, respectively. Both possess allometric growth pattern. The sex ratio analysis (male: female) resulted in significant difference for Auxis thazard whereas Auxis rochei was not significant (p> 0:05). Based on the individual size, the smallest mature fish of A. thazard was 26 cmFL and 23 cmFL for A. rochei. Furthermore, Spearman Karber method was applied to assess the first length of maturity based on the fish size when 50% of the population were mature. A. thazard has a bigger first length maturity (34,89 cm FL) than A. rochei (27,16 cmFL). Lastly, the fecundity was counted from both species. The fecundity of A. thazard was 27.534-720.800 eggs and A. rochei was 24.727-220.000 eggs. According to the eggs size distribution, both A. thazard and A. rochei were partial spawner*".

169. The WPNT **THANKED** the authors for presenting the results of the study, and **NOTED** that the size of first length maturity for bullet tuna based on this research was 27.16 cm FL, and for frigate tuna was 34.89 cm FL. For frigate tuna, the Lm from this study was still within the expected range based on the literature[7] (i.e., 29-35 cm FL), however, the bullet tuna length at maturity was small compared with other studies[7] (i.e., ~35cm FL), indicating that further research is needed to investigate the reason for the differences.

170. The WPNT **NOTED** that there are no regulations for bullet tuna and frigate tuna size of landings, but there are regulations relating to gear selectivity such as mesh size.

171. The WPNT **NOTED** that the study is based on individuals of a small size for estimating fecundity and **ENCOURAGED** the authors to extend the size range of the samples and provide an estimate of maturity stage.

[7] www.iotc.org/science/status-summary-species-tuna-and-tuna-species-under-iotc-mandate-well-other-species-impacted-iotc

172. The WPNT **NOTED** that this research began last year for several small scale fishing gears, and is continued this year focused on purse seine fishing vessels and **REQUESTED** that the results are presented next year once the study is complete.

Sri Lanka neritic tuna fisheries

173. The WPNT **NOTED** paper IOTC–2016–WPNT06–20 which provided an analysis of catch rates of frigate tuna in Sri Lanka, including the following abstract provided by the authors:

"Tuna is the most important commercial fish group in the marine fishery in Sri Lanka. Within the tuna group, the subgroup of neritic tuna, comprising Auxis thazard (frigate tuna), Auxis rochei (bullet tuna), Euthynnis affinis (kawakawa) and Scomberomorus commerson (narrow- barred Spanish mackerel), is also an important contributor in the marine fish production. Among the four key species of neritic tuna found in Sri Lankan waters, frigate tuna is the dominant species presently contributing over 40% of the total neritic tuna production. Frigate tuna is normally caught as a by-catch in the tuna fishery. Ten year port sampling data of Sri Lanka (2005-2014) was used to explore the gear-vessel catch efficiency of frigate tuna in the tuna fishery of Sri Lanka. Four single gears (gillnet, pole & line, ringnet and trolling line) and three gear combinations (gillnet-handline, gillnet-ringnet, longline-gillnet) mainly contributed for catching frigate tuna. However, only 14% of tuna vessels operated during this period with above gears brought frigate tuna. Based on port sampling data, the estimated probability of presence of frigate tuna on a given fishing boat (p) greatly varies among above gears/ gear combinations. Accordingly, the highest probability (p=0.36) was reported for boats operated with ringnets whereas the lowest probability (p=0.08) was reported for boats operated with gillnet-longline gear combination". – See paper for full abstract.

174. The WPNT **NOTED** that the offshore vessels have the highest CPUE (measured in kg/boat/day).

175. The WPNT **NOTED** that the ringnets have a small net size, target fish associated with floating objects and that tuna is only caught as bycatch (around 30% of total catch) in these fisheries.

176. The WPNT **THANKED** the authors for the interesting study with 10 years of information and **REQUESTED** that the authors collaborate to develop standardised CPUE series from these data for input to future stock assessments.

177. The WPNT **NOTED** the seasonal variation in the use of ringnet gear while gillnet and longlines are operated continuously throughout the year.

178. The WPNT **NOTED** the issues with separating out the catches of multigear fisheries on landing resulting in effort data for combined gear types which presents challenges for CPUE standardisation.

179. **ACKNOWLEDGING** the efforts that DFAR and NARA are making to implement logbooks to record this detailed effort information, the WPNT **REQUESTED** that Sri Lanka submits this to the IOTC Secretariat as outlined in Resolution 15/02.

Tanzania neritic tuna fisheries

180. The WPNT **NOTED** paper IOTC–2016–WPNT06–22 which provided an analysis of the genetic stock structure and phylogenetic relationship of kawakawa *Euthynnus affinis* – Cantor (1849) in the northern coastal waters of Tanzania using mitochondrial DNA, including the following abstract provided by the authors:

"Accurate identification of population genetic subdivision is crucial when planning for management-conservation strategies of highly migratory marine fishes like Kawakawa Euthynnus affinis Cantor (1849). Although the species is of commercial importance in the Indo-Pacific Ocean, its management and conservation strategies are hindered partly by the lack of information on the population genetic structure. The present study investigated the genetic structure and phylogenetic relationship of the species at 500bp of the mitochondrial D-loop region for the 46 samples collected at two localities in Tanzania coastal waters. The study indicated higher overall haplotype (0.969) and nucleotide (0.108) diversities indicating stable habitats, absence of strong directional or stabilizing selection. However, the study indicated the presence of both sharing and locality specific haplotypes. Further analysis using hierarchical AMOVA tests indicated a single genetic structure of the Kawakawa (P>0.05) in the northern Tanzania coastal waters. Therefore, a null hypothesis that Kawakawa in the northern Tanzanian coastal waters are composed of single genetic stock can not be rejected. In addition, the study revealed the existence of a single evolutionary clade demonstrating that Kawakawa caught in the northern coastal waters of Tanzania share the same gene pool. Another study

covering large geographical areas by applying more than one genetic marker is recommended to precisely the genetic structure and possible sex biased migration in the Indian Ocean".

181. The WPNT **THANKED** the authors for providing this study on genetic diversity of kawakawa tuna, and **NOTED** the homogeneity of the stocks on northern Tanzania coastal waters, indicating that there is a single migratory stock between Dar es Salaam and Pangani.

182. The WPNT **NOTED** that this is an interesting study, not just in terms of implications for stock structure, but also in terms of the impacts of fishing explored and **ACKNOWLEDGED** that this study constitutes good progress in beginning to assess stock structure.

Review of the statistical data available for Indo-Pacific king mackerel

183. The WPNT **NOTED** paper IOTC–2016–WPNT06–07 which provided an overview of the standing of a range of information received by the IOTC Secretariat for Indo-Pacific king mackerel, in accordance with IOTC Resolution 15/02 *Mandatory statistical reporting requirements for IOTC Members and Cooperating non-Contracting Parties (CPC)*, for the period 1950–2014. A summary is provided at Appendix IVf.

184. The WPNT **NOTED** that only 30% of catches are reported by CPCs, with the remaining 70% estimated by the Secretariat, highlighting the high uncertainty associated with the catch data for this species which are predominantly caught by India and Indonesia.

185. The WPNT **NOTED** that neritic species are often caught together by the same fisheries, resulting in mixed species catches and issues with differentiating between some of the neritic species mean that catches are commonly reported as aggregates. In these situations, nominal catches of each species must be estimated from the best estimates available, which is usually the proportional representation of species caught by the fleet in previous years, or based on proportional catches by similar fleets which are used as proxies. As a result, the catch statistics are often correlated across species (Fig. 5), however, this has improved over time.

186. The WPNT **NOTED** that the catches of *S. guttatus* are therefore highly correlated with *S. commerson.* This should be taken into consideration when considering the reliability of the assessment results, given that these methods are highly dependent on the catch series trends.

187. The WPNT also **NOTED** that the nominal catch data in the IOTC database for all of the neritic tuna species assessed shows strong positive correlations among all species, particularly for historic years, whereas they are not so highly correlated in more recent years where more disaggregated data have been provided.

188. The WPNT **NOTED** that 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 very high correlations observed in early years are unlikely to reflect real trends but are more likely to be indicative of the estimation processes used and therefore indicative of the data quality.

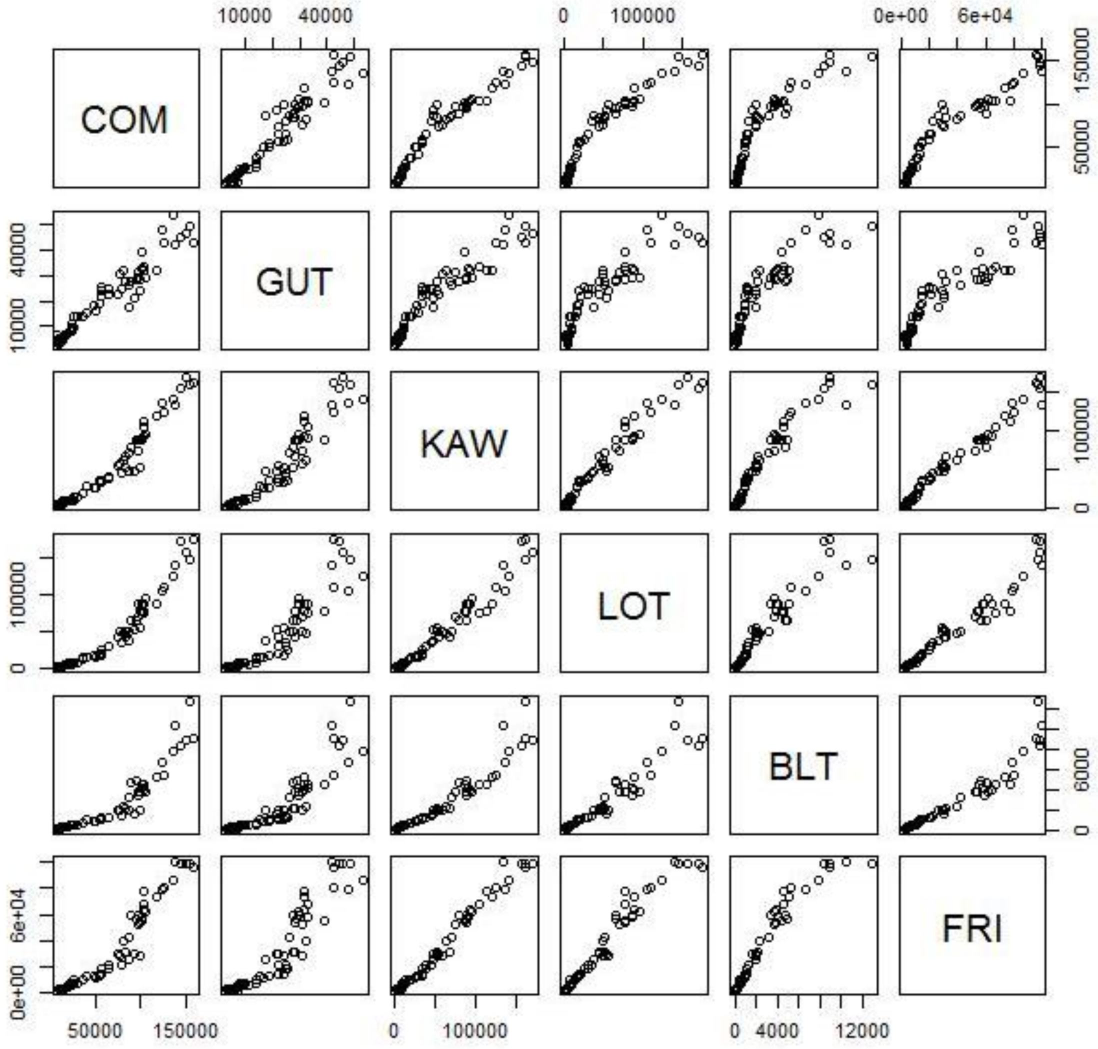

Fig. 5. Scatterplot matrix showing the correlations between catches of the six neritic tuna species. COM *(Scomberomorus commerson)*, GUT *(Scomberomorus guttatus*), KAW *(Euthynnus affinis)*, LOT *(Thunnus tonggol)*, BLT (*Auxis rochei*) and FRI (*Auxis thazard*) (1950-2014).

7.2 Data for input into stock assessments

No papers provided.

7.3 Stock assessment updates

Indian Ocean Indo-Pacific king mackerel assessment using catch-based methods

189. The WPNT **NOTED** paper IOTC-2016-WPNT06-21 which included a stock assessment for Indo-Pacific king mackerel using catch-based 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, a lack of standardised CPUE series and biological information. A number of assessment methods for the data-poor context of neritic tuna species have been used by IOTC in recent years, including a first stock assessment attempt for Indo-pacific king mackerel (Scomberomorus guttatus) in 2015 (IOTC-2015-WPNT05-24). In this paper, two data-poor methods are again applied to assess the status of Indian Ocean Indo-pacific king mackerel: (i) a Catch-MSY method, based on stock reduction analysis (Kimura and Tagart 1982; Walters et. al. 2006; Martell and Froese 2012) and a recently developed posterior-focussed Optimised Catch Only Method, OCOM (Zhou et al., 2013). Other neritic species investigated using the same methods in 2016 included: Indian Ocean Longtail tuna (Thunnus tonggol) (IOTC-2016-WPNT06-17) and Narrow-barred Spanish mackerel (Scomberomorus commerson) (IOTC-2016-WPNT06-18)".

Indian Ocean Indo-pacific king mackerel assessment using Catch-MSY

190. The WPNT **NOTED** the results from the Catch-MSY assessment method (Table 6, Fig. 6).

Table 6. Indo-Pacific king mackerel: Key management quantities from the Catch-MSY used in 2016. Geometric means and plausible ranges across all feasible model runs. n.a. = not available.

Management Quantity	Aggregate Indian Ocean
Most recent catch estimate (2014) t	49 060
Mean catch 2010–2014 t	44 930
MSY (plausible range) t	45 022 (35 873 - 54 034)
Data period used in assessment	1950 – 2014
F_{MSY} (plausible range)	0.45 (0.28 – 0.64)
B_{MSY} (plausible range) t	79 695 (47 867 – 109 011)
F_{2014}/F_{MSY} (plausible range)	1.02 (0.70 – 1.94)
B_{2014}/B_{MSY} (plausible range)	1.06 (0.60 – 1.40)
SB_{2014}/SB_{MSY} (80% CI)	n.a
B_{2014}/B_0 (plausible range)	0.53 (0.30 – 0.70)
SB_{2014}/SB_0 (80% CI)	n.a
$B_{2014}/B_{0,\ F=0}$ (80% CI)	n.a
$SB_{2014}/SB_{0,\ F=0}$ (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.

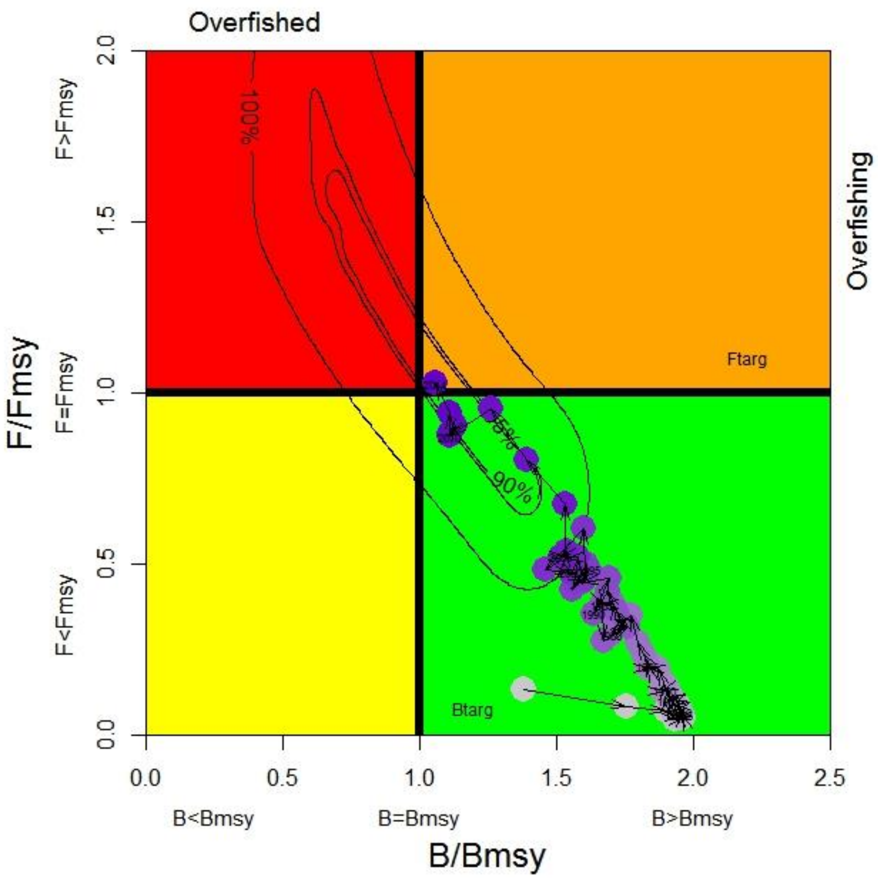

Fig. 6. Indo-Pacific king mackerel. Catch-MSY assessment for Indian Ocean *S. guttatus*. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

Indian Ocean Indo-Pacific king mackerel: assessment using OCOM

191. The WPNT **NOTED** the results from the OCOM assessment method (Table 7, Fig. 7).

Table 7. Indo-Pacific king mackerel: Key management quantities from the OCOM assessment in 2016 using a base case with maximum depletion of 70%. Geometric means and plausible ranges in brackets. n.a. = not available.

Management Quantity	Indian Ocean
Most recent catch estimate (2014) t	49 060
Mean catch 2010–2014 t	44 930
MSY (plausible range) t	45 632 (38 856 – 54 395)
Data period used in assessment	1950 - 2014
F_{MSY} (plausible range)	0.52 (0.40 – 0.69)
B_{MSY} (plausible range) t	65 951 (45 901 – 107 881)
F_{2014}/F_{MSY} (plausible range)	0.98 (0.85 – 1.14)
B_{2014}/B_{MSY} (plausible range)	1.10 (0.84 – 1.29)
SB_{2014}/SB_{MSY} (80% CI)	n.a.
B_{2014}/B_0 (plausible range)	0.55 (0.42 – 0.64)
SB_{2014}/SB_0 (80% CI)	n.a.
$B_{2014}/B_{0, F=0}$ (80% CI)	n.a.
$SB_{2014}/SB_{0, F=0}$ (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.

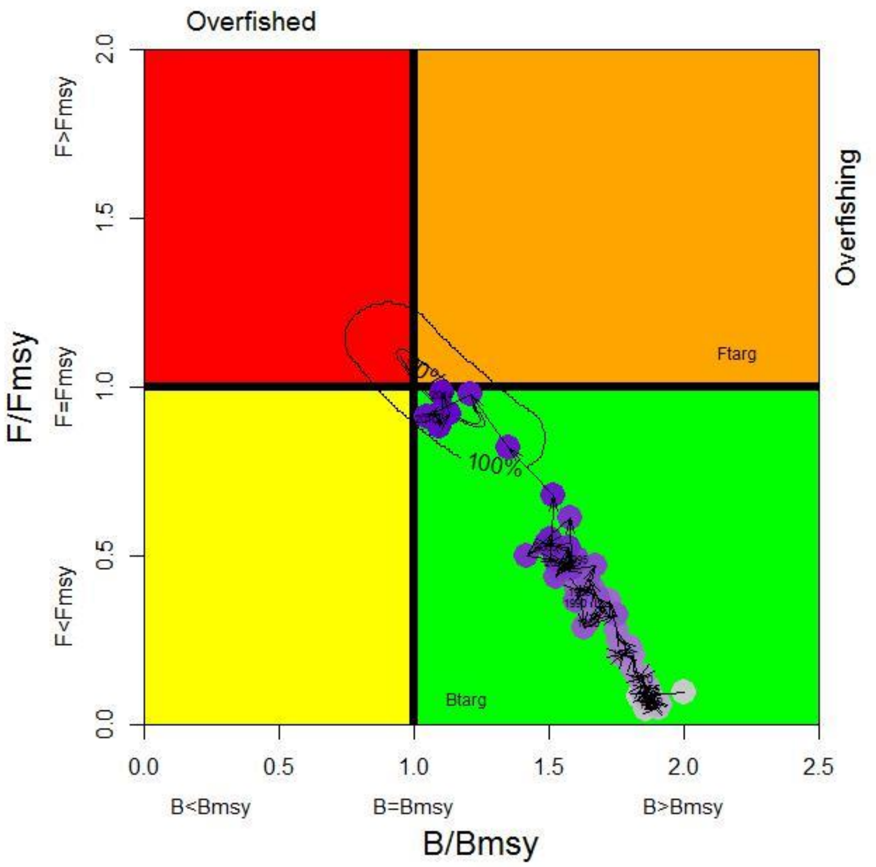

Fig. 7. Indo-Pacific king mackerel: *S. guttatus* OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

192. The WPNT **NOTED** the new, higher prior range used for r in the OCOM model, informed by paper IOTC–2015–WPNT05–DATA13 and the high variability and uncertainty of the growth estimates in the literature for Indo-pacific king mackerel in the Indian Ocean.

193. The WPNT **NOTED** that the catch data used have a higher uncertainty than other neritic tuna which should be acknowledged when presenting results.

194. The WPNT **NOTED** that both assessment models indicated that the biomass was above B_{MSY}, however the fishing mortality ratio was close to the management target with Catch-MSY results suggesting that it was just above F_{MSY} (1.02) and OCOM suggesting it was just below (0.98).

Selection of Stock Status indicators

195. The WPNT **NOTED** that the continuing uncertainty in catch estimation, coupled with the highly variable and uncertain estimates of growth parameters, warrants caution in assigning status for king mackerel. Therefore, the WPNT **AGREED** to be consistent with the approach taken in 2015 and assign an uncertain status.

196. **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.

197. The WPNT **NOTED** that a precautionary approach is needed for management and **AGREED** that as it is clear that the stock is at the very least approaching target reference points it would be advisable to be more precautionary now rather than exceed reference points further.

198. The WPNT **AGREED** that the management advice developed in 2015 for kawakawa, frigate tuna and bullet tuna shall be rolled over for 2016 with minor updates on species biology and fishery statistics.

7.5 Development of management advice for other neritic tuna species

199. Based on the poor quality of the data available and the uncertainty of the model results, the WPNT **AGREED** not to provide stock status advice for Indo-Pacific king mackerel (*Scomberomorus guttatus*) this year in the draft resource stock status summary – Appendix XII. The WPNT **REQUESTED** that the IOTC Secretariat update the draft stock status summary for Indo-Pacific king mackerel with the latest (2015) catch data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration.

200. The WPNT **ADOPTED** the management advice developed for kawakawa, bullet tuna 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 for bullet tuna and frigate tuna with the latest (2015) 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

8. PROGRAM OF WORK (RESEARCH AND PRIORITIES)

201. 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 (2017–2021)

202. The WPNT **NOTED** paper IOTC-2016-WPNT06-08 providing an outline of the programme of work for 2017 – 2021.

203. **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).

204. To assist participants in preparing for a CPUE standardisation workshop for neritic tunas, as per the Program of Work, Dr Zhou provided an overview of the main variables and statistical methods for CPUE standardisation. Dr Zhou also provided information on methods that are currently being explored for CPUE standardisation of Australian Eastern Billfish and Tuna longline fisheries, which are innovative in dealing with multiple species and gears, as well as spatial and temporal correlations.

205. The WPNT **ACKNOWLEDGED** that sufficient time series of data must be available for CPUE standardisation and that the success of the workshop would be dependent on participants sourcing and making available the required information in advance.

206. The WPNT **RECALLED** that CPCs participating at WPNT05 (notably Thailand, Malaysia, Indonesia, I.R. Iran and Pakistan) indicated that fine scale catch and effort datasets exist and **REQUESTED** that all CPCs make available the data for CPUE standardisation by end-December 2016.

207. The WPNT further **REQUESTED** the IOTC Secretariat also formally request support from key CPCs in accessing, compiling and analysing these data.

208. The WPNT **NOTED** that previous requests of the WPNT for CPCs submit historical data have often yielded little or no information and so **REQUESTED** that the participants of the current meeting assist the IOTC Secretariat in making contact with the relevant individuals to obtain the data based on a template of data requirements developed by Dr Zhou and the IOTC Secretariat. CPCs are requested to indicate whether the data listed in the template exist or not within one month after the template is received.

209. The WPNT **WELCOMED** the upcoming data mining, support missions and capacity building workshops planned by the IOTC Secretariat data section to address the issues identified during the meeting.

210. The WPNT **RECOMMENDED** that the SC request that the Commission further increases the IOTC Capacity Building budget line so that capacity building training on improved data collection and analysis can be carried out in 2017.

211. The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2017–2021), as provided at Appendix VI.

9. OTHER BUSINESS

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

212. The WPNT **COMMENDED** the newly appointed Chair and Vice-Chairperson, Dr Farhad Kaymaram and Dr Mathius Igulu on their roles in conducting and facilitating the meeting.

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

213. 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 2017, by an Invited Expert:

1) Expertise: data poor assessment approaches (i.e. catch only methods, Bayesian approaches); stock structure/connectivity; including from regions other than the Indian Ocean;
2) Meta-analysis of Indian Ocean biological data.

214. The WPNT **NOTED** with thanks the outstanding contributions of the invited expert for the meeting, Dr Shijie Zhou (CSIRO – Australia). Dr Zhou has contributed to the WPNT on a voluntary basis for the past five years as the Invited Expert and his expertise has been greatly appreciated and contributed substantially to the stock status determination of the neritic tuna species under the IOTC mandate. It was agreed that his expertise in data poor approaches in determining stock status should be formalised via a consultancy contract for 2017.

215. The WPNT **AGREED** that the success of this workshop and a meta-analysis will be fully dependent on the cooperation of CPCs in the provision of data. Therefore the WPNT **AGREED** that this would be provided prior to a workshop as a prerequisite to it taking place .

9.3 Date and place of the 7th Working Party on Neritic Tunas

216. The WPNT **NOTED** the expression of interest from the Maldives to host the 7th Session of the WPNT. The IOTC Secretariat shall liaise with Maldives to confirm the expression of interest. Given that the dates proposed by the SC (3-6 March 2017) leave little time for the activities in the program of work to be carried out, the WPNT **RECOMMENDED** the SC consider pushing the dates back to July 2017.

217. The WPNT **REQUESTED** CPCs consider hosting the 8th Session of the WPNT, to be discussed further at the WPNT07.

Meeting participation fund (MPF)

218. 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 WPNT07 as a high priority meeting for MPF.

219. 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.

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
Total		188	149	68	60

9.4 Review of the draft, and adoption of the Report of the 6th Working Party on Neritic Tunas

220. The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT06, 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 two species assigned a stock status in 2016 (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

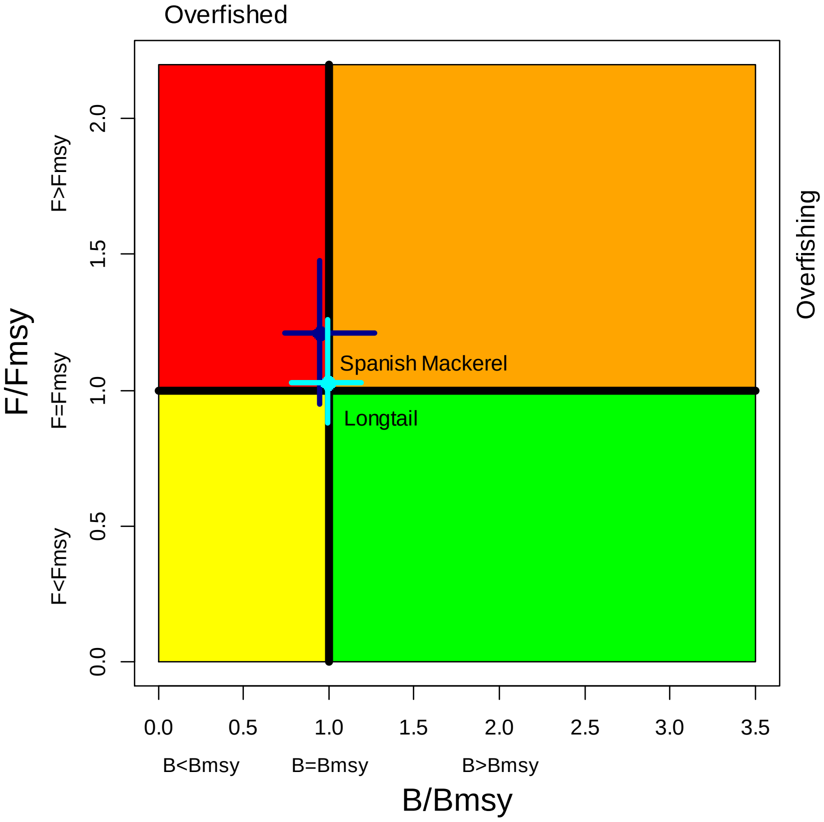

Fig. 8. Combined Kobe plot for longtail tuna and narrow-barred Spanish mackerel, showing the estimates of stock size (B) and current fishing mortality (F) in 2014 in relation to optimal spawning stock size and optimal fishing mortality using the OCOM modelling approach. Cross bars illustrate the range of uncertainty from the model runs.

221. Based on these stock status summaries (Fig. 8) and ongoing increasing catch and effort, the WPNT **RECOMMENDED** that current catch levels are not increased further by constraining catch and/or effort to no more than 2014 levels.

222. The report of the 6th Session of the Working Party on Neritic Tunas (IOTC–2016–WPNT06–R) was **ADOPTED** on the 24 June 2016.

APPENDIX I
LIST OF PARTICIPANTS

Chairperson
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Vice-Chairperson
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APPENDIX II
AGENDA FOR THE 6TH WORKING PARTY ON NERITIC TUNAS

Date: 21–24 June 2016
Location: Mahé, Seychelles
Venue: Coral Strand Hotel, Beau Vallon
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 18th Session of the Scientific Committee (IOTC Secretariat)
   - 3.2 Outcomes of the 20th 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 WPNT05 (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 2017–2021 (Chair)
8.2 Development of priorities for an Invited Expert at the next WPNT meeting

9. OTHER BUSINESS

9.2 Date and place of the 7th and 8th Working Party on Neritic Tunas (Chair)
9.3 Review of the draft, and adoption of the Report of the 6th Working Party on Neritic Tunas (Chair)

APPENDIX III
LIST OF DOCUMENTS

Document	Title	Availability
IOTC–2016–WPNT06–01a	Draft: Agenda of the 6th Working Party on Neritic Tunas	✓ (24 May 2016)
IOTC–2016–WPNT06–01b	Annotated agenda of the 6th Working Party on Neritic Tunas	✓ (24 May 2016)
IOTC–2016–WPNT06–02	List of documents of the 6th Working Party on Neritic Tunas	✓ (24 May 2016)
IOTC–2016–WPNT06–03	Outcomes of the 18th Session of the Scientific Committee (IOTC Secretariat)	✓ (24 May 2016)
IOTC–2016–WPNT06–04	Outcomes of the 20th Session of the Commission (IOTC Secretariat)	✓ (6 June 2016)
IOTC–2016–WPNT06–05	Review of current Conservation and Management Measures relating to neritic tuna species (IOTC Secretariat)	✓ (6 June 2016)
IOTC–2016–WPNT06–06	Progress made on the recommendations and requests of WPNT05 and SC18 (IOTC Secretariat)	✓ (3 June 2016)
IOTC-2016-WPNT06-07	Review of the statistical data available for the neritic tuna species (IOTC Secretariat)	✓ (6 June 2016)
IOTC–2016–WPNT06–08	Revision of the WPNT Program of Work (2017–2021) (IOTC Secretariat)	✓ (3 June 2016)
IOTC–2016–WPNT06–09	Improving the core IOTC data management processes (IOTC Secretariat)	✓ (6 June 2016)
IOTC–2016–WPNT06–10	Overview of the pilot sampling project of artisanal fisheries in North and West Sumatra: implications on IOTC catch estimates of neritic tunas in Indonesia. (IOTC Secretariat)	✓ (20 June 2016)
IOTC–2016–WPNT06–11	Review of neritic tuna fishery in the Maldives (M. Ahusan)	✓ (21 June 2016)
IOTC–2016–WPNT06–12	Assessment of social consideration on neritic tuna in Iran fishery management (R. Naderi)	✓ (6 June 2016)
IOTC–2016–WPNT06–13	Method of data collection in the Andaman Sea (T. Jaiyen and P. Nootmorn)	✓ (20 June 2016)
IOTC–2016–WPNT06–14	Towards improvement of neritic tuna data in artisanal fishery (I. Wafula, S. Ndegwa)	✓ (7 June 2016)
IOTC–2016–WPNT06–15	Fishery, biology and population characteristics of neritic tuna in the West Coast Of Peninsular Malaysia (S. Jamon, E. M. Faizal and S. Basir)	✓ (14 June 2016)
IOTC–2016–WPNT06–16	A Productivity Susceptibility Analysis for neritic tuna species (J.Robinson)	✓ (6 June 2016)
IOTC–2016–WPNT06–17	Assessment of Indian Ocean longtail tuna (*Thunnus tonggol*) using data poor catch-based methods (IOTC Secretariat)	✓ (6 June 2016)
IOTC–2016–WPNT06–18	Assessment of Indian Ocean narrow-barred Spanish mackerel (*Scomberomorus commerson*) using data poor catch-based methods (IOTC Secretariat)	✓ (6 June 2016)
IOTC–2016–WPNT06–19	Size distribution and reproductive aspects of *Auxis* spp. From west coast Sumatera, Eastern Indian Ocean (A.R.P.Prawira et al.)	✓ (20 June 2016)
IOTC–2016–WPNT06–20	Exploring gear-vessel catch efficiency of frigate tuna (Auxis thazard) in tuna fishery in Sri Lanka (S.S.K. Haputhantri)	✓ (13 June 2016)
IOTC–2016–WPNT06–21	Assessment of Indian Ocean Indo-Pacific king mackerel (*Scomberomorus guttatus*) using data poor catch-based methods (IOTC Secretariat)	✓ (6 June 2016)
IOTC–2016–WPNT06–22	Genetic Stock Structure and Phylogenetic Relationship of Kawakawa *Euthynnus affinis* – Cantor (1849) in the Northern Coastal Waters of Tanzania Using Mitochondrial DNA Control Region (Johnson M.G, Mgaya Y.D and Shaghude Y.W)	✓ (20 June 2016)
IOTC–2016–WPNT06–23	A review of artisanal tuna fisheries statistical data collection systems in Coastal East Africa (Igulu M.)	Pending
IOTC–2016–WPNT06–24	Update on the neritic tuna fisheries of Pakistan (Khan, M.M., Nawaz, R. and Ayub, S.)	✓ (6 June 2016)
IOTC–2016–WPNT06–INF01	BOBLME-DGCF-IOTC-OFCF Pilot Project: Collection of Data from Tuna Fisheries in the Provinces of West Sumatra and North Sumatra in Indonesia (K.Sakonju)	✓ (20 June 2016)
IOTC–2016–WPNT06–INF02	A comparison of PSA and SAFE methods (S.Zhou)	✓ (21 June 2016)

Document	Title	Availability
IOTC–2016–WPNT06–DATA01	IOTC Neritic tuna datasets available	✓ (19 May 2016)
IOTC–2016–WPNT06–DATA02	IOTC Species data catalogues – availability of data	✓ (19 May 2016)
IOTC–2016–WPNT06–DATA03	Nominal catches per Fleet, Year, Gear, IOTC Area and species	✓ (17 May 2016)
IOTC–2016–WPNT06–DATA04	Catch and effort data - vessels using drifting longlines	✓ (17 May 2016)
IOTC–2016–WPNT06–DATA05	Catch and effort data - vessels using pole and lines or purse seines	✓ (17 May 2016)
IOTC–2016–WPNT06–DATA06	Catch and effort data - vessels using other gears (e.g., gillnets, lines and unclassified gears)	✓ (17 May 2016)
IOTC–2016–WPNT06–DATA07	Catch and effort data - all gears	✓ (17 May 2016)
IOTC–2016–WPNT06–DATA08	Catch and effort – reference file	✓ (17 May 2016)
IOTC–2016–WPNT06–DATA09	Size frequency data - neritic tunas	✓ (17 May 2016)
IOTC–2016–WPNT06–DATA10	Size frequency – reference file	✓ (17 May 2016)
IOTC–2016–WPNT06–DATA11	Equations used to convert from fork length to round weight for neritic tuna species	✓ (17 May 2016)
IOTC–2016–WPNT06–DATA12	Population parameters for Indo-Pacific king mackerel	✓ (25 May 2016)
IOTC–2016–WPNT06–DATA13	Population parameters for Frigate tuna	✓ (25 May 2016)
IOTC–2016–WPNT06–DATA14	Population parameters for Bullet tuna	✓ (25 May 2016)

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

Extract from IOTC–2016–WPNT06–07

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, India and Indonesia (**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 2015.

Bullet tuna – estimation of catches: data related issues

Retained catches for bullet tuna were derived from incomplete information, and are therefore uncertain[8] (**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.

It is for the above reasons that 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.

[8] 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 1950–2014 (in metric tonnes).

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Purse seine	-	-	28	278	552	655	625	650	581	908	1,055	1,372	635	549	513	535
Gillnet	41	153	296	531	1,222	1,741	1,631	1,872	1,692	2,236	2,587	3,347	2,692	2,830	2,724	2,561
Line	113	193	325	393	780	1,190	1,052	1,165	1,141	1,858	2,182	2,903	1,162	1,078	1,054	1,138
Other	5	13	44	242	755	1,322	1,188	1,465	1,908	1,638	2,022	2,748	3,905	4,503	4,597	4,118
Total	**159**	**360**	**693**	**1,444**	**3,309**	**4,907**	**4,496**	**5,152**	**5,323**	**6,640**	**7,847**	**10,370**	**8,394**	**8,960**	**8,888**	**8,352**

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.

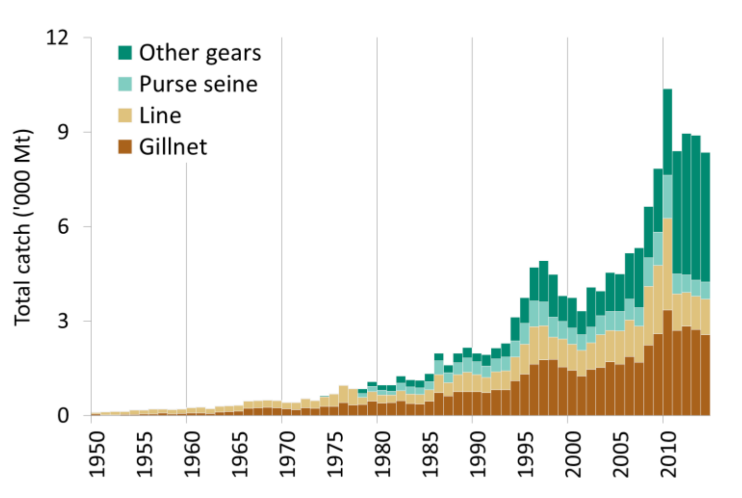

Fig.19. Bullet tuna: Annual catches by gear recorded in the IOTC Database (1950–2014).

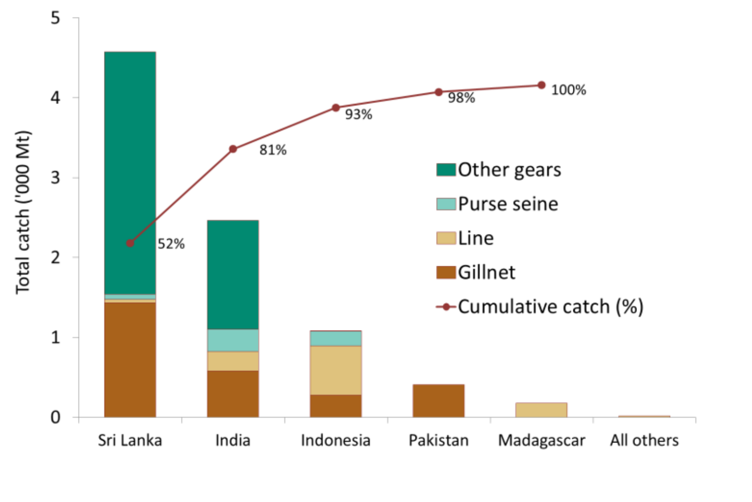

Fig.20. Bullet tuna: Average catches in the Indian Ocean over the period 2012–14, by country[9].

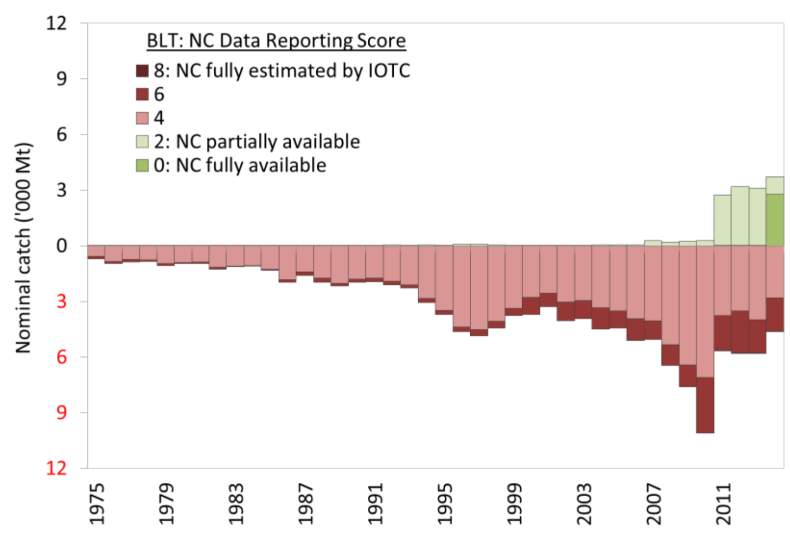

Fig.21. Bullet tuna: nominal catch; uncertainty of annual catch estimates (1975–2014).

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). Data as of May 2016.

[9] 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 2012-2014.

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**).

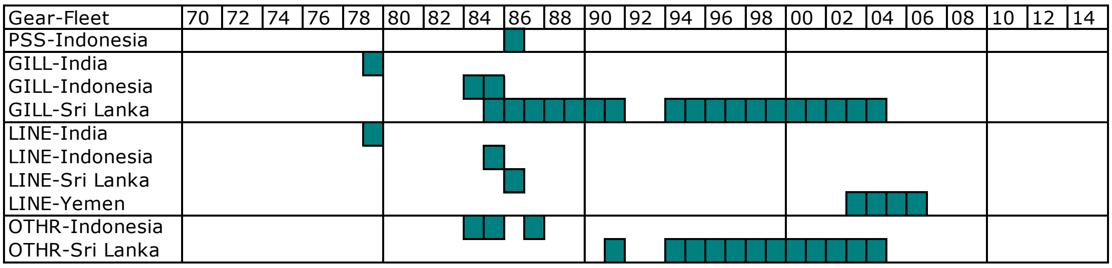

Fig.22. Bullet tuna: Availability of catches and effort series, by fishery and year (1970–2014)[10]. Note that no catches and effort are available at all for 1950–78.

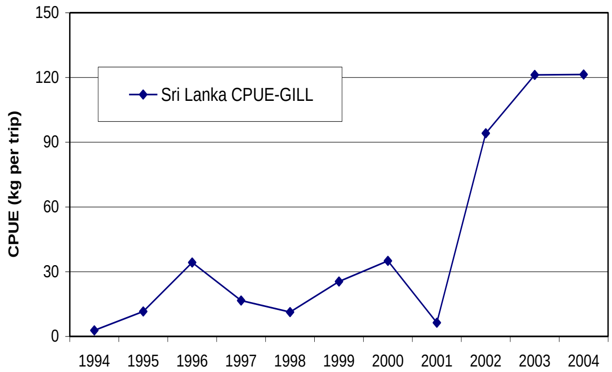

Fig.23. Bullet tuna: Nominal CPUE series for the gillnet fishery of Sri Lanka derived from the available catches and effort data (1994–2004).

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.

[10] 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

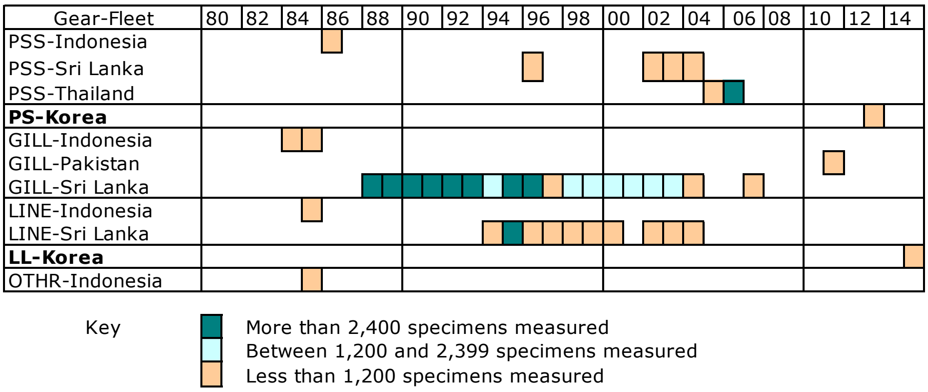

Fig. 24. Bullet tuna: Availability of length frequency data, by fishery and year (1980–2014)[11]. Note that no length frequency data are available at all for 1950–83.

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*

[11] 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–2016–WPNT06–07

Fisheries and main catch trends

- Main fisheries: 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. Since 2006 catches have increased, rising to the highest levels recorded at nearly 100,000 t in 2010 and 2011.
- Discard levels**:** are moderate for industrial purse seine fisheries. The EU recently 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 2014.

Frigate tuna: estimation of catches – data related issues

Retained catches for frigate tuna were derived from incomplete information, and are therefore uncertain[12] (**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 Mynamar, 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 misidentification, with all catches assigned to the 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, its catches are seldom recorded in the logbooks, nor can they be monitored in port. The EU recently reported catch levels of frigate tuna for its purse seine fleet, for 2003–07, estimated using observer data.

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[12] 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 1950–2012 (in metric tonnes). Data as of May 2016.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Purse seine	-	15	824	4,664	7,550	10,021	11,384	11,320	10,337	9,501	9,663	12,044	11,636	10,362	10,400	11,039
Gillnet	485	1,239	2,837	6,948	14,519	20,190	21,189	22,190	23,322	24,082	23,750	30,908	30,361	31,026	30,117	37,673
Line	1,265	2,408	4,419	7,432	13,753	27,150	29,987	27,805	31,820	30,806	34,923	38,209	37,687	36,689	39,416	36,642
Other	1,441	2,007	2,349	3,683	9,276	13,670	15,253	12,715	15,382	15,193	18,112	18,550	18,934	17,649	18,766	17,231
Total	**3,191**	**5,670**	**10,428**	**22,728**	**45,098**	**71,031**	**77,812**	**74,030**	**80,862**	**79,582**	**86,448**	**99,710**	**98,618**	**95,725**	**98,699**	**102,586**

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.

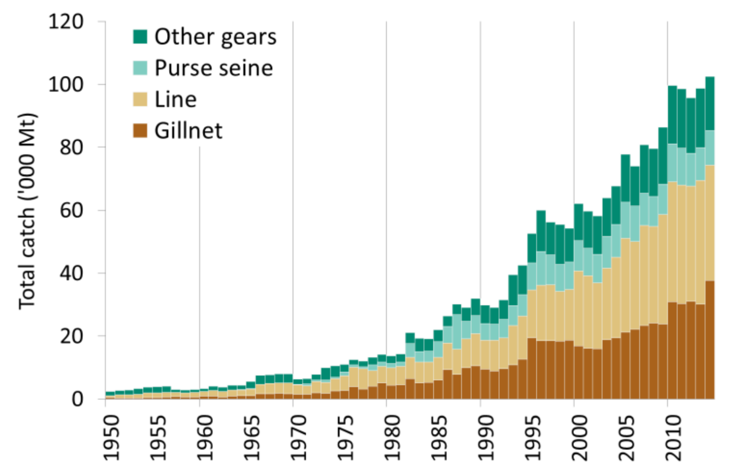


Fig.12. Frigate tuna: Annual catches by gear recorded in the IOTC Database (1950–2014).

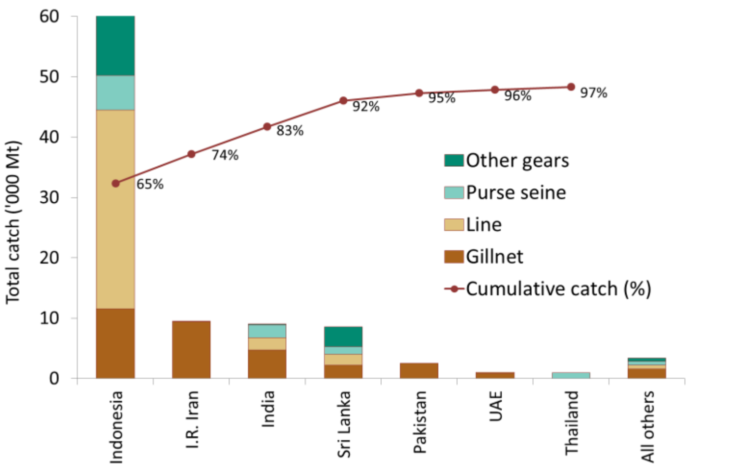


Fig.13. Frigate tuna: Average catches in the Indian Ocean over the period 2012–14, by country[13].

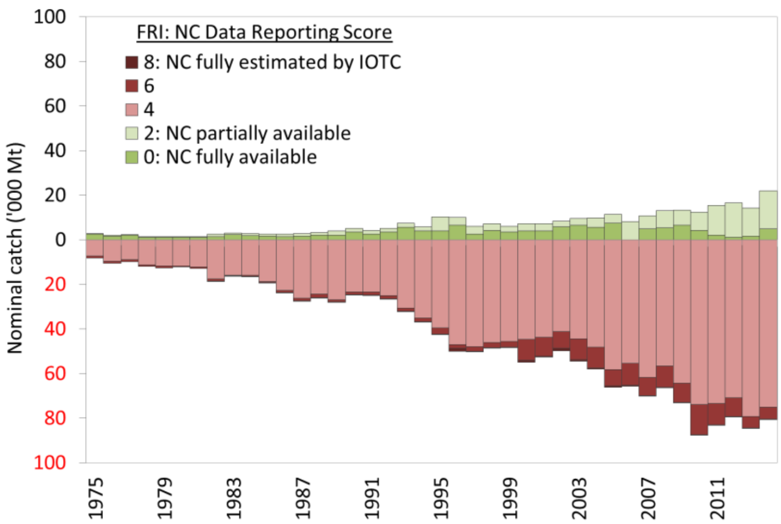


Fig.14. Frigate tuna: nominal catch; uncertainty of annual catch estimates (1975–2014).

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). Data as of May 2016.

[13] 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 2012-2014.

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 (i.e., 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 dramatic changes in the CPUE between consecutive years.

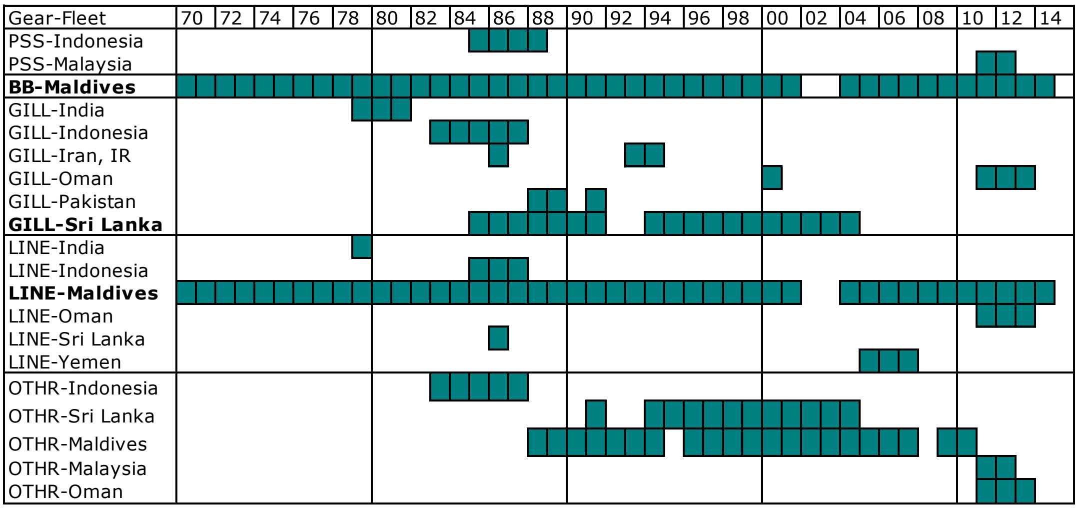


Fig.15: Frigate tuna: Availability of catches and effort series, by selected fishery and year (1970–2014)[14]. Note that no catch-and-effort data are available for 1950–69.

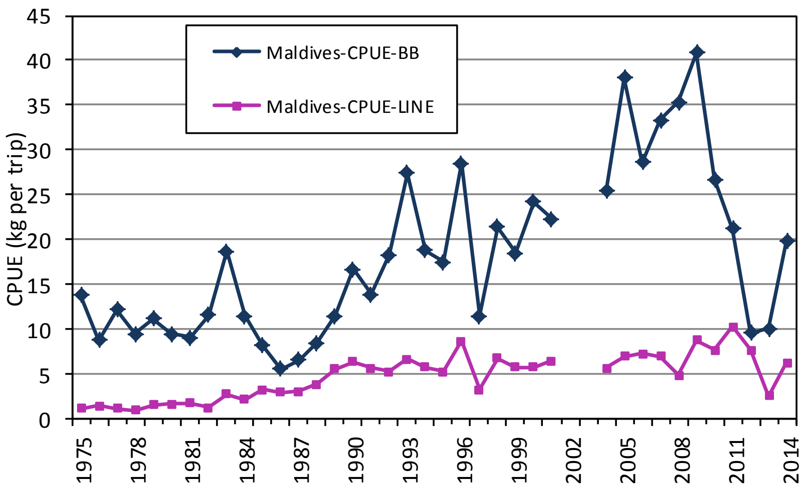


Fig.16. *Frigate tuna: Nominal CPUE series for the baitboat (BB using mechanized boats) and line (LINE, including handlines and trolling using mechanized boats) fisheries of Maldives derived from the available catches and effort data (1975–2014). Data since 2014 has been reported as fishing days (rather than as fishing trips for data up to 2014).*

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

- 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

[14] 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

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 Maldives (pole-and-line).
  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.

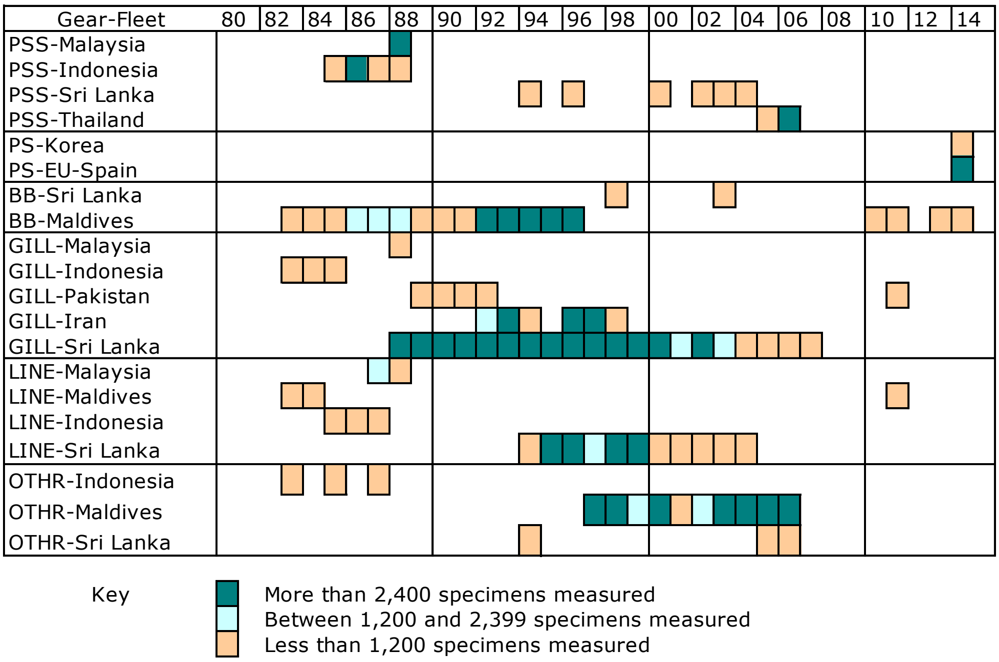
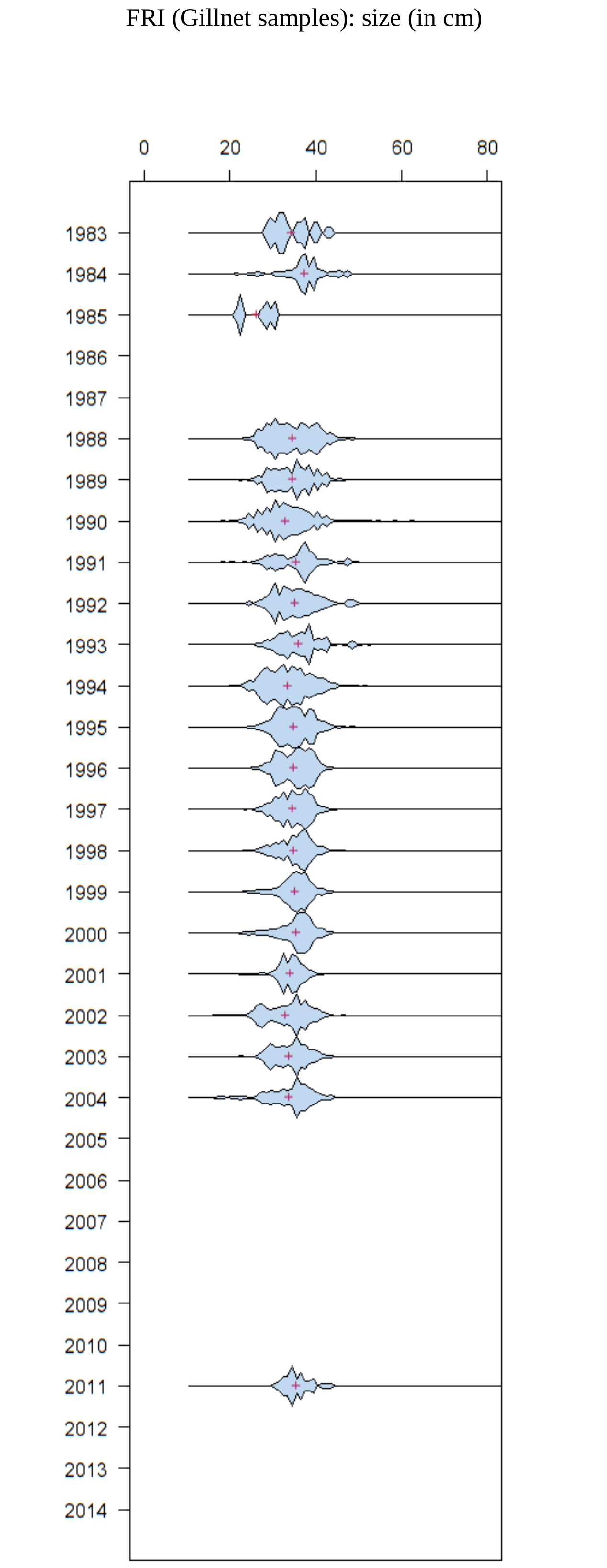


Fig.17. Frigate tuna: Availability of length frequency data, by fishery and year (1980–2014)[15]. Note that no length frequency data are available at all for 1950–82.

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 WeightA*	*RND=a*L^b*	*a= 0.00001700 b= 3.0*		*Min:20 Max:45*

[15] 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



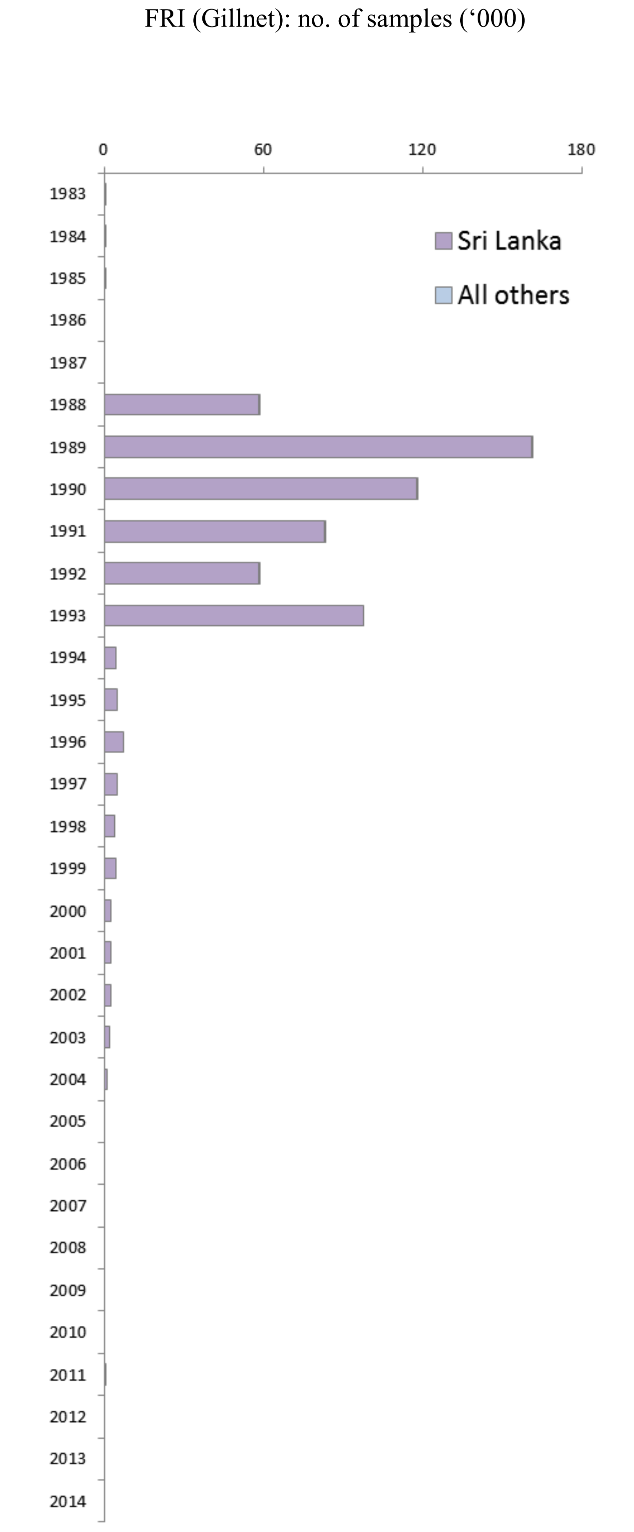


Fig.18a-b. Left: Frigate tuna (gillnet fisheries): Length frequency distributions (by 1cm length class) derived from data available at the IOTC Secretariat, 1983-2014.

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–2016–WPNT06–07

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 and 156,000 t in 2012, the highest catches ever recorded for this species.
- Discard levels: are moderate for industrial purse seine fisheries. The EU recently 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 2015.

Kawakawa tuna – estimation of catches: data related issues

Retained catches for kawakawa were derived from incomplete information, and are therefore uncertain[16] (**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 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 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.
- 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 kawakawa for its purse seine fleet, for 2003–07, estimated using observer data.

[16] 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 1950–2014 (in metric tonnes). Data as of May 2016.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Purse seine	107	385	2,616	12,070	21,396	28,613	32,393	34,785	32,586	32,441	37,051	35,064	44,892	42,700	42,961	39,242
Gillnet	2,568	4,486	9,691	17,958	30,709	53,547	50,443	55,651	59,138	70,971	69,772	64,713	74,884	75,600	86,417	84,862
Line	1,714	3,263	6,642	9,865	15,673	19,874	21,154	20,409	22,299	22,524	23,804	23,356	25,710	32,656	29,105	25,934
Other	295	719	1,357	2,690	5,127	7,819	8,383	8,027	9,629	9,015	10,129	9,994	10,007	9,976	10,255	9,226
Total	**4,685**	**8,853**	**20,306**	**42,583**	**72,905**	**109,853**	**112,374**	**118,871**	**123,652**	**134,952**	**140,756**	**133,127**	**155,492**	**160,932**	**168,737**	**159,264**

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.

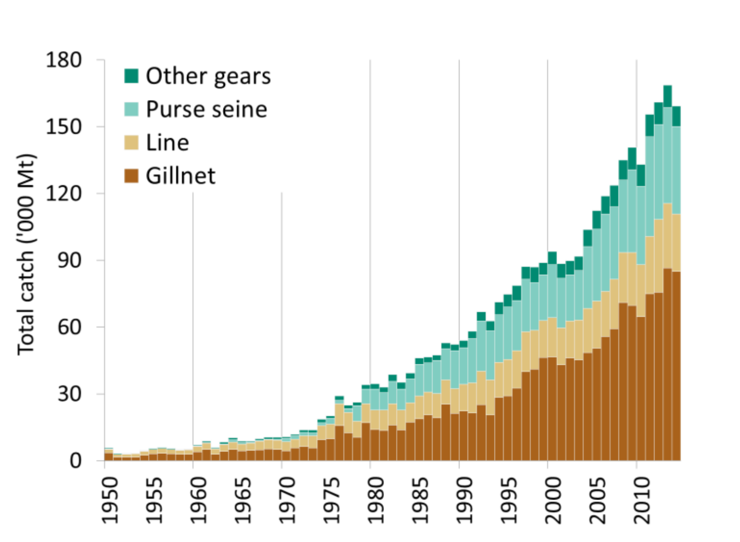


Fig.25. Kawakawa: Annual catches by gear recorded in the IOTC Database (1950–2014).

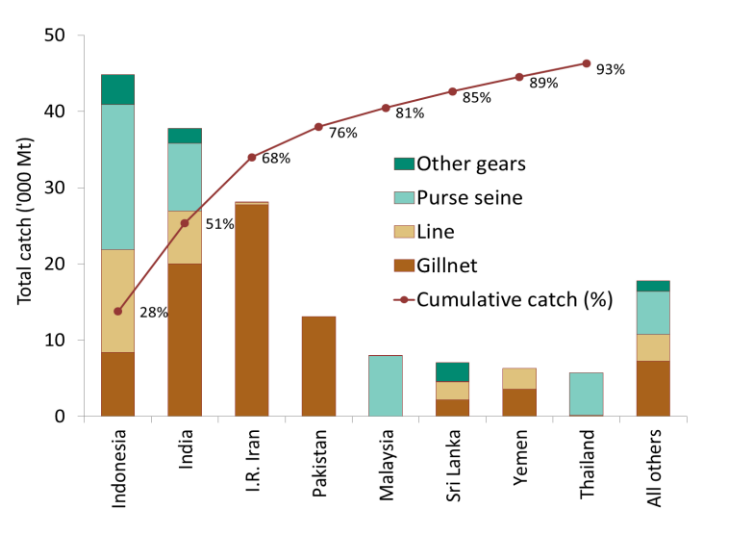


Fig.26. Kawakawa: Average catches in the Indian Ocean over the period 2012–14, by country[17].

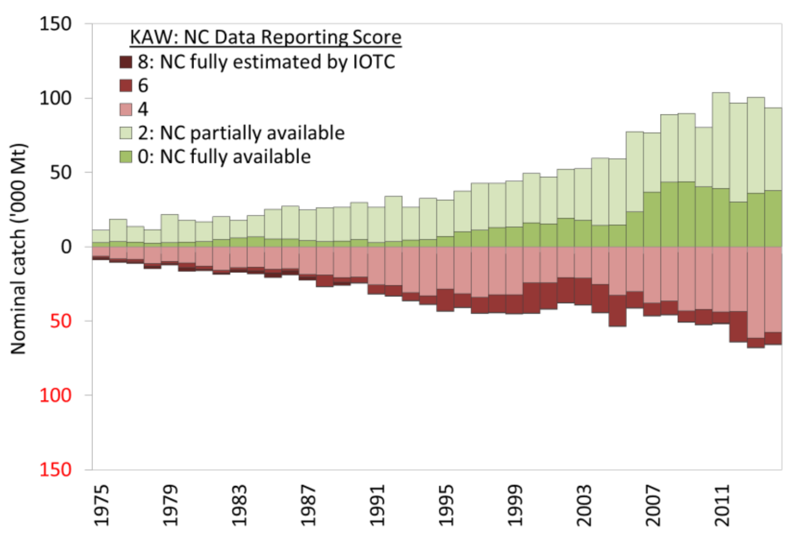


Fig.27. Kawakawa: nominal catch; uncertainty of annual catch estimates (1975–2014).

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). Data as of May 2016.

[17] 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 2012-2014.

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.

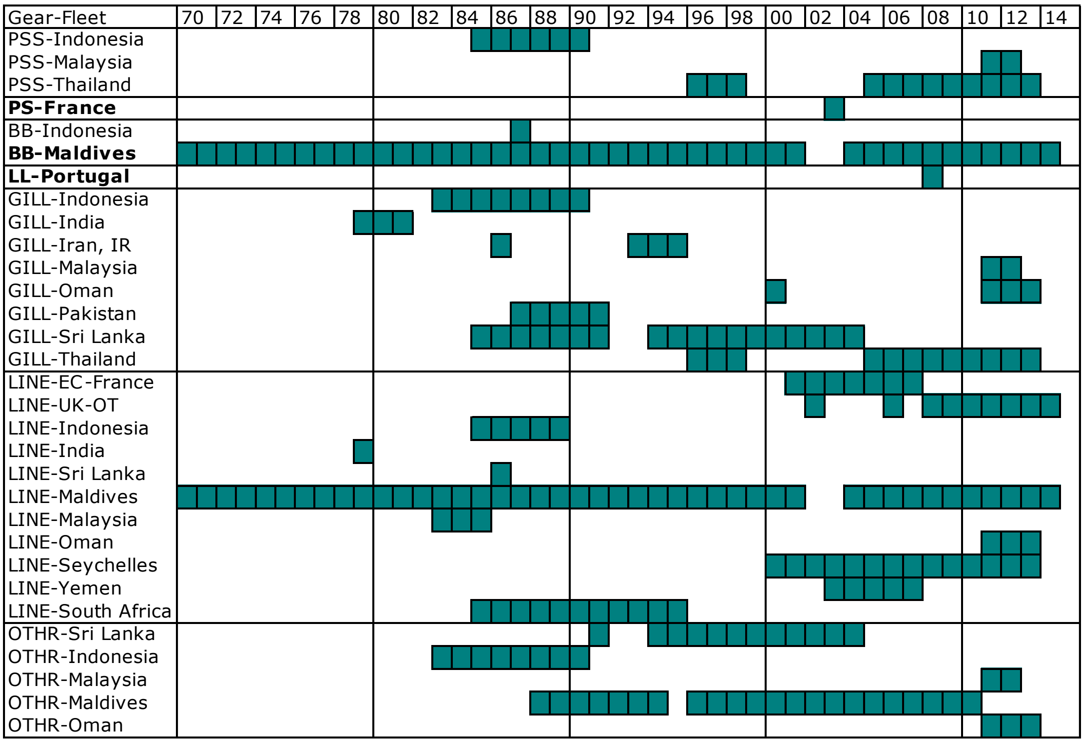


Fig. 28. Kawakawa: Availability of catches and effort series, by fishery and year (1970-2014)[18]. Note that no catches and effort are available at all for 1950–69.

[18] 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

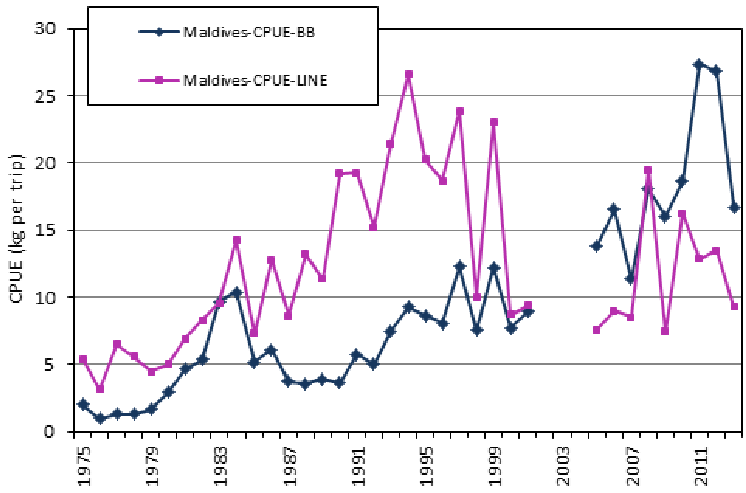
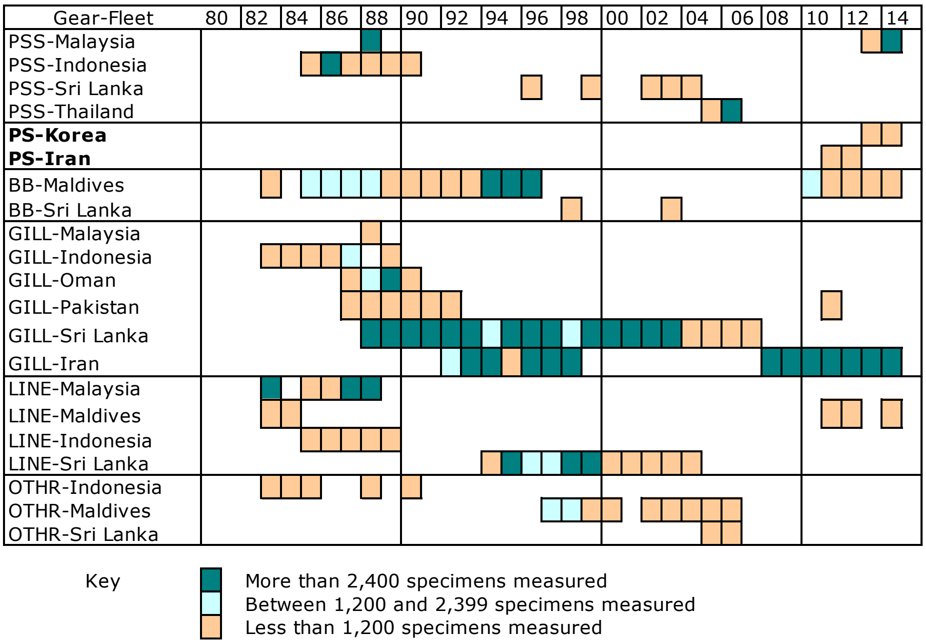


Fig. 29. Kawakawa: Nominal CPUE series for baitboat (BB) and troll line (TROL) fisheries of Maldives (1975–2014) derived from the available catch-and-effort data.

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 small size (15–30 cm) while the 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**. No data are 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.

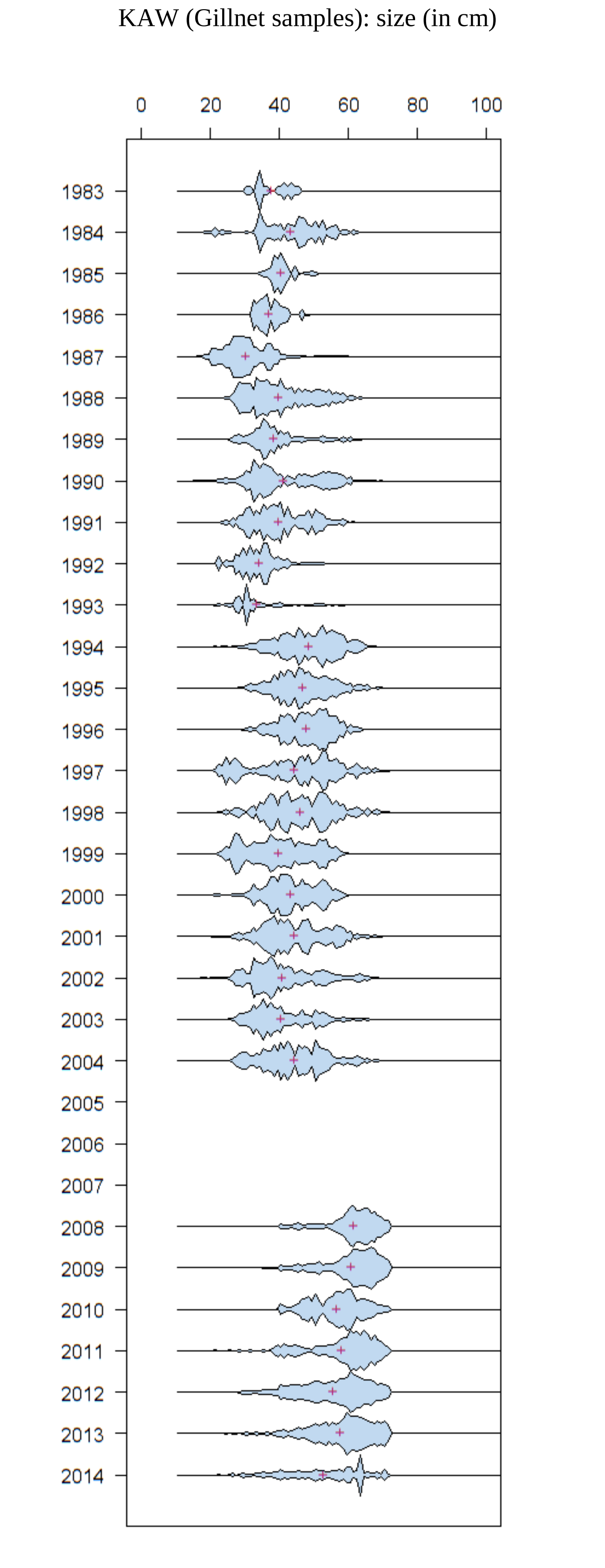


- **Fig.30.** Kawakawa: Availability of length frequency data, by fishery and year (1980-2014)[19]. Note that no length frequency data are available for 1950–82.

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 WeightA*	*RND=a*L^b*	*a= 0.0000260 b= 2.9*		*Min: 20 Max: 65*

[19] 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



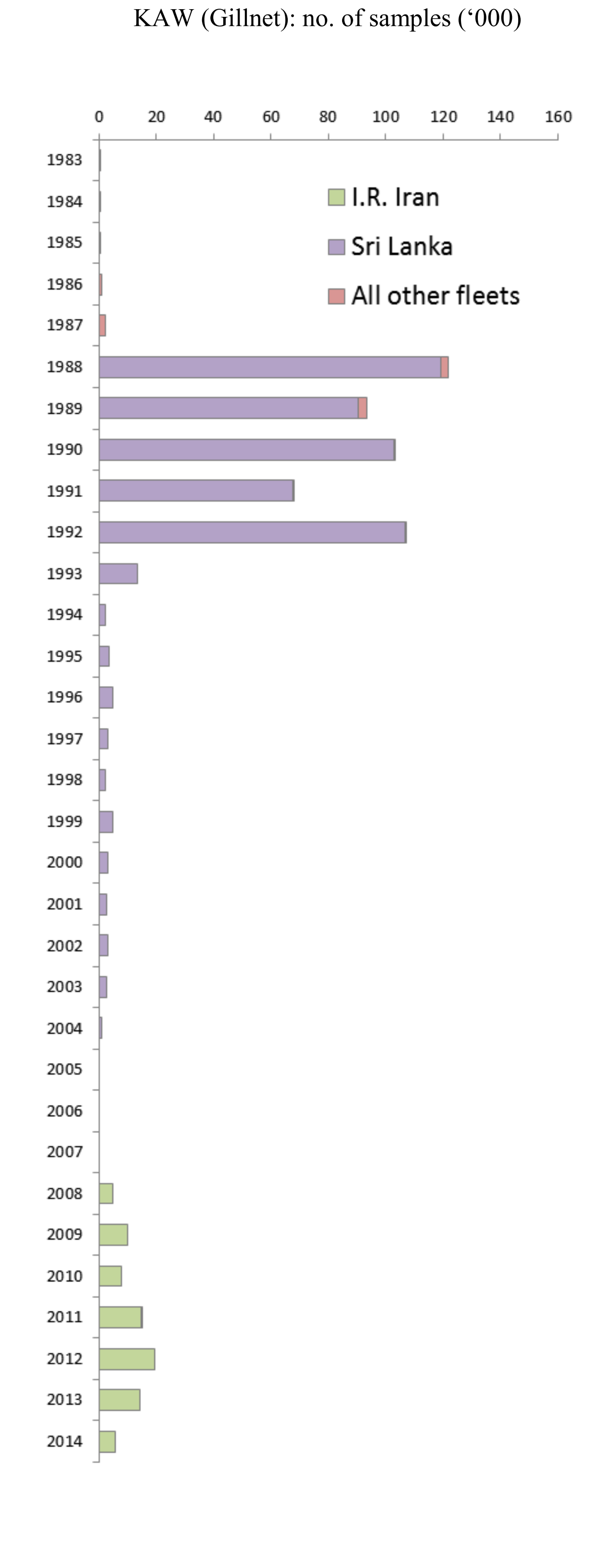


Fig.31a-b. Left: Kawakawa (gillnet fisheries): Length frequency distributions (by 1cm length class) derived from data available at the IOTC Secretariat, 1983-2014.

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–2016–WPNT06–07

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):
  Nearly half of catches of longtail in the Indian Ocean are accounted for by I.R. Iran (gillnet), followed by Indonesia (gillnet, trolling), Malaysia (coastal purse seine) and Pakistan (gillnet) (**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, most likely 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 2015.

Longtail tuna: estimation of catches – data related issues

Retained catches for longtail tuna were derived from incomplete information, and are therefore uncertain[20] (**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 Mynamar, catches are taken from FAO and SEAFDEC (various years).
- Other artisanal fisheries: The IOTC Secretariat had to estimate catches of longtail tuna for the artisanal fisheries of Yemen (no data reported to the IOTC Secretariat) and until recently Malaysia (with catches of the main neritic tunas aggregated and reported as longtail).

[20] 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 2. Longtail tuna: latest scientific estimates of the catches of longtail tuna by type of fishery for the period 1950–2014 (in metric tonnes). Data as of May 2016.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Purse seine	55	204	1,012	4,863	10,933	17,719	12,388	16,128	23,838	18,885	20,649	16,531	26,062	25,218	17,687	11,416
Gillnet	2,969	6,227	10,026	25,839	41,648	63,485	52,092	59,802	68,398	69,708	87,159	105,094	121,672	115,278	113,473	107,711
Line	549	808	1,564	4,349	5,016	9,502	10,268	9,514	11,929	11,206	12,494	12,977	15,295	25,891	20,707	22,709
Other	0	0	125	1,090	1,992	3,732	3,751	3,638	5,686	5,460	5,300	6,513	8,467	9,073	5,789	4,915
Total	**3,573**	**7,239**	**12,727**	**36,141**	**59,590**	**94,437**	**78,498**	**89,081**	**109,851**	**105,260**	**125,601**	**141,115**	**171,496**	**175,459**	**157,656**	**146,751**

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.

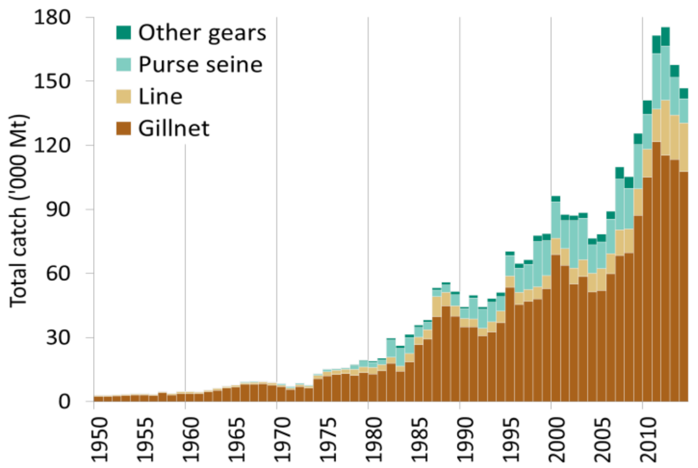


Fig.5. Longtail tuna: Annual catches by gear recorded in the IOTC Database (1950–2014).

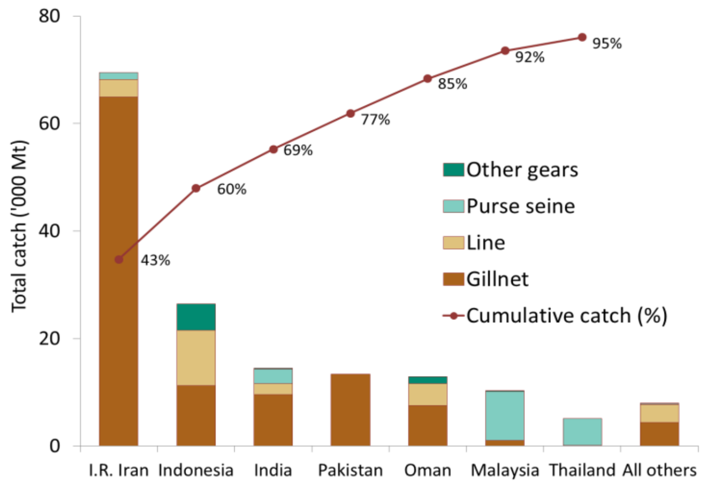


Fig.6. Longtail tuna: Average catches in the Indian Ocean over the period 2012–14, by country[21].

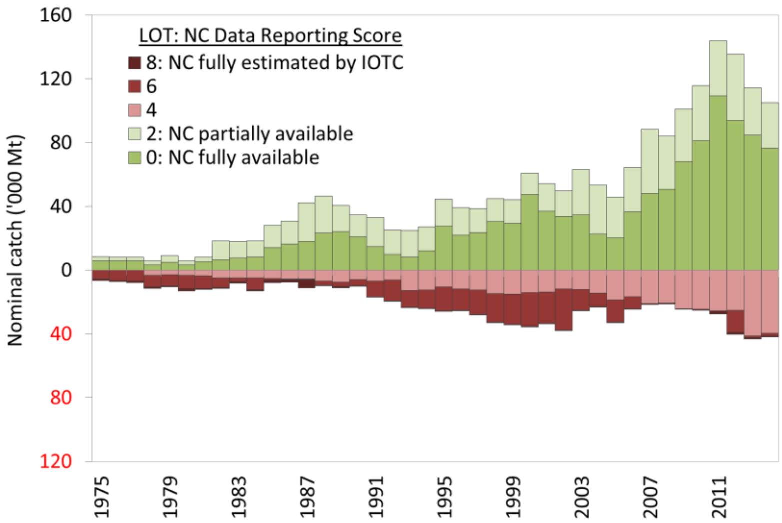


Fig.7. Longtail tuna: nominal catch; uncertainty of annual catch estimates (1975–2014).

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). Data as of May 2016.

[21] 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 2012-2014.

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**).

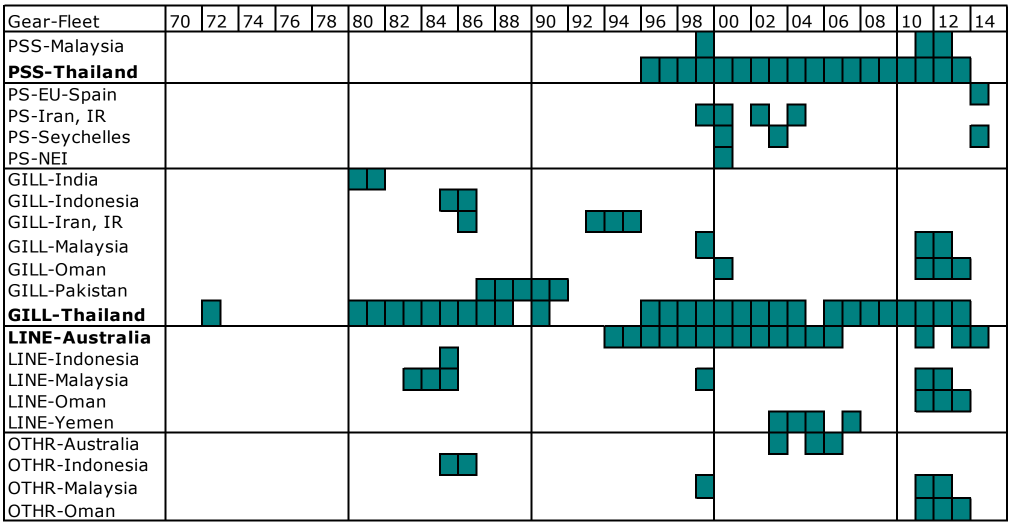


Fig.8. Longtail tuna: Availability of catches and effort series, by fishery and year (1970–2014)[22]. No catch-and-effort is available for 1950–1971.

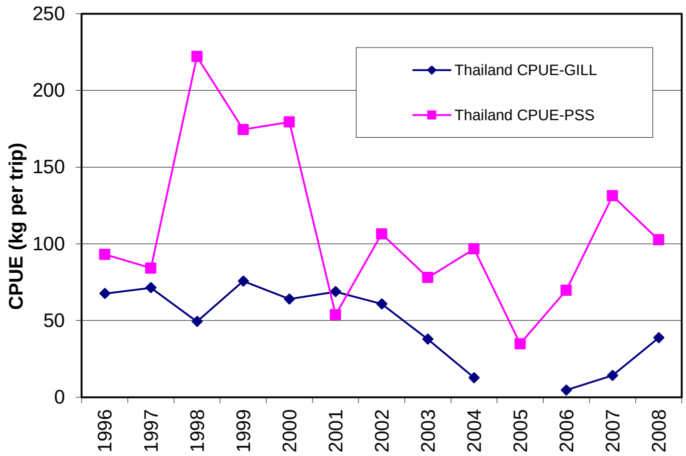


Fig.9. Longtail tuna: Nominal CPUE series for gillnet (GILL) and coastal purse seine (PSS) fisheries of Thailand derived from available catch-and-effort data (1996–2008). Effort reported as fishing days post-2008.

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.

[22] 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) and Oman (gillnet).
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.

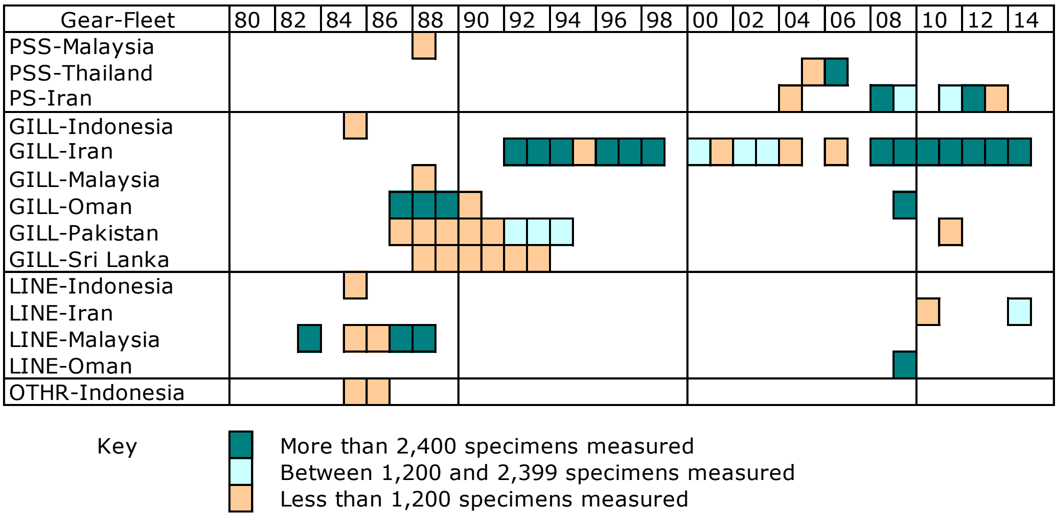


Fig.10. Longtail tuna: Availability of length frequency data, by fishery and year (1980–2014)[23]. Note that no length frequency data are available at all for 1950–1982.

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[c]	RND=a*L^b	a= 0.00002 b= 2.83		Min:29 Max:128

[23] 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

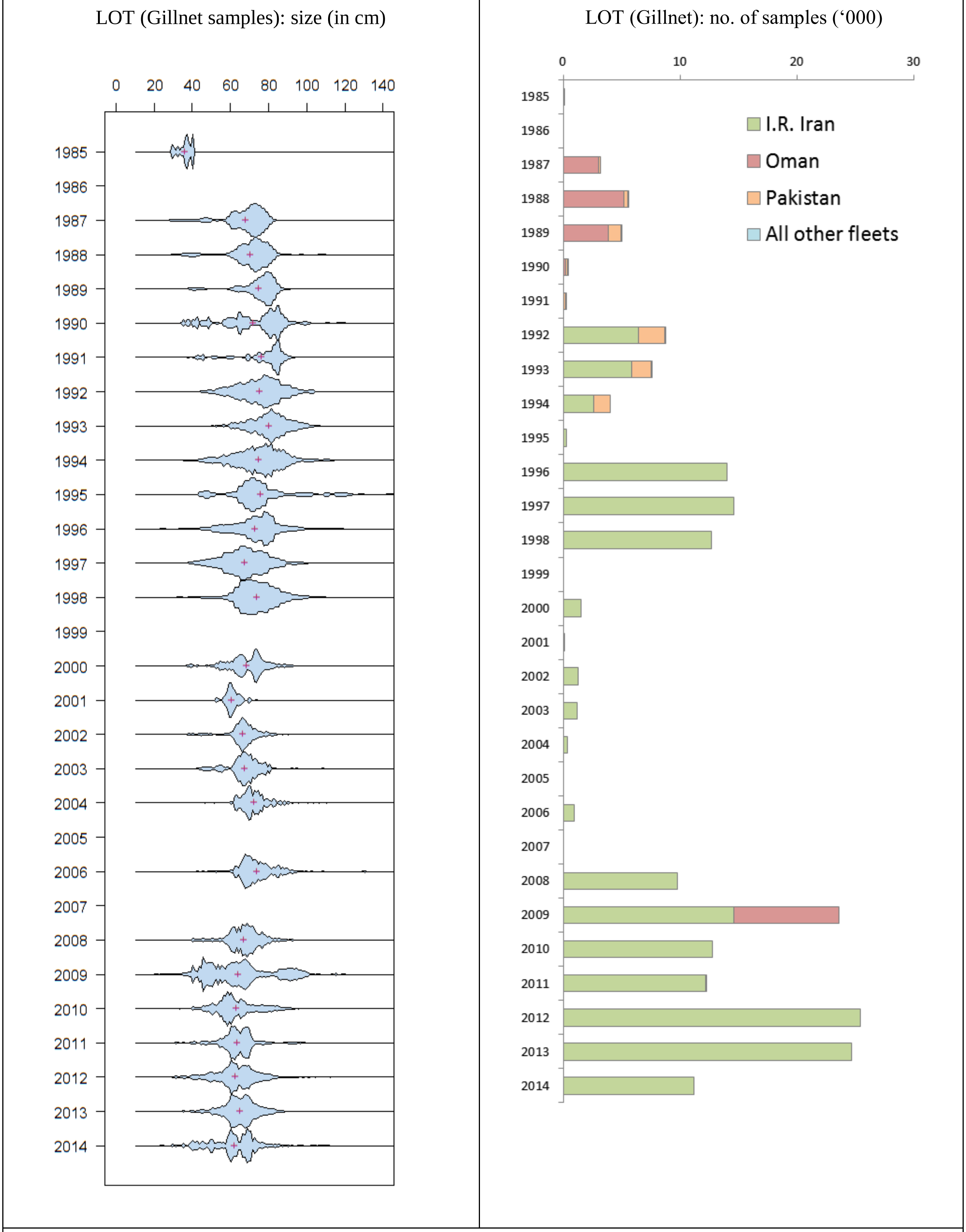


Fig.11a-b. Left: Longtail tuna (gillnet fisheries): Length frequency distributions (by 1cm length class) derived from data available at the IOTC Secretariat, 1985-2014.

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–2016–WPNT06–07

Fisheries and main catch trends

- Main fisheries: Indo-Pacific king mackerel[24] 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):
  Around two-thirds of catches are accounted for by fisheries in India, Indonesia; with important catches also reported by I.R. Iran and Myanmar (**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 2015.

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

Retained catches for King mackerel were derived from incomplete information, and are therefore uncertain[25] (**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.

[24] Hereinafter referred to as King mackerel.

[25] 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 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 May 2016.*

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Purse seine	-	-	34	584	772	938	768	720	1,109	1,239	1,605	1,104	1,268	1,103	1,195	1,250
Gillnet	4,367	6,897	13,948	17,097	21,709	23,634	20,347	20,915	27,450	31,192	32,069	26,800	28,547	27,834	29,955	33,225
Line	250	349	768	1,333	1,834	2,504	2,240	2,046	3,493	3,520	4,041	3,497	3,601	3,575	3,656	3,707
Other	13	21	48	3,879	5,101	9,353	8,334	8,208	10,872	11,929	15,733	10,859	11,268	9,964	11,363	10,878
Total	**4,630**	**7,268**	**14,798**	**22,893**	**29,416**	**36,428**	**31,689**	**31,889**	**42,923**	**47,880**	**53,448**	**42,260**	**44,684**	**42,476**	**46,169**	**49,060**

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.

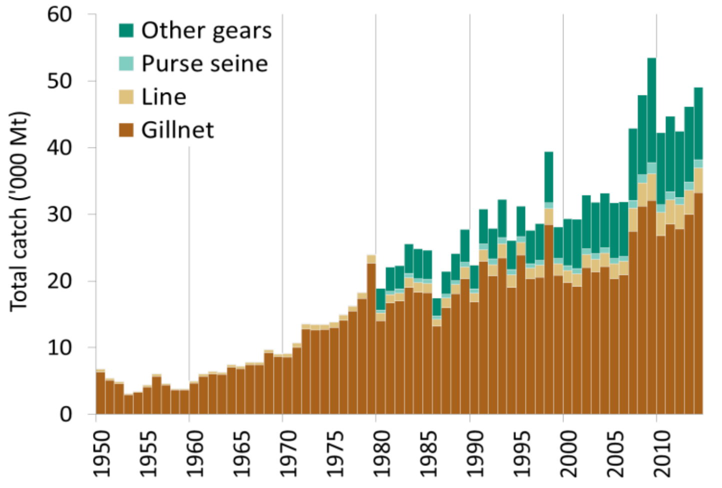


Fig. 39. Indo-Pacific king mackerel: Annual catches by gear recorded in the IOTC Database (1950–2014).

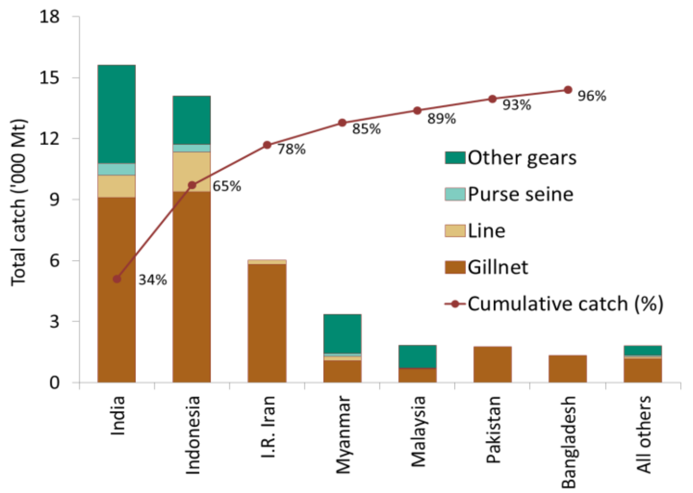


Fig. 40. Indo-Pacific king mackerel: Average catches in the Indian Ocean over the period 2012–14, by country[26].

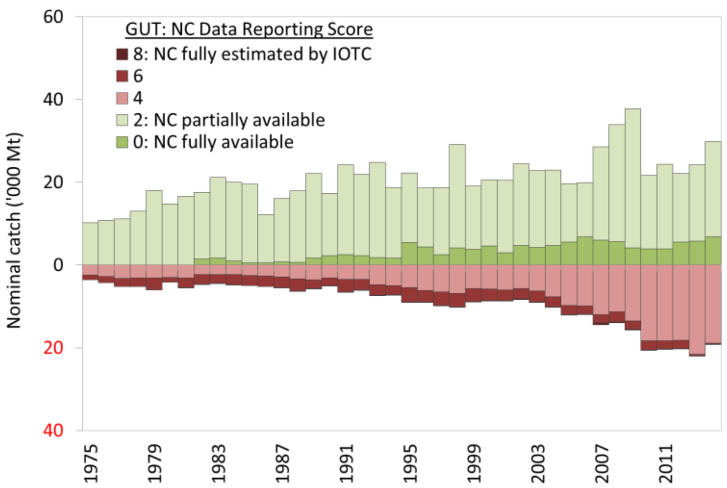


Fig. 41. Indo-Pacific king mackerel: nominal catch; uncertainty of annual catch estimates (1975–2015).

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). Data as of May 2016.

[26] 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 2012-2014.

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.

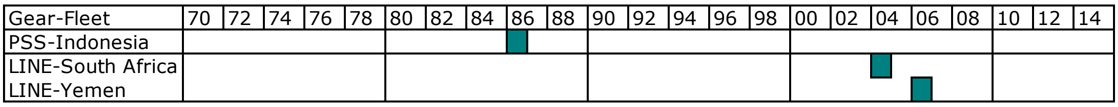


Fig. 42. Indo-Pacific king mackerel: Availability of catches and effort series, by fishery and year (1970–2014)[27]. Note that no catches and effort are available at all for 1950–85.

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 for 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.

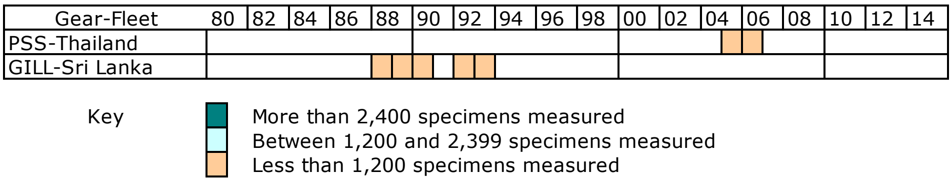


Fig. 43. Indo-Pacific king mackerel: Availability of length frequency data, by fishery and year (1980–2014)[28]. Note that no length frequency data are available for 1950–82.

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 WeightA*	*RND=a*L^b*	*a= 0.0000100000* *b= 2.89400*		*Min:20* *Max:80*

[27] 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.

[28] 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–2016–WPNT06–07

Fisheries and main catch trends

- Main fisheries: Narrow-barred Spanish mackerel[29] 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 to a lesser extent I.R. Iran, Myanmar, the UAE and Pakistan (**Fig.33**). Spanish mackerel is also targeted throughout the Indian Ocean by artisanal and 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, at 145,000 t in 2011.
- 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 2015.

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

Retained catches for Spanish mackerel were derived from incomplete information, and are therefore uncertain[30] (**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. 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 mislabelled, the catches of Indo-Pacific king mackerel and, to a lesser extent, other seerfish species, labelled as narrow-barred Spanish mackerel. Similarly, the catches of wahoo in some longline fisheries are thought to be mislabelled as narrow-barred Spanish mackerel. This mislabelling is thought to have little impact in the case of the narrow-barred Spanish mackerel but may be important for other seerfish species.

[29] Hereinafter referred to as Spanish mackerel.

[30] 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 1950–2014 (in metric tonnes). Data as of May 2016.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Purse seine	-	0	285	2,355	4,145	5,611	5,877	7,631	6,588	6,133	8,459	8,789	9,113	8,894	9,037	8,344
Gillnet	9,530	17,704	32,168	54,918	62,712	67,281	59,611	67,804	73,041	75,675	77,071	81,734	80,963	88,731	84,808	92,504
Line	1,731	2,477	4,672	11,334	12,071	17,139	17,392	18,259	19,755	18,747	21,328	22,075	28,645	30,664	28,339	29,069
Other	57	96	468	5,603	9,741	21,351	20,523	23,915	25,530	22,741	28,170	24,551	25,802	29,347	26,834	24,806
Total	**11,318**	**20,277**	**37,593**	**74,210**	**88,669**	**111,382**	**103,404**	**117,609**	**124,914**	**123,297**	**135,028**	**137,148**	**144,523**	**157,636**	**149,018**	**154,723**

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.

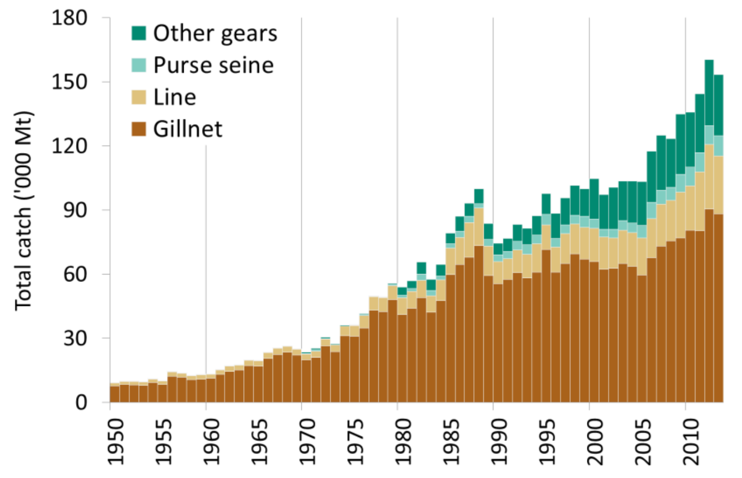


Fig.32. Narrow-barred spanish mackerel: Annual catches by gear recorded in the IOTC Database (1950–2014).

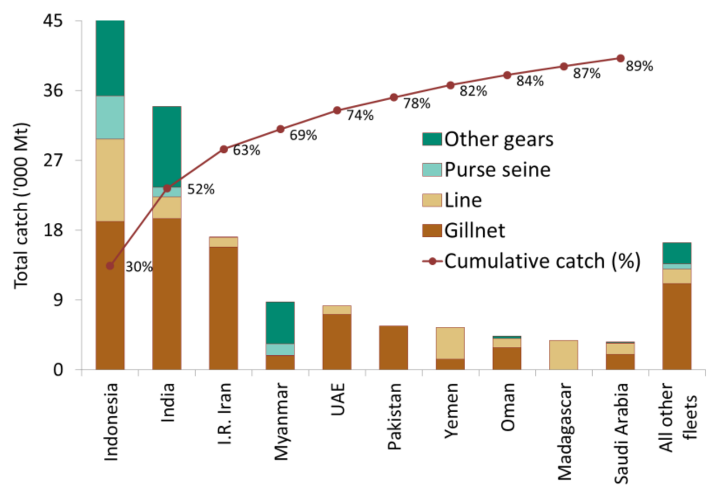


Fig.33. Narrow-barred spanish mackerel: Average catches in the Indian Ocean over the period 2012–14, by country[31].

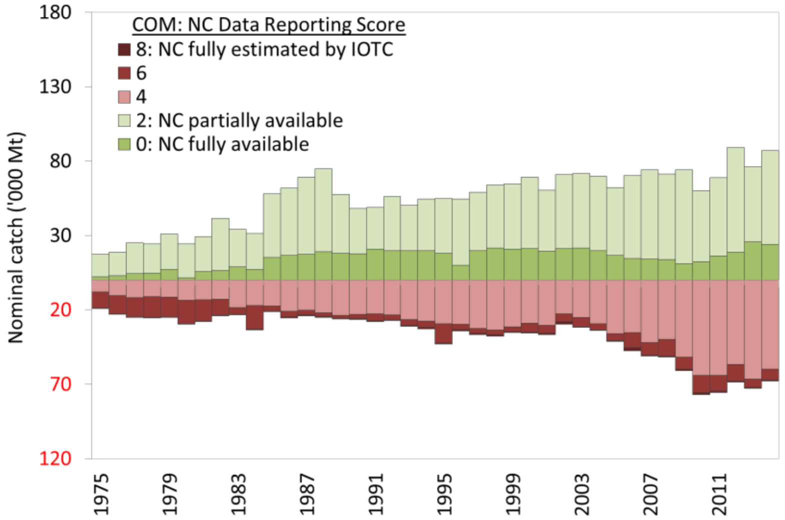


Fig.34. Narrow-barred spanish mackerel: nominal catch; uncertainty of annual catch estimates (1975–2014).

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). Data as of May 2016.

[31] 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 2012-2014.

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**).

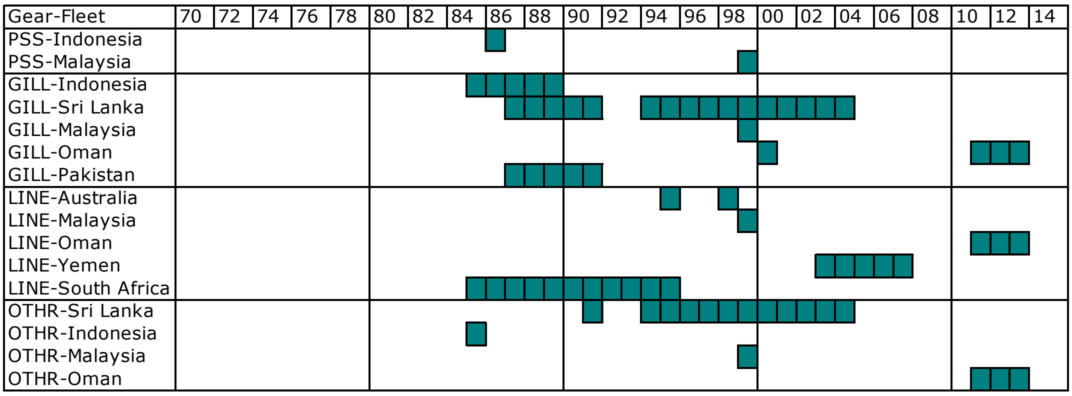


Fig.35. Narrow-barred Spanish mackerel: Availability of catches and effort series, by fishery and year (1970–2014)[32]. No catches and effort are available at for 1950–84, and 2008–10.

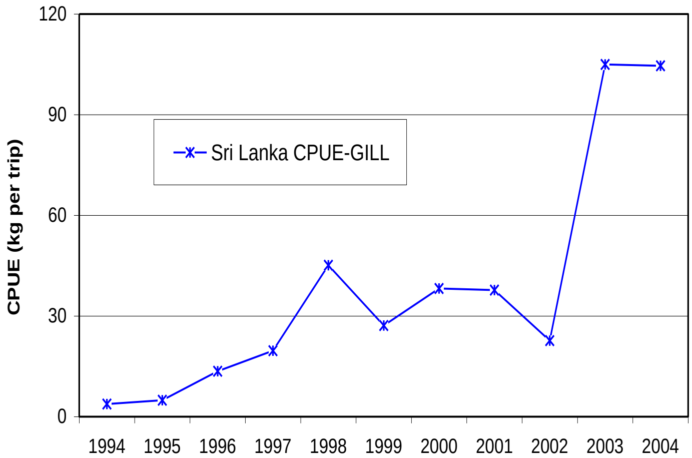


Fig.36. Narrow-barred Spanish mackerel: Nominal CPUE series for the gillnet fishery of Sri Lanka derived from the available catches and effort data (1994–2004). No data available since 2004.

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.[33]
- Size frequency data: highly incomplete data, available only for selected years and/or fisheries (**Fig.37**).

[32] 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

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

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 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.

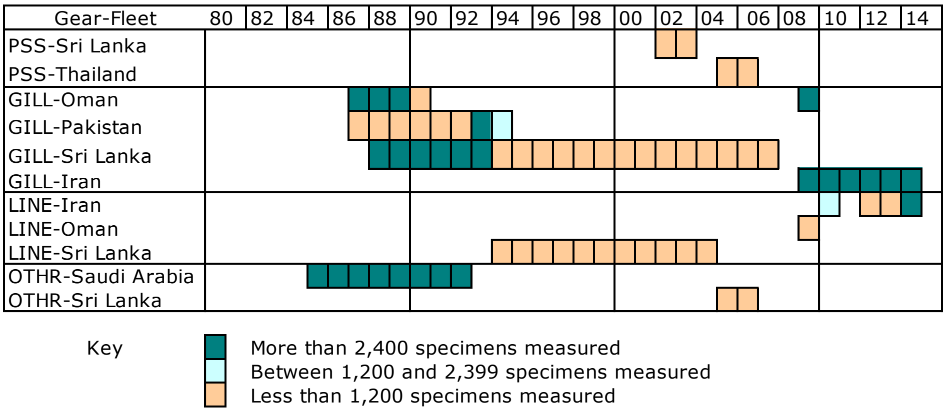


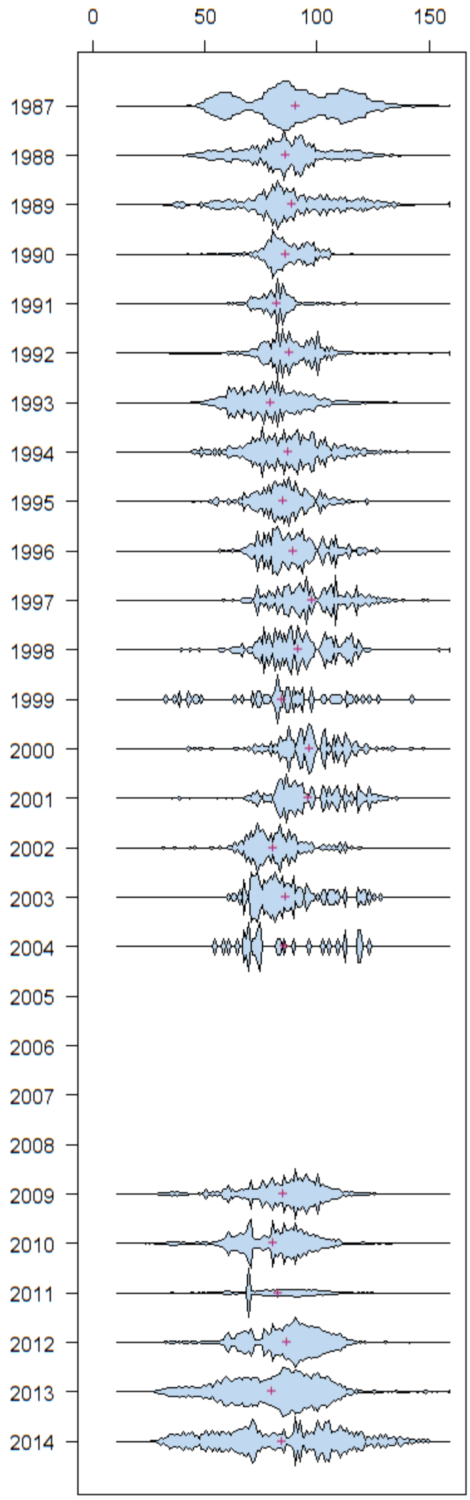
Fig.37. Narrow-barred Spanish mackerel: Availability of length frequency data, by fishery and year (1980–2014)[34]. Note that no length frequency data are available prior to 1984.

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 WeightA*	*RND=a*L^b*	*a= 0.00001176 b= 2.9002*		*Min:20 Max:200*

[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.

COM (Gillnet samples): size (in cm)



COM (Gillnet): no. of samples (‘000)

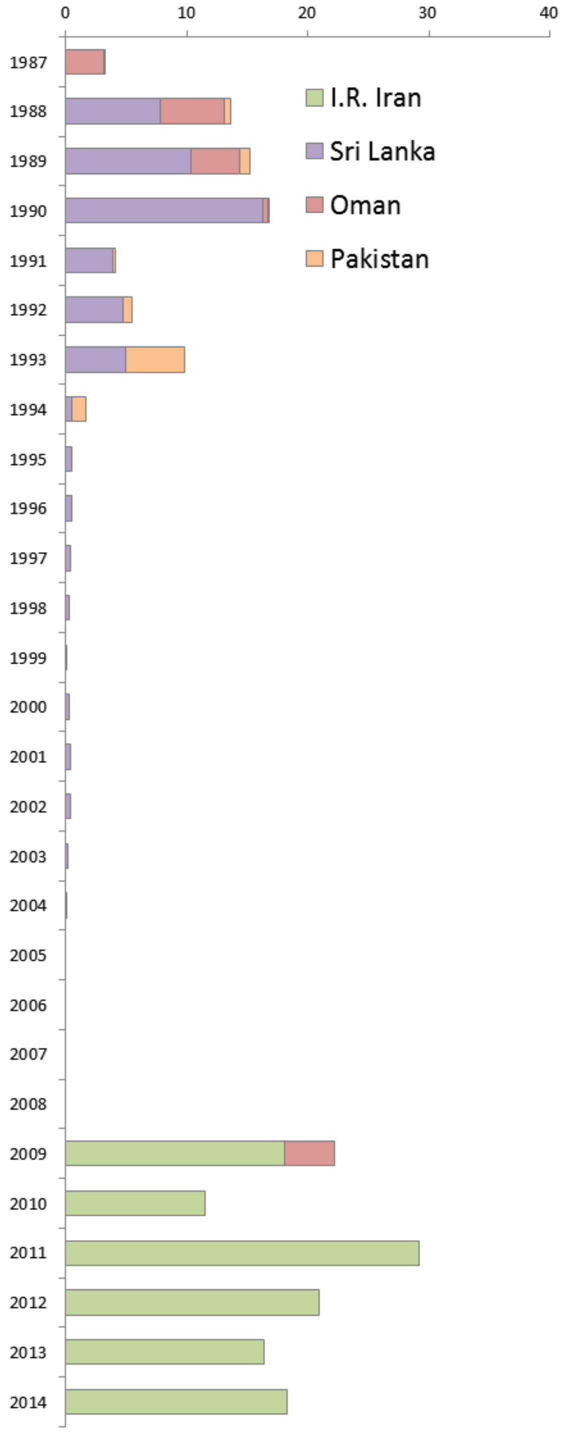


Fig.38a-b. Left: Narrow-barred Spanish Mackerel (gillnet fisheries): Length frequency distributions (by 1cm length class) derived from data available at the IOTC Secretariat, 1987-2014.

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–2016–WPNT06–07

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. • 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 Feburary 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, Malaysia, and Thailand	Reliability of catch estimates A number of issues have been identified for the following fisheries, which compromise the quality of the data in the IOTC database.	• Indonesia (nominal catch): catch estimates for neritic tunas are considered highly uncertain due to issues of species misidentification and aggregation of juvenile neritic and tropical tunas species reported as commercial category *tongkol*. The IOTC Secretariat is currently coordinating 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 remain pending until inconsistencies in the data are satisfactorily resolved". • Thailand (catch-and-effort): catch-and-effort shows large increases for longtail 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). • Pakistan – drifting gillnets: no update. No catch-and-effort or size data has been reported to date.
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.	No update. 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.
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.	No update. 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.
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.	No update. Collection of biological information, including size data, remains very low for most neritic species. The IOTC coordinated Stock Structure Project, which commenced in early-2015, 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 (2017–2021)

The following is the Draft WPNT Program of Work (2017 to 2021) and is based on the specific requests of the Commission and Scientific Committee as well as topics identified during the WPNT06. 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				
				2017	2018	2019	2020	2021
1. Stock structure (connectivity)	Genetic research to determine the connectivity of neritic tunas throughout their distributions	High (1)	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					
2. 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	High (2)	CPCs directly					

		including age-at-maturity and fecundity-at-age/length relationships, age-length keys, age and growth, which will be fed into future stock assessments.							
3.	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 (4)	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					
4.	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					

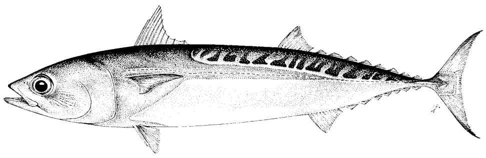
Table 2. Assessment schedule for the IOTC Working Party on Neritic Tunas 2017–2021

Working Party on Neritic Tunas					
Species	**2017**	**2018**	**2019**	**2020**	**2021**
Bullet tuna	Indicators	Indicators	Data-poor assessment	Indicators	Data-poor assessment
Frigate tuna	Indicators	Indicators	Data-poor assessment	Indicators	Data-poor assessment
Indo-Pacific king mackerel	Indicators	Indicators	**Full assessment***	Indicators	Data-poor assessment
Kawakawa	Indicators	Data-poor assessment	**Full assessment***	Data-poor assessment	Indicators
Longtail tuna	**Full assessment***	Data-poor assessment	Indicators	**Full assessment***	Indicators
Narrow-barred Spanish mackerel	Data-poor assessment	**Full assessment***	Indicators	Data-poor assessment	**Full 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		2016 stock status determination
Indian Ocean	Catch[2] 2014: Average catch[2] 2010–2014:	8,352 t 8,993 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): F_{2014}/F_{MSY} (80% CI): B_{2014}/B_{MSY} (80% CI): B_{2014}/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]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 a more formal assessment, 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 bullet tuna should be applied.

Outlook. Total annual catches for bullet tuna over the past three years have ranged between 8,400 t and 8,900 t. There is insufficient information to evaluate the effect that this level of catch, or an increase in catch may have on the resource. Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries should be considered a high priority for this species.

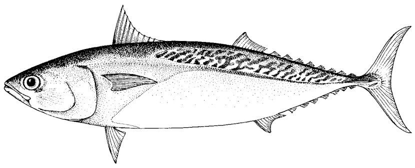
The following should be noted:

- The Maximum Sustainable Yield estimate for the whole Indian Ocean is unknown.
- Species identification, data collection and reporting urgently need to be improved.
- Reconstruction of the catch history needs to occur before a reliable assessment can be attempted.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.

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 current catches (average 2010-2014). 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.

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		2016 stock status determination
Indian Ocean	Catch[2] 2014: Average catch[2] 2010–2014:	102,586 t 99,068 t	
	MSY (1,000 t) (80% CI): F_{MSY} (80% CI): B_{MSY} (1,000 t) (80% CI): F_{2014}/F_{MSY} (80% CI): B_{2014}/B_{MSY} (80% CI): B_{2014}/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]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 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 a more formal assessment 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 (~102,500 t). There is insufficient information to evaluate the effect that this level of catch, or a further increase in catch may have on the resource. Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries should be considered a high priority for this species.

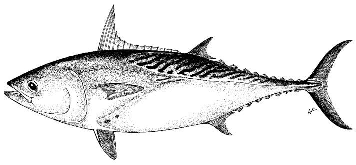
The following should be noted:

- The Maximum Sustainable Yield estimate for the whole Indian Ocean is unknown.
- Species identification, data collection and reporting urgently need to be improved.
- Reconstruction of the catch history needs to occur before a reliable assessment can be attempted.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.

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 current catches (average 2010-2014). 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.

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		2016 stock status determination
Indian Ocean	Catch[2] 2014: Average catch[2] 2010–2014:	159,264 t 155,511 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]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. A stock assessment was not undertaken for kawakawa in 2016 and 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 2015indicates 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, measures need to be taken in order to slow the rate of increasing catch, though current catch (2014) is lower than that observed in 2013. Based on the weight-of-evidence available to the WPNT, the kawakawa stock for the whole Indian Ocean is classified as **not overfished** and **not subject to overfishing** (Table 1, Fig. 1). Further analysis of the CPUE data should be undertaken in preparation for the next stock assessment so that more traditional approaches for assessing stock status may be used.

Outlook. There remains considerable uncertainty about stock structure and about the total catches. Due to a lack of fishery data for several gears, 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 formal assessment are a cause for considerable concern. In the interim until more traditional approaches are developed the data-poor approaches will be used to assess stock status. The continued increase of annual catches for kawakawa is likely to have further increased the pressure on the Indian Ocean stock as a whole resource. Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries should be undertaken. 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).

The following should be noted:

- The Maximum Sustainable Yield estimate 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 stocks becoming overfished.
- Reconstruction of the catch history needs to occur, as do annual catches submitted to the Secretariat.

- Improvement in data collection and reporting is required to assess the stock using more traditional stock assessment techniques.
- Given the rapid increase in kawakawa catch in recent years, some measures need to be taken to reduce the catches in the Indian Ocean.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate

Management Advice. Although the stock status is classified as not overfished and not subject to overfishing, the K2MSM 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 current catch levels in 2014, thus if the Commission wishes to recover the stock to levels above the MSY reference points, the Scientific Committee recommends that catches should be reduced by 20% of current levels.

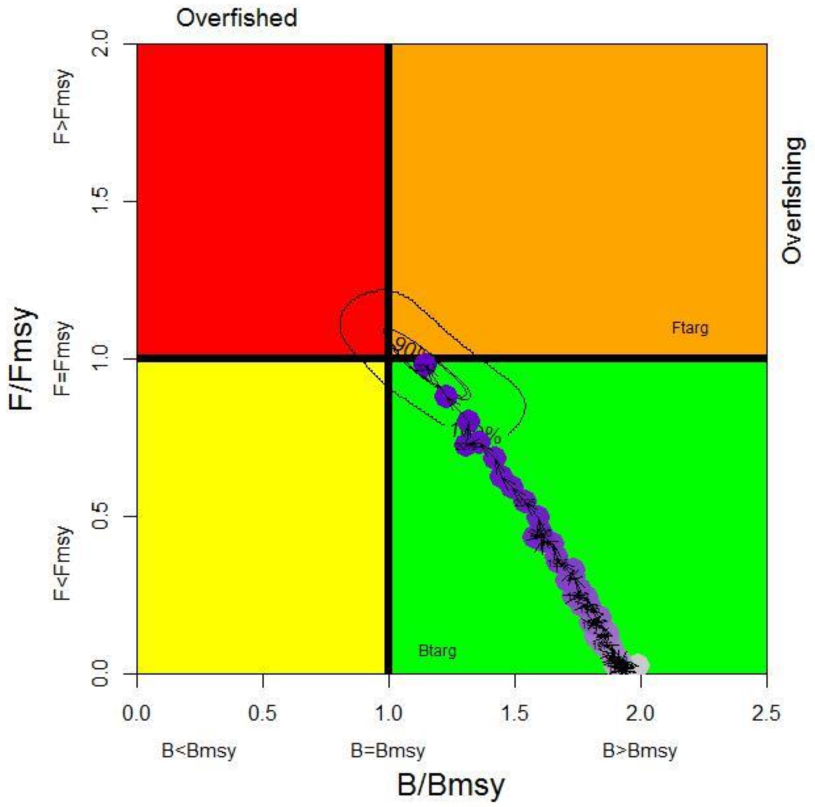


Fig. 1. Kawakawa. OCOM aggregated Indian Ocean assessment. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented (1950–2013).

Table 2. Kawakawa: 2015 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 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

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APPENDIX X
EXECUTIVE SUMMARY: LONGTAIL TUNA

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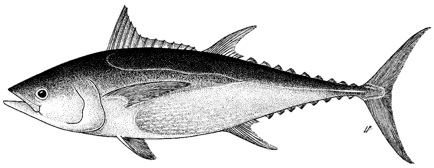

Status of the Indian Ocean longtail tuna (LOT: *Thunnus tonggol*) resource

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

Area[1]	**Indicators**		**2016 stock status determination**
Indian Ocean	Catch[2] 2014: Average catch[2] 2010–2014:	146,751 t 158,495 t	(red)
	MSY (1,000 t) (*): F_{MSY} (*): B_{MSY} (1,000 t) (*): F_{2014}/F_{MSY} (*): B_{2014}/B_{MSY} (*): B_{2014}/B_0 (*):	143 (106–194) 0.39 (0.29–0.54) 298 (197–545) 1.03 (0.88–1.26) 0.99 (0.78–1.19) 0.50 (0.39-0.60)	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2]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.
*Estimated probability that the stock is in the respective quadrant of the Kobe plot (shown below), derived from the retained biomass trajectories associated with the current stock status (OCOM stock assessment model).

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

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. Analysis using the 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} (51% of plausible models runs) (Fig. 1). Although catches decreased between 2012 and 2014 from 175 459 to 146 751 t, catches have remained above all current (and previous) estimates of MSY since 2011. The F_{2014}/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_{2014}/B_{MSY} ratio (0.99) was also slightly lower than in previous years. An assessment using Catch-MSY was also undertaken in 2016 and results were consistent with OCOM in terms of status. Therefore, based on the weight-of-evidence currently available, the stock is considered to be both **overfished** and **subject to overfishing** (Table 1; Fig. 1).

Outlook. There remains considerable uncertainty about stock structure and the total catches in the Indian Ocean. The increase of annual catches for longtail tuna to a peak in 2012 increased the pressure on the Indian Ocean stock as a whole, though that trend has reversed in 2013 and 2014. 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 improving indicators and exploration of stock structure and stock assessment approaches for more traditional models for fisheries management are warranted. There is a continued high risk of exceeding MSY-based reference points by 2017 if catches are maintained at current (2014) levels (69% risk that $B2017<B_{MSY}$, and 81% risk that $F\ 2017>F_{MSY}$). (Table 2).

The following should be noted:

- The Maximum Sustainable Yield estimate of around 143,000 t is still being exceeded in spite of recent declines in catches. Given that the stock is overfished according to the point estimate, reductions in catch are warranted to maintain the stock at B_{MSY} level.
- Reconstruction of the catch history needs to occur, as do annual catches submitted to the IOTC Secretariat.

- Improvement in data collection and reporting is required to assess the stock using more traditional stock assessment techniques.
- Improvement in data collection and reporting is required to assess the stock status, primarily abundance index series from I.R. Iran, Oman, India and Indonesia.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.

Management advice. There is a continued high risk of exceeding MSY-based reference points by 2017 if catches are maintained at current (2014) levels. (69% risk that B2017<B_{MSY}, and 81% risk that F 2017>F_{MSY}). If catches are reduced by 10% this risk is lowered to 27% probability B2017<B_{MSY} and 39% probability F2017>F_{MSY}). If the Commission wishes to recover the stock to levels above the MSY reference points, the Scientific Committee recommends catches should be reduced by approximately 10% of current levels 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.

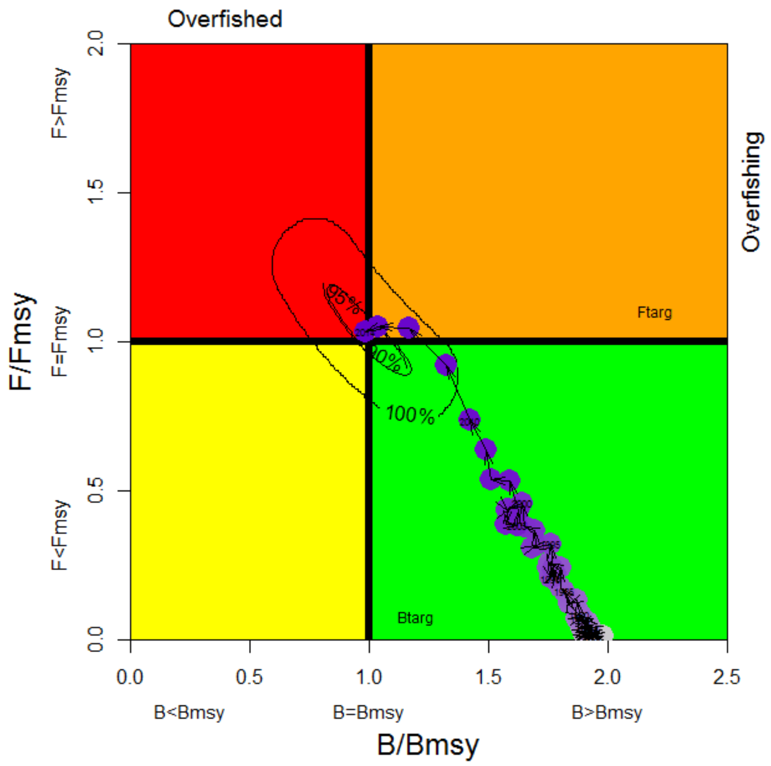

Fig. 1. Longtail tuna. Longtail OCOM Indian Ocean assessment Kobe plot (all plausible model runs shown around 2014 estimate). Blue circles indicate the trajectory of the point estimates for the SB ratio and F ratio for each year 1950–2014. Target reference points are shown as B_{MSY} and F_{MSY}.

TABLE 2. Longtail tuna OCOM aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based target for nine constant catch projections (2014 +20%,+10%, -10%, - 20%, -30% projected for 3 and 10 years).

Reference point and projection timeframe	Alternative catch projections (relative to 2014) and weighted probability (%) scenarios that violate reference points					
	70% (102,726 t)	80% (117,401 t)	90% (132,076 t)	100% (146,751 t)	110% (161,426 t)	120% (176,101 t)
$B^{35}_{2017} < B_{MSY}$	1	7	27	69	95	100
$F_{2017} > F_{MSY}$	1	12	39	81	98	100
$B_{2024} < B_{MSY}$	0	0	2	85	100	100
$F_{2024} > F_{MSY}$	0	0	2	90	100	100

[35] Fishable biomass

APPENDIX XI
EXECUTIVE SUMMARY: INDO-PACIFIC KING MACKEREL

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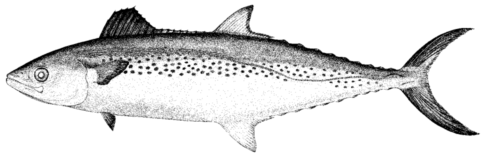

Status of the Indian Ocean Indo-Pacific king mackerel (GUT: *Scomberomorus guttatus*) resource

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

Area[1]	Indicators		2016 stock status determination
Indian Ocean	Catch[2] 2014: Average catch[2] 2010–2014:	49,060 t 44,930 t	
	MSY (1,000 t) [*]: F_{MSY} [*]: B_{MSY} (1,000 t) [*]: F_{2014}/F_{MSY} [*]: B_{2014}/B_{MSY} [*]: B_{2014}/B_0 [*]:	46 [38.9–54.4] 0.52 [0.40–0.69] 66.0 [45.9–107.9] 0.98 [0.85–1.14] 1.10 [0.84–1.29] 0.55 [0.42–0.64]	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2]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. Following a first data-poor assessment in 2015, Indo-Pacific king mackerel was again assessed using SRA techniques (Catch-MSY and OCOM) in 2016. The OCOM model, considered the more robust of the two SRA models applied in terms of assumptions and treatment of priors, indicates that overfishing is not occurring and the stock is not overfished (Fig. 1; Table 1). Moreover, the average catches (c. 45,000 t) over the last 5 years have been within the estimated MSY range (43,000 – 46,000 t). However, catches have increased in the last 2 years and in 2014 exceeded this MSY range. The continuing low levels of catch reporting for this species, coupled with the highly variable and uncertain estimates of growth parameters used to estimate model priors, prompted the WPNT to exercise caution in interpreting model results for king mackerel. Consequently, and similar to 2015, the WPNT considered that 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 Indo-Pacific king mackerel should be adopted.

Outlook. Total annual catches for Indo-Pacific king mackerel have started to increase over the last 2 years and are likely to have increased pressure on the Indian Ocean stock. There remains considerable uncertainty about stock structure and the total catches. Due to a lack of fishery data for several gears, 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 formal assessment, are a cause for considerable concern. In the interim, and until more data-rich approaches can be applied, data-poor approaches will be required to assess stock status. Though data-poor methods are yet to be used to provide stock status advice, further refinements to the SRA models and application of additional data-poor approaches may improve confidence in the results.

The following should be noted:

- The Maximum Sustainable Yield estimate for the whole Indian Ocean is between 43,000 and 46,000 t, while catches in recent years have exceeded this target.

- Data collection and reporting urgently need to be improved.
- Reconstruction of the catch history needs to occur before a reliable assessment can be attempted.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.

Management advice. A precautionary approach to the management of IP king mackerel should be considered by the Commission, by ensuring that catches are reduced to levels below the current estimated range of MSY. 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 requirement, so as to better inform scientific advice.

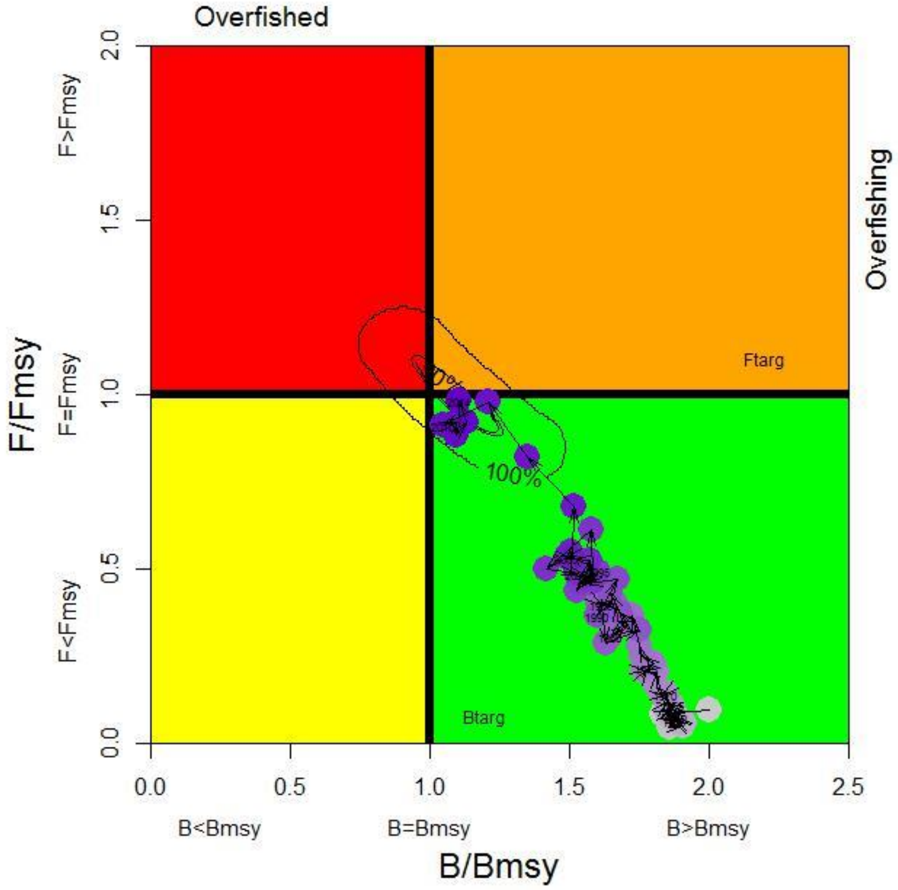

Fig. 1. Indo-Pacific king mackerel: OCOM Indian Ocean assessment Kobe plot (Plausible range shown around 2014 estimate). Blue circles indicate the trajectory of the point estimates for the SB ratio and F ratio for each year 1950–2014. Target reference points are shown (B_{MSY} and F_{MSY}).

APPENDIX XII
EXECUTIVE SUMMARY: NARROW-BARRED SPANISH MACKEREL

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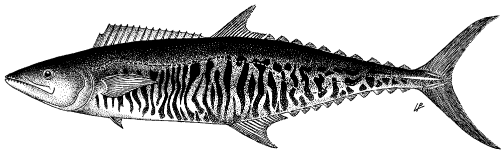

Status of the Indian Ocean narrow-barred Spanish mackerel (COM: *Scomberomorus commerson*) resource

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

Area[1]	Indicators		2016 stock status determination
Indian Ocean	Catch[2] 2014: Average catch[2] 2010–2014:	154,723 t 148,609 t	(red)
	MSY (1,000 t) [*]: F_{MSY} [*]: B_{MSY} (1,000 t) [*]: F_{2014}/F_{MSY} [*]: B_{2014} B_{MSY} [*]: B_{2014}/B_0 [*]:	131.1 [98.7–178.8] 0.34 [0.21–0.56] 326 [178–702] 1.21 [0.95–1.48] 0.95 [0.74–1.27] 0.47 [0.37–0.63]	

[1]Boundaries for the Indian Ocean stock assessment are defined as the IOTC area of competence.
[2]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)	(red)	(orange)
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	(yellow)	(green)
Not assessed/Uncertain	(grey)	

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. OCOM techniques indicate that the stock is being exploited at a rate exceeding F_{MSY} in recent years, and the stock appears to be below B_{MSY} (72% of plausible model runs). Northwest Indian Ocean (Gulf of Oman Sea countries) indicate that localised depletion may be occurring from an analysis done in 2013, and overfishing is occurring in this area, though the degree of connectivity with other stocks remains unknown. Stock structure issues remain to be clarified for this stock. Based on the weight-of-evidence available, including the two different SRA approaches pursued in 2016, the stock appears to be **overfished** and **subject to overfishing** (Table 1, Fig. 1). Catches in 2014 and recent average catches are above the range in current MSY estimates (131,000 – 140,000 t).

Outlook. There remains considerable uncertainty about stock structure and the total catches. The continued increase of annual catches for narrow-barred Spanish mackerel in recent years has further increased the pressure on the Indian Ocean stock as a whole, and the stock is 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, as was presented at a previous meeting (IOTC-2015-WPNT03-27). Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries are warranted. There is a high to very high risk of exceeding MSY-based reference points by 2017 and 2024 if catches are maintained at current (2014) levels (100% risk that $B_{2017}<B_{MSY}$, and 100% risk that $F_{2017}>F_{MSY}$) (Table 2).

The following should be noted:

- Maximum Sustainable Yield estimates for the whole Indian Ocean range from 131,000 to 140,000 t, while current catches (154,723 t) are exceeding this.
- Reconstruction of the catch history needs to occur, as do improvements to annual catches submitted to the Secretariat.
- Improvement in data collection and reporting is required to assess the stock using more traditional stock assessment techniques.

- 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).
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.

Management advice. There is a continued high to very high risk of exceeding MSY-based reference points by 2023, even if catches are reduced to 80% of the current (2013) levels (67% risk that $B_{2023}<B_{MSY}$, and 99% risk that F $2023>F_{MSY}$). The modelled probabilities of the stock achieving levels consistent with the MSY reference levels (e.g. $SB > SB_{MSY}$ and $F<F_{MSY}$) in 2023 are 98 and 79%, 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, the Scientific Committee recommends that catches should be reduced by at least 30% of current levels which corresponds to catches below to MSY in order to recover the status of the stock. The change in advice from 2015 is due to the fact that the stock biomass has continued to decline, and that catches have continued to increase, resulting in a lower probability of recovering the stock with last year's recommended reduction in catches.

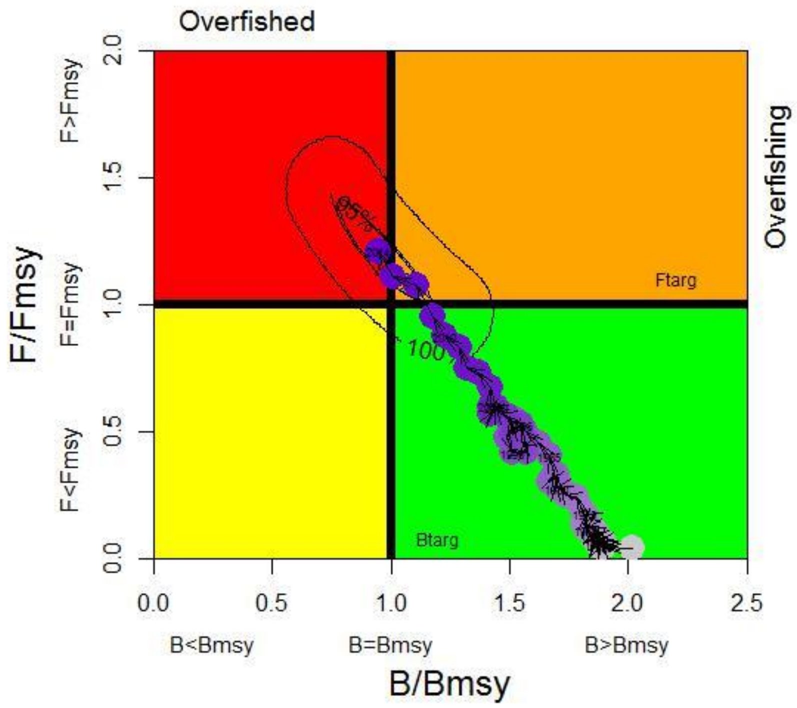

Fig. 1. Narrow-barred Spanish mackerel. OCOM Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

Table 2. Narrow-barred Spanish mackerel: 2016 OCOM Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of plausible models 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 2016 stock assessment using catch estimates at that time.

Reference point and projection timeframe	Alternative catch projections (relative to 2014) and weighted probability (%) scenarios that violate reference point					
	70% (108,306 t)	80% (123,778 t)	90% (139,251 t)	100% (154,723 t)	110% (170,195t)	120% (185,668 t)
$B_{2017} < B_{MSY}$[36]	53	86	98	100	100	100
$F_{2017} > F_{MSY}$	97	100	100	100	100	100
$B_{2024} < B_{MSY}$	1	53	100	100	100	100
$F_{2024} > F_{MSY}$	10	97	100	100	100	100

[36] Fishable biomass

APPENDIX XIII
CONSOLIDATED RECOMMENDATIONS OF THE 6TH SESSION OF THE WORKING PARTY ON NERITIC TUNAS

Note: Appendix references refer to the Report of the 6th Session of the Working Party on Neritic Tunas (IOTC–2016–WPNT06–R)

Indonesia

WPNT06.01 (para. 105) **ACKNOWLEDGING** that OFCF are planning to follow-up the sampling project further, the WPNT **RECOMMENDED** that IOTC regular budget is allocated to support the extension of the Indonesia sampling project in both geographical scope and over time.

Selection of Stock Status indicators

WPNT06.02 (para. 144) The WPNT **NOTED** the importance of exploring alternative models or sources of information that can evidence results from data-poor assessments, and **RECOMMENDED** that other methods are explored based on different data sources, such as catch curve estimation of mortality from length-frequency data. A range of data sources should be explored, including data from observer programmes, the sport fisheries project, and non-state actor (e.g. WWF) projects for suitability.

WPNT06.03 (para. 148) The WPNT **RECALLED** the recommendation of the WPNT05 for the SC to request the Working Party on Methods evaluate a proposed alternative methodology for presenting management advice for data poor methods in 2016. The WPNT **RECOMMENDED** that the WPM evaluate the possibility of using different colours to distinguish between stocks which have not been assessed (e.g., white) and stocks which have been assessed but the status is considered to be uncertain (e.g., grey).

Revision of the WPNT Program of Work (2017–2021)

WPNT06.04 (para. 204) **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).

WPNT06.05 (para. 211) The WPNT **RECOMMENDED** that the SC request that the Commission further increases the IOTC Capacity Building budget line so that capacity building training on improved data collection and analysis can be carried out in 2017.

WPNT06.06 (para. 212) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2017–2021), as provided at Appendix VI.

Date and place of the 7th Working Party on Neritic Tunas

WPNT06.07 (para. 217) The WPNT **NOTED** the expression of interest from the Maldives to host the 7th Session of the WPNT. The IOTC Secretariat shall liaise with Maldives to confirm the expression of interest. Given that the dates proposed by the SC (3-6 March 2017) leave little time for the activities in the program of work to be carried out, the WPNT **RECOMMENDED** the SC consider pushing the dates back to July 2017.

Meeting participation fund (MPF)

WPNT06.08 (para. 291) 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 WPNT07 as a high priority meeting for MPF.

WPNT06.09 (para. 220) 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 21).

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.

Review of the draft, and adoption of the Report of the 6th Working Party on Neritic Tunas

WPNT06.10 (para. 221) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT06, 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 two species assigned a stock status in 2016 (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

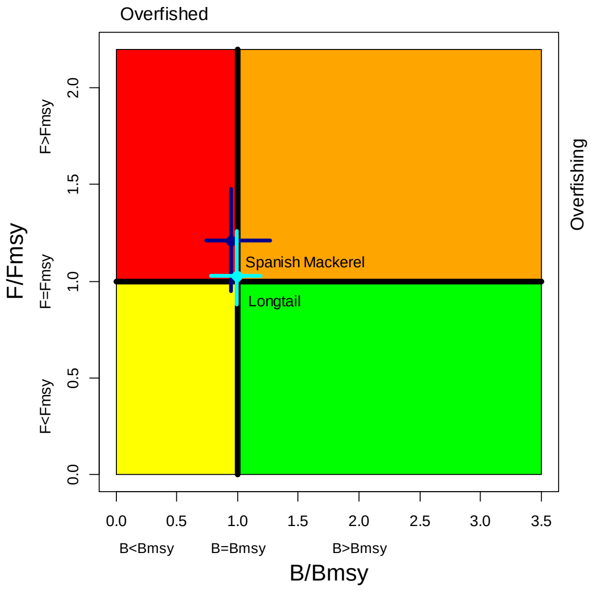

Fig. 8. Combined Kobe plot for longtail tuna and narrow-barred Spanish mackerel, showing the estimates of stock size (B) and current fishing mortality (F) in 2014 in relation to optimal spawning stock size and optimal fishing mortality using the OCOM modelling approach. Cross bars illustrate the range of uncertainty from the model runs.

WPNT06.11 (para. 222) Based on these stock status summaries (Fig. 8) and ongoing increasing catch and effort, the WPNT **RECOMMENDED** that current catch levels are not increased further by constraining catch and/or effort to no more than 2014 levels.