Report of the Fourth Session of the IOTC Working Party on Neritic Tunas

Phuket, Thailand, 29 June – 2 July 2014

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ACRONYMS

AFAD	Anchored fish aggregating device
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_{2011} is the fishing mortality estimated in the year 2011
FAD	Fish aggregating device
F_{MSY}	Fishing mortality at MSY
FRI	Frigate tuna
GLM	Generalized liner model
GUT	Indo-Pacific king mackerel
IO	Indian Ocean
IOTC	Indian Ocean Tuna Commission
KAW	Kawakawa
LL	Longline
LOT	Longtail tuna
M	Natural mortality
MPF	Meeting participation fund
MSY	Maximum sustainable yield
n.a.	Not applicable
NGS	Next Generation Sequencing
NTAD	Non-target and dependent (species)
PS	Purse-seine
ROS	Regional Observer Scheme
SC	Scientific Committee of the IOTC
SB	Spawning biomass (sometimes expressed as SSB)
SB_{MSY}	Spawning stock biomass which produces MSY
SNP	Single Nucleotide Polymorphisms
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 4th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT04) was held in Phuket, Thailand, from 29 June to 2 July 2014. A total of 37 participants (42 in 2013, 35 in 2012) attended the Session, including the Invited Expert Dr. Shijie Zhou from CSIRO, Australia.

The following are a subset of the complete recommendations from the WPNT04 to the Scientific Committee, which are provided at Appendix XIII.

Identification cards for tuna and tuna-like species

(para. 11) **NOTING** the excellent work undertaken by the IOTC Secretariat and other experts to develop and finalise the cards for the *Identification of tuna and tuna-like species in the Indian Ocean fisheries*, the WPNT **RECOMMENDED** that the cards be translated, in priority order to the following languages, according to the proportion of total catches of neritic tuna species reported by country, and that the IOTC Secretariat utilise funds from both the 2014 and 2015 IOTC budget, as well as external funding sources to translate and print the identification cards. Number in brackets represents the recent proportion of the total neritic tuna catch in the IOTC area of competence:

1) Bahasa (Indonesia 29%) and Malaysian (Malaysia 4%)
2) Persian (Farsi-I.R. Iran 20%) and Arabic (Oman 3%)
3) Hindi (India 18%) and Sinhala (Sri Lanka 5%)
4) Urdu (Pakistan 7%)

Revision of the WPNT Program of Work (2014–2018)

(para 175) The WPNT **RECOMMENDED** that the SC request the Commission further increases the IOTC Capacity Building budget line so that capacity building workshops/training can be carried out in 2015 and 2016 on the collection, reporting and analyses of catch and effort data for neritic tuna and tuna-like species. Where appropriate these training sessions shall include information that explains the entire IOTC process from data collection, reporting, verification, analysis, the development of scientifically based management advice and how the advice is used by the Commission to develop Conservation and Management Measures.

(para 176) The WPNT **RECOMMENDED** that the SC request that the Commission further increases the IOTC Capacity Building budget line so that capacity building training on data analysis and applied stock assessment approaches, with a priority being data poor approaches, can be carried out in 2015 and 2016.

(para 178) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2014–2018), as provided at Appendix VI.

(para 180) The WPNT **RECOMMENDED** that a consultant be hired to assist in building capacity among the WPNT participants by supplementing the skill set available within IOTC CPCs to develop data poor stock assessment approaches for neritic tuna stocks. An indicative budget is provided at Table 16.

Meeting participation fund (MPF)

(para 185) The WPNT **RECOMMENDED** that the SC and Commission note the following:

1) The participation of developing coastal state scientists to the WPNT has increased dramatically in recent years 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 17).
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 4th Working Party on Neritic Tunas

(para 191) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT04, 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 three species assigned a stock status in 2014 (Fig. 9):

- 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

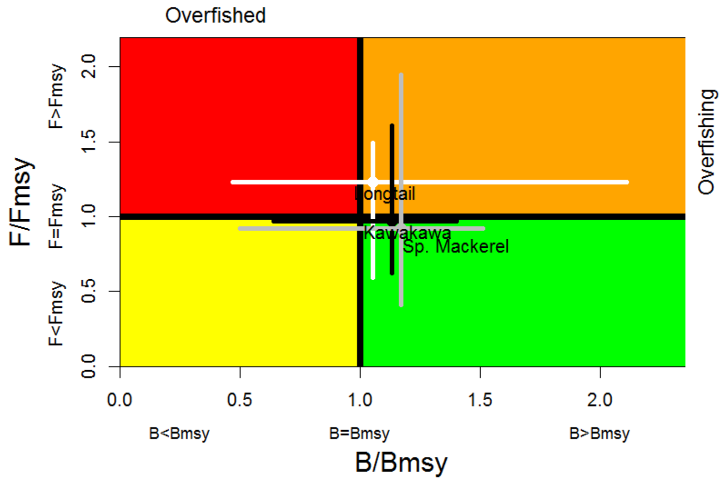

Fig. 9. Combined Kobe plot for kawakawa (black), longtail tuna (white) and narrow-barred Spanish mackerel (grey), showing the 2012 estimates of current stock size (B) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality using the PFCRA approach. Cross bars illustrate the range of uncertainty from the model runs.

A summary of the stock status for neritic tuna and tuna-like species under the IOTC mandate is provided in Table 1.

Table 1. Status summary for species of neritic tuna and tuna-like species under the IOTC mandate: 2014

Stock	**Indicators**		**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**Advice to the Commission**
Neritic tunas: These are important species for small-scale and artisanal fisheries, almost always caught within the EEZs of IO coastal states. They are caught only occasionally by industrial fisheries.									
Bullet tuna *Auxis rochei*	Catch[2] 2012: Average catch[2] 2008–2012: MSY: F_{MSY}: B_{MSY}: F_{2012}/F_{MSY}: SB_{2012}/SB_{MSY}: SB_{2012}/SB_0:	8,878 t 8,475 t unknown unknown unknown unknown unknown unknown							No quantitative stock assessment is currently available for these species in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Aspects of the fisheries for these species 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 management of these species should be applied. Click on each species below for a full stock status summary: • Bullet tuna (*Auxis rochei*) • Frigate tuna (*Auxis thazard*)
Frigate tuna *Auxis thazard*	Catch[2] 2012: Average catch[2] 2008–2012: MSY: F_{MSY}: B_{MSY}: F_{2012}/F_{MSY}: SB_{2012}/SB_{MSY}: SB_{2012}/SB_0:	83,108 t 90,678 t unknown unknown unknown unknown unknown unknown							
Kawakawa *Euthynnus affinis*	Catch 2012: Average catch 2008–2012: MSY: F_{MSY}: B_{MSY}: F_{2012}/F_{MSY}: B_{2012}/B_{MSY}: B_{2012}/B_0:	156,017 t 144,394 t 144 Kt [113–167 Kt] 0.51 217 Kt (168 –152 Kt) 0.97 (0.62–1.61) 1.13 (0.64–1.4) 0.57 (0.32–0.7)							Analysis using a stock-reduction analysis (SRA) approach for a second year indicates that the stock is near optimal levels of F_{MSY}, and stock biomass is near the level that would produce MSY (B_{MSY}). 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**. Click below for a full stock status summary: • Kawakawa (*Euthynnus affinis*)
Longtail tuna *Thunnus tonggol*	Catch 2012: Average catch 2008–2012:	160,532 t 139,971 t							Stock Reduction Analysis techniques indicate that the stock is being exploited at a rate that may have exceeded F_{MSY} in recent years. Based on the weight-of-evidence available to the

Stock	Indicators	2009	2010	2011	2012	2013	2014	Advice to the Commission
Neritic tunas: These are important species for small-scale and artisanal fisheries, almost always caught within the EEZs of IO coastal states. They are caught only occasionally by industrial fisheries.								
	MSY: 120 Kt [79–171 Kt] F_{MSY}: 0.39 (0.27–0.51) B_{MSY}: 255 Kt (173–377 Kt) F_{2012}/F_{MSY}: 1.23 (0.47–2.11) B_{2012}/B_{MSY}: 1.05 (0.59–1.49) B_{2012}/B_0: 0.53(0.3–0.75)							WPNT, including that estimated values of current biomass are near the estimated abundance to produce B_{MSY} in 2012, and that fishing mortality has exceeded F_{MSY} values in recent years, the stock is considered to be **not overfished**, but **subject to overfishing**. Click below for a full stock status summary: • Longtail tuna (*Thunnus tonggol*)
Indo-Pacific king mackerel *Scomberomorus guttatus*	Catch[2] 2012: 46,430 t Average catch[2] 2008–2012: 47,257 t MSY: unknown F_{MSY}: unknown B_{MSY}: unknown F_{2012}/F_{MSY}: unknown SB_{2012}/SB_{MSY}: unknown SB_{2012}/SB_0: unknown							No quantitative stock assessment is currently available for this species in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can 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. Stock status in relation to the Commission's B_{MSY} and F_{MSY} target reference points remains **uncertain**, indicating that a precautionary approach to management of these species should be applied. Click on each species below for a full stock status summary: • Indo-Pacific king mackerel (*Scomberomorus guttatus*)
Narrow-barred Spanish mackerel *Scomberomorus commerson*	Catch 2012: 143,333 t Average catch 2008–2012: 137,117 t MSY: 137 Kt [93–164 Kt] F_{MSY}: 0.47 (0.41–1.95) B_{MSY}: 229 Kt (132–265Kt) F_{2012}/F_{MSY}: 0.92 (0.41–1.95) B_{2012}/B_{MSY}: 1.17 (0.5–1.51) B_{2012}/B_0: 0.59 (0.25–0.75)							Stock Reduction Analysis techniques indicate that the stock is being exploited at a rate that is near F_{MSY} in recent years, and the stock appears to be fully exploited. Stock structure issues remain to be clarified with this stock. Based on the weight-of-evidence available to the WPNT, including the two different SRA approaches pursued in 2014, the stock appears to be **not overfished** and **not subject to overfishing**. Click below for a full stock status summary: • Narrow-barred Spanish mackerel (*Scomberomorus commerson*)

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 4th Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT04) was held in Phuket, Thailand from 29 June to 2 July 2014. A total of 37 participants (42 in 2013, 35 in 2012) attended the Session. The list of participants is provided at Appendix I. The meeting was opened by the Chair, Dr. Prathibha Rohit from India, who welcomed participants to Phuket, Thailand, including the Invited Expert, Dr. Shijie Zhou from CSIRO, Australia.

2. The WPNT **EXPRESSED** its thanks to the BOBLME project that provided financial support to an additional six national scientists to attend the WPNT04 meeting (five in 2013 and six in 2012), and asked the IOTC Secretariat to continue to liaise with BOBLME in the hope that such funding may be offered in 2015.

3. The WPNT **NOTED** the address by Ms Praulai Nootmorn, Director, Marine Fisheries Research and Technological Development Institute, Department of Fisheries, Thailand, who welcomed participants to Thailand and formally opened the 4th Session of the IOTC Working Party on Neritic Tunas (WPNT04).

4. The WPNT **ACKNOWLEDGED** the participation of the new IOTC Fishery Officer (Science), Dr. Sarah Martin, and that as agreed and requested by the WPNT in 2013, she would work on a range of topics in support of the WPNT Program of Work.

2. Adoption of the Agenda and Arrangements for the Session

5. The WPNT **ADOPTED** the Agenda provided at Appendix II. The documents presented to the WPNT04 are listed in Appendix III.

3. Outcomes of the 16th Session of the Scientific Committee

6. The WPNT **NOTED** paper IOTC–2014–WPNT04–03 which outlined the main outcomes of the 16th Session of the Scientific Committee (SC16), specifically related to the work of the WPNT and **AGREED** to consider how best to progress these issues at the present meeting.

7. **NOTING** that the SC adopted a set of standardised IOTC Working Party and Scientific Committee reporting terminology, contained in Appendix IV of the SC16 Report (para. 23 of the SC16 Report), the WPNT **AGREED** that the terminology (which is provided in opening pages of this WPNT04 Report) will provide greater clarity and remove some of the ambiguity in the way advice is provided to the next level in the Commission's structure.

8. The WPNT **RECALLED** that the SC adopted revised '*Guidelines for the presentation of stock assessment models'* in 2012, which includes the minimum requirements for presenting CPUE standardisations. All participants who undertake CPUE standardisations and/or stock assessments for neritic tunas should familiarise themselves with these guidelines (provided in paper IOTC–2014–WPNT04–INF01).

9. The WPNT **RECALLED** the agreement and recommendation from the SC16 that:

   "*…in the absence of reliable evidence relating to stock structure bullet tuna, frigate tuna, kawakawa, longtail tuna, Indo-Pacific king mackerel and narrow-barred Spanish mackerel are assumed to exist as single stocks throughout the Indian Ocean, until proven otherwise. The need for genetic and tagging studies on neritic tunas in order to further define the stock structure of neritic tunas was identified as a high priority*." (para. 35 of the SC16 Report)

   "*...the IOTC Secretariat act in a project coordination role, as well as to seek funding for stock structure projects in the Indian Ocean. Initially, this would require the establishment of an intersessional discussion group with participants from the WPNT, and experts in the field of stock structure differentiation. CPCs with current or planned stock structure studies are encouraged to circulate project proposals to the wider group for comment that may be considered for submitting to prospective funding partners with support from the IOTC Secretariat*." (para. 36 of the SC16 Report)

10. The WPNT **AGREED** that upon request of a CPC/s, the IOTC Secretariat shall assist in the coordination of research activities being developed and implemented at national and regional levels, with the aim of determining the stock structure and more generally, the status of neritic tuna stocks in the IOTC area of competence.

11. **NOTING** the excellent work undertaken by the IOTC Secretariat and other experts to develop and finalise the cards for the *Identification of tuna and tuna-like species in the Indian Ocean fisheries*, the WPNT **RECOMMENDED** that the cards be translated, in priority order to the following languages, according to the proportion of total catches of neritic tuna species reported by country, and that the IOTC Secretariat utilise funds from both the 2014 and 2015 IOTC budget, as well as external funding sources to translate and print the identification cards. Number in brackets represents the recent proportion of the total neritic tuna catch in the IOTC area of competence:
    1) Bahasa (Indonesia 29%) and Malaysian (Malaysia 4%)
    2) Persian (Farsi-I.R. Iran 20%) and Arabic (Oman 3%)
    3) Hindi (India 18%) and Sinhala (Sri Lanka 5%)
    4) Urdu (Pakistan 7%)

4. OUTCOMES OF SESSIONS OF THE COMMISSION

4.1 Outcomes of the 18th Session of the Commission

12. The WPNT **NOTED** paper IOTC–2014–WPNT04–04 which outlined the main outcomes of the 18th Session of the Commission, specifically related to the work of the WPNT and **AGREED** to consider how best to provide the SC with the information it needs, in order to satisfy the Commission's requests, throughout the course of the current WPNT meeting.

13. The WPNT **NOTED** the 7 Conservation and Management Measures (CMMs) adopted at the 18th Session of the Commission (consisting of 6 Resolutions and 1 Recommendation):

    IOTC Resolutions
    1) Resolution 14/01 *On the removal of obsolete Conservation and Management Measures*
    2) Resolution 14/02 *For the conservation and management of tropical tunas stocks in the IOTC area of competence*
    3) Resolution 14/03 *On enhancing the dialogue between fisheries scientists and managers*
    4) Resolution 14/04 *Concerning the IOTC record of vessels authorised to operate in the IOTC area of competence*
    5) Resolution 14/05 *Concerning a record of licensed foreign vessels fishing for IOTC species in the IOTC area of competence and access agreement information*
    6) Resolution 14/06 *On establishing a programme for transhipment by large-scale fishing vessels*

    IOTC Recommendations
    7) Recommendation 14/07 *To standardise the presentation of scientific information in the annual Scientific Committee report and in Working Party reports*

14. The WPNT **ACKNOWLEDGED** the importance of standardising the way in which the subsidiary bodies of the Commission provide advice. Recommendation 14/07, newly adopted at the 18th Session of the Commission, details a range of options for further standardising the way in which advice may be presented in the IOTC Executive Summaries.

15. The WPNT **AGREED** that while the current species Executive Summaries already comply with most of the suggestions contained in Recommendation 14/07, there was always room for improvement. In particular, on the way in which the alternative approaches currently being used for neritic tuna species (data poor stocks), are summarised and presented in the Executive Summaries. The weight-of-evidence approach has been discussed by the WPNT and the SC in previous years as a way of presenting stock status advice for data poor stocks. In 2013, the SC16 encouraged further exploration and potential utilisation of the weight-of-evidence approach to determine stock status by its Working Parties in 2014 and future years.

4.2 Review of Conservation and Management Measures relevant for neritic tunas

16. The WPNT **NOTED** paper IOTC–2014–WPNT04–05 which aimed to encourage participants at the WPNT04 to review some of the existing Conservation and Management Measures (CMM) relating to neritic tunas, noting the CMMs contained in document IOTC–2014–WPNT04–04; and as necessary to 1) provide recommendations to the Scientific Committee on whether modifications may be required; and 2) recommend whether other CMMs may be required. Resolution 13/03 *On the recording of catch and effort data by fishing vessels in the IOTC area of competence* and Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPCs)*, which sets out mandatory minimum recording and reporting requirements for fisheries statistics to the IOTC Secretariat were reviewed by the WPNT.

17. The WPNT **NOTED** that the Commission did not consider amending Resolution 10/02, despite recommendations to do so by the WPNT, WPDCS and SC in 2013. The proposed amendments included a request to add a set of 'Definitions', including those for coastal fisheries, longline fisheries and purse seine fisheries.

5. PROGRESS ON THE RECOMMENDATIONS OF WPNT03

18. The WPNT **NOTED** paper IOTC–2014–WPNT04–06 which provided an update on the progress made in implementing the recommendations from the 3rd Session of the WPNT, and also provided alternative recommendations for those yet to be completed, for the consideration and potential endorsement by participants.

19. The WPNT **REQUESTED** that the 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.

6. NEW INFORMATION ON FISHERIES AND ASSOCIATED ENVIRONMENTAL DATA RELATING TO NERITIC TUNAS

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

20. The WPNT **NOTED** paper IOTC–2014–WPNT04–07 Rev_1 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 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPCs)*, for the period 1950–2012. A summary is provided at Appendix IVa–IVf.

21. **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 598,297 t being landed in 2012 (617,943 t in 2011; 561,434 t in 2010), the WPNT **AGREED** that neritic tunas should receive appropriate management resources from the IOTC, and additional support from the IOTC Secretariat.

22. 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 the Appendix, to make efforts to remedy the data issues identified and to report back to the WPNT at its next meeting.

General discussion on data

23. **NOTING** that the data held by the IOTC Secretariat on neritic tuna species has improved substantially over the past few years, the WPNT **RECALLED** the current minimum data recording and reporting requirements that were adopted by the Members of the Commission under Resolution 13/03 *On the recording of catch and effort data by fishing vessels in the IOTC area of competence* and Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPCs)*. All participants to the WPNT04 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 13/03 and Resolution 10/02.

24. **NOTING** the indication from Kenya that it had recently commenced a sampling program aimed at improving its data collection program and that over the course of the coming year the catch data will be processed, the WPNT **REQUESTED** that the IOTC Secretariat provide technical assistance during the processing of the data, so as to share experiences from other areas, and assist in the evaluation of the Kenyan sampling program and analysis of the catch data.

25. **NOTING** that some CPCs do not currently have a sampling scheme dedicated to the recording of effort, catch and size frequency data for neritic tuna species under the IOTC mandate, the WPNT **REQUESTED** that the IOTC Secretariat assist CPCs to coordinate the development of project proposals in order to seek support from funding agencies to develop the necessary data collections systems.

26. **NOTING** that some CPCs, in particular from India, have collected large data sets on neritic tuna species over long time periods, the WPNT **REQUESTED** that this data, as well as data from other CPCs, be submitted to the IOTC Secretariat as per the requirements adopted by IOTC Members in Resolution 10/02. 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.

27. **NOTING** the different approaches to data collection in each CPC are not currently documented in a consistent and coordinated manner, the WPNT **REQUESTED** that the IOTC Secretariat undertake, or facilitate the development of a document outlining the data collection strategies currently in place in each CPC to be a useful reference resource for other CPCs in order to share practices and create efficiencies.

28. The WPNT **NOTED** that species misidentification remains a serious impediment to the Secretariat's ability to develop robust estimates of catch history by CPC. CPCs should use the species identification cards developed by the IOTC Secretariat and other experts to undertake the necessary training to ensure those identifying fish are accurately recording the species.

29. The WPNT **NOTED** that although there have not been significant changes to the estimated catch history for longtail tuna since the WPNT meeting in 2012, the IOTC Secretariat has conducted revisions to the catch series for some fleets, primarily Malaysia. Indonesia is also subject to an on-going review of the catch-series by the IOTC Secretariat, and further improvements to the catch series for longtail tuna in particular are expected for the WPNT05.

IOTC Capacity building activities: Data

30. The WPNT **NOTED** the following capacity building projects recently completed in Comoros/Madagascar, Malaysia/Thailand, and Sri Lanka, with the aim of strengthening the implementation of data collection and reporting programs. Several of the activities are due to report data during 2014–15 and are likely to have implications on current and historical catch estimates of IOTC species, including some neritic species:

    - Comoros/Madagascar (joint IOTC & COI-SMARTFISH project). Capacity building and strengthening of the implementation of IOTC CMMs related to the collection and reporting of fisheries data. The main expected outputs are the preparation of a Sampling Design and a Catch Estimation Manual, development of a catch and vessel database and improvements to catch sampling.
    - Malaysia and Thailand: Data mining for neritic tunas (joint IOTC & OFCF project). Review the nominal catch and operational catch-and-effort data collected from the coastal purse seine fisheries and actions required to improve the quality of the data collected from those fisheries. The expected outputs include improvements to the quality of data collected, revision of the catch-and-effort series of kawakawa and longtail tuna for coastal purse seine fisheries of Malaysia and Thailand to improve future abundance estimates derived from these datasets.
    - Sri Lanka: Data collection and management (joint IOTC & BOBLME project). To strengthen data collection in Sri Lanka, in particular species of pelagic sharks. The main expected output is the strengthening of sampling activities (training in sampling, increase in field enumerators and sites sampled, including landing sites in northern Sri Lanka), development of database and data processing training. Sri Lanka has also maintained sampling activities, under the revised sampling scheme, following the termination of support and end of project funding in early 2014.

31. The WPNT **NOTED** paper IOTC–2014–WPNT04–INF02 which provided a progress report of Phase IV of the IOTC-OFCF Project for strengthening and improving statistical systems for tuna resources in the Indian Ocean activities.

32. The WPNT **NOTED** a number of new capacity building projects planned for 2014–15, with a focus on delivering further improvements in the technical expertise and data collected by Indonesia in particular:

    - Indonesia: Review of the coastal fisheries (joint IOTC, OFCF & BOBLME project). Implementation of a pilot project in the Provinces of West Sumatra and North Sumatra to assess catches of neritic tuna species and juvenile tunas, by species, in commercial categories containing more than one species, in particular the categories Tongkol (Longtail tuna: *Thunnus tonggol*) and Tuna. 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. The expected outputs will be the review and improvements to catch series for the coastal fisheries of Indonesia.
    - Indonesia: Data Collection Workshop for the DGCF and Provincial Authorities in Bali and Jawa Timur (joint IOTC & OFCF project). Support the DGCF to review the status of data collection and quality of catch statistics in Bali and Jawa Timur provinces, in particular the collection of fisheries data from oceanic ports and other important landing places, with a focus on catches of juvenile tropical tunas and neritic tuna species. Provide training on sampling techniques and the identification of tuna, tuna-like species and main species of pelagic sharks by enumerators.

- Indonesia: Technical guidance and assistance to improve reporting of data at the DGCF (joint IOTC & OFCF project). Provide assistance DGCF to data processing for data collected from the longline fishery, in particular length frequency data, which Indonesia has not reported since 2010. Improve the compliance of Indonesia in terms of IOTC Resolution 10/02; submission of data to enable the Working Parties to help develop stock status indicators and increase the amount of data available for comprehensive stock assessments of IOTC species in the future.

6.2 Review new information on fisheries and associated environmental data

I.R. Iran neritic tuna fisheries

33. The WPNT **NOTED** paper IOTC–2014–WPNT04–09 which provided an overview of the role and importance of neritic tuna catches by the I.R. Iran fleets, including the following abstract provided by the authors:
“*There are around 12 thousand fishing crafts in I.R. Iran in different classes which are engaged in fishing activities. Total volume of country catches in 2012 was around 500 thousand tonnes of which around 226 thousand tonnes attributed to tuna and tuna-like species which showed a considerable increase of 25 % in compared to previous year. Neritic tuna plays an important role in the livelihood of coastal community. Tuna fish catch quantity in 2012 was equivalent to 144 thousand tonnes. Longtail tuna plays an important role and is in higher value in catch composition of neritic tuna, so that it includes approximately more than 50% of Neritic tuna catches. Longtail tuna catch trend has been accompanied with fluctuation in recent years which depend on different conditions of fishing and exploitation. Since 2006 onward, it shows an increase in trend. Given the importance of tuna fishes in the country and necessary coordination with the secretariat of IOTC to conform to the requirements of the relevant legislation and the provision of relevant executive, was carried out so that the fishing data collection, crew training.*” – See paper for full abstract

34. The WPNT **NOTED** that as a direct result of piracy activities in the western Indian Ocean, many of the vessels from the I.R. Iran targeting tropical tuna species on the high seas moved back to the EEZ of I.R. Iran several years ago to target neritic tuna and tuna-like species. This has resulted in substantial increases in the total catch and effort of neritic tuna and tuna-like species under the IOTC mandate and this pattern remained in 2013 and 2014.

35. The WPNT **NOTED** that substantial catches of neritic tuna and tuna-like species are caught outside of the EEZ of I.R. Iran and in coastal waters. Logbooks are currently only issued/required for those vessels from the I.R. Iran that are fishing on the high seas, as well as the four Iranian purse seine vessels. The monitoring of coastal fisheries is based on port sampling with enumerators using oral information to estimate catches provided by the fishers at 43 of the 63 current landing sites also sampled for effort.

India neritic tuna fisheries

36. The WPNT **NOTED** paper IOTC–2014–WPNT04–10 which provided an overview of the status and of neritic tunas fisheries in India, including the following abstract provided by the authors:
“*India is the prominent coastal nation in Indian Ocean region, engaged in tuna fishing and research. For years together, tuna fishing activities in Indian seas were limited to coastal waters targeting mainly for neritic tunas. Neritic tunas are represented by Little tuna (Euthynnus affinis), Frigate tuna (Auxis thazard), Bullet tunas (Auxis rochei), Longtail tuna (Thunnus tonggol) and Striped Bonito (Sarda orientalis). Neritic tuna are mainly caught by small traditional crafts; which operates mainly gillnets, mini purse seines, ring seines, hook and lines where the main target fish is not tuna rather it is a bycatch but it contributes significantly to the tuna landing. Pole and lines and troll lines are mainly targeting tunas; which also contributes to the tuna fishery, mainly in the Island groups of Indian EEZ. At present the modern fishing fleets are also being deployed to catch the neritic tunas*”. – See paper for full abstract

37. The WPNT **NOTED** the efforts being made by India to improve fisheries data recording and reporting for neritic tuna species through a logbook system and catch sampling (10% coverage), including training on species identification given the large proportion of unidentified neritic tuna species.

India: yield trend, biology and population characteristics of major species

38. The WPNT **NOTED** paper IOTC–2014–WPNT04–11 Rev_1 which provided an overview of the yield trend, biology and population characteristics of major species, including the following abstract provided by the authors:
“*India has a long coastline of 8,129 km and a vast EEZ of 2.02 million km2 rich in fishery diversity and abundance. Fishery wealth is being exploited by 72,559 small to medium mechanized boats, 71,313 motorised crafts and 50,618 non-mechanised crafts. Mechanised sector consists trawlers, gillnetters, dol netters, liners, ring seiners and purse seiners. Fishing activity is manned by 791,808 fulltime and 135,312*

part-time fishers. They fish mainly along the continental shelf and adjacent oceanic waters. Gillnetters targets mainly large pelagics, such as Spanish mackerels and tunas and the liners target perches and elasmobranchs. Fishery of neritic tunas were supported by five species and Spanish mackerel by three species. Neritic tuna catch during 2005-'13 varied between 32,942 t (2005) and 62,065 t (2013) with an average of 48,942 t. Despite distribution and abundance along entire coast, major share of the catch is being realized from south and northwest coasts". – See paper for full abstract

39. The WPNT **NOTED** that the Rapid Stock Assessment method used in this paper (constituting a comparison of the historical maximum catch with the average catch in recent years) did not take into account changes in management such as effort, gears used and area fished which are all highly likely to contribute to the difference in catches over time. It was suggested that alternative approaches should be examined.

Sri Lanka: Neritic tuna fisheries

40. The WPNT **NOTED** paper IOTC–2014–WPNT04–12 which provided an update on the neritic tuna fisheries of Sri Lanka, including the following abstract provided by the authors:
"*This paper presents the trend of neritic tuna fishery in Sri Lanka with an update of the status of resources. In Sri Lanka, neritic tunas were exploited by variety of fishing gears. The main fishing gears used for catching neritic tunas are the ring net and gill net. The fishing seasons and fishing activities are generally associated with the southwest monsoon from (May to September) and the northeast monsoon from November to March. Neritic tuna species are gaining more economic importance in both commercial and local fisheries with higher local consumer demand. Three species of neritic tuna are frequently found in Sri Lankan waters, namely, Euthynnus affinis (kawakawa), Auxis rochei (bullet tuna) and Auxis thazard (frigate tuna). Scomberomorus commerson (narrow-barred Spanish mackerel) dominates the catch of other species associated with neritic tunas. Annual neritic tuna production in 2012 was 12552.46 Mt in Sri Lankan waters* ". – See paper for full abstract

41. The WPNT **NOTED** that the lack of data from the northern areas of Sri Lanka's EEZ is not solely due to a lack of sampling effort, but also because the fishery is not very well developed in this area.

42. The WPNT **NOTED** the size frequency data indicates a high proportion of small, juvenile fish in the landings data, as well as the lack of regulations in place to specifically address the catch of juvenile fish.

43. The WPNT **NOTED** that more than 80% of catches were reported to be caught by offshore fisheries, however, it was clarified that offshore fisheries are characterised here as multi-day vessels travelling further than 10 km, but remaining within the EEZ.

44. The WPNT **NOTED** the high proportion of bullet tuna reported in the Sri Lankan fisheries compared with other CPC findings. As the information on species composition is obtained from fisher logbooks, port sampling by independent enumerators would be useful to validate these data further.

45. The WPNT **NOTED** that disaggregating the length-frequency analysis by gear type might be more informative for management, as it could allow the identification of particular fishing methods which have a higher juvenile catch and so management strategies could be further developed based on this information.

46. **NOTING** that the data currently collected on fishing effort would be very informative for future meetings, the WPNT **ENCOURAGED** Sri Lanka to provide an updated paper for consideration at the next WPNT meeting.

Malaysia: neritic tuna fisheries

47. The WPNT **NOTED** paper IOTC–2014–WPNT04–13 which provided an overview of the neritic tuna fisheries in the Malacca Strait; west coast of Peninsular of Malaysia, including the following abstract provided by the authors:
"*The catches of neritic tuna in the west coast of Peninsular Malaysia (Strait of Malacca) were about 50% of the annual neritic tuna landing in Malaysia. Compared to 2012, the landings of neritic tuna in 2013 from the west coast decreased to 18,200mt from 24,200mt. Nearly 96% of the neritic tuna landings contributed by purse seiners with two main species longtail and kawakawa with the overall ratio of 3:2. There are two types of purse seiners vessels in the west coast; purse seiners using AFAD (AFAD purse seiners) and free school purse seiners (FS purse seiners). The average catch rates of AFAD purse seiners and FS purse seiners were estimated at 2,100 kg/day and 1,769 kg/day respectively while the percentage of neritic tuna caught by the AFAD purse seiners to FS purse seiners 47% and 40% respectively. Species composition from these two type of purse seiners especially ratio trend of longtail and kawakawa were also analyzed to determine possible effect of AFAD on neritic tuna catch composition*."

48. The WPNT **NOTED** that the Malaysian purse seine fishery operating in the Malacca Strait and targeting small pelagics is also catching large amounts of neritic tunas, and that the effort and catches from this fishery have

been steadily increasing over the last decade, although catches in 2013 declined from 2012, as a result of a decline in effort coinciding with the removal of a government fuel subsidy to larger sized coastal purse seine vessels (more than 70 GRT).

49. The WPNT **NOTED** that further analysis of the seasonal catch data, including effort, for earlier years, in addition to disaggregating the catch-and-effort by vessel and gear type might help account for the high variability displayed.

50. The WPNT **NOTED** that catch rates were higher when sets were associated with FADs rather than free schools, however, the high costs associated with creating and maintaining FADs prevents the methods being used more widely. There are currently no legal limits regarding the number of FADs owned.

51. The WPNT **NOTED** the similar species composition for catches associated with FADs and free schools. This is likely to be due to the near shore fishing sometimes undertaken by purse seine vessels which results in a catch comprising a number of species of smaller fish.

Maldives neritic tuna fisheries

52. The WPNT **NOTED** paper IOTC–2014–WPNT04–14 which provided the results of investigations on the change in catch and effort data collection as a cause of decline in reported neritic catches from 2009–12, including the following abstract provided by the authors:

    "*The Ministry of Fisheries and Agriculture introduced logbooks to the tuna fishermen in an effort to strengthen the catch and effort data collection system of the Maldives. As a result of several measures to encourage reporting, the amount of logbook data reported increased through 2010–2012. However, this period saw a decline in catch of 84% for frigate tuna and 51% for kawakawa, compared to 2009. The observed trend needs investigation as it coincided with the increased reporting of logbooks. It was assumed that the decline in reported catch of neritic species was somehow due to the use of logbooks to report catch. Fishermen's reliance on purchase receipts issued by tuna exporting companies as the basis of logbook information would further add to the non-reporting, as the companies do not export neritic species. Investigations of effort and catch from pole-and-line, handline and trolling gear from 2004 – 2012 revealed that the drop in neritic catches was most probably due to decline in effort from pole and line and trolling gear.*" – see paper for full abstract

53. The WPNT **NOTED** that while the logbook system began in 2010, the island office reports also continue to be submitted, so where there are no logbook data, this information is still available.

54. **NOTING** the recent decline in catches of frigate tuna and kawakawa, the WPNT **REQUESTED** that the Maldives undertake further investigation as to the extent to which the declines are the result of a change in the reporting system.

55. The WPNT **NOTED** the decline in effort by the pole and line fishery and corresponding decline in catches of neritic tuna species. The authors indicated that this may be due to the fact that neritic tunas are not exported so their commercial value is low relative to other species.

Maldives size data from fish market

56. The WPNT **NOTED** paper IOTC–2014–WPNT04–15 which provided size variation in neritic tuna landings at Male' fish market, including the following abstract provided by the author:

    "*Only two species of neritic tuna – Euthynnus affinis and Auxis thazard – are caught in the Maldives and is popular among local communities throughout Maldives. Male' fish market is one of the sites across Maldives where large quantities of fish including the two species of neritic tuna are landed and sold for local consumption. This study was conducted over 2012 and 2013 to understand the seasonal variation in size of the two species of neritic tuna landed at the Male' fish market. Regular visits were made to the fish market and the fork lengths of the two species were measured. Analysis of these measurements indicated that both species of neritic tuna landed at the Male' market varies seasonally. Larger Euthynnus affinis are common at the market during the northeast monsoon (December to March). There was no clear size variation with monsoons in the Auxis thazard at the market.*"

57. The WPNT **NOTED** that although the neritic tuna species are generally considered a non-target and dependent (NTAD) species of the pole-and-line fishery for skipjack tuna and yellowfin tuna, at certain times when these two species are in low abundance, fishers will actively target neritic tuna species by fishing around the 50 AFADs currently deployed (limited to 50 by the government) around the Maldives, with most fishing effort focused on atolls in the north. Studies have indicated that tuna remain associated with a particular AFAD for only 3-4 days so they are not considered to have adverse ecological impacts.

58. The WPNT **NOTED** that bullet tuna landings have never been observed at the Male market, whereas Sri Lanka reports high catches of bullet tuna in neighbouring fishing grounds.

59. The WPNT **NOTED** that the sampling method was based on repeat visits to fishing markets based in Male, with surveys carried out at the same time (2 to 4 pm) rather than random sampling throughout the day or complete enumeration of the catch delivered to markets.

60. The WPNT **AGREED** that as the results indicate that juveniles are being landed, further research on the maturity should be undertaken.

61. The WPNT **NOTED** the lack of seasonal variation in size in the fishery compared with the coastal Tanzania fisheries where different gear types are used according to the season, due to the lack of net fishing in the Maldives.

Madagascar: neritic tuna fisheries

62. The WPNT **NOTED** paper IOTC–2014–WPNT04–16 which provided a comparison between the composition of the byproduct of the purse seiners and catch of multi-gear small vessels landed in Madagascar, including the following abstract provided by the author:

> *"Two types of fishery fishing on different zone, landing their products in Madagascar were compared. The first landed their product at Antsiranana Harbor to provide the PFOI. These are the purse seiners operating in the Mozambique Channel, targeting tropical tunas and mainly the skipjack tuna. Among the landed bycatch, not admissible at the PFOI, the by-products are delivered in the local market. The quantity landed was measured and the specific composition of these byproducts were followed by the USTA. The second landed their product in Toamasina to provide local markets. These are small artisanal vessels using multi-gear in the eastern facade of Madagascar. Total catch of 2013 was collected. Two neritic tuna species are identified in the composition of by-product of the year 2013 such as the Frigate tuna (5%) and Wahoo (1%). Small boats also recorded two neritic tuna species such as narrow-barred spanish mackerel (7%) and Wahoo (5%).*" – see paper for full abstract

63. The WPNT **NOTED** the high proportion (52%) of purse seine byproduct classified as "mixture" and suggested that a future study to investigate the species composition and size of specimens in this category would be informative.

Bangladesh: neritic tuna fisheries

64. The WPNT **NOTED** paper IOTC–2014–WPNT04–17 which provided an overview of neritic tuna catches by Bangladesh, including the following abstract provided by the authors:

> "*The study was conducted from July, 2012 to June, 2013 and 7 tuna fish species were recorded of Bangladesh marine territory, mainly south patches & middle ground areas, in artisanal and industrial fishing sector respectively. These seven species are, Auxis thazard* - *Frigate tuna (Lacepede, 1800), A. rochei* - *Bullet tuna (Risso,1810), Euthynnus affinis* - *Eastern little tuna / kawakawa(Cantor, 1849), Thunnus albacares* - *Yellowfin tuna (Bonnaterre,1788), T. obesus* - *Bigeye tuna (Lowe, 1839), T. tonggol* - *Longtail tuna (Bleeker,1851) and Katsuwonus pelamis* - *Skipjack tuna (Linnaeus,1758). Maximum number of small sizes of K. pelamis, T. tonggol and A. rochei are harvested in deep sea fishing and E. affinis, A. thazard and T. obesus are exploited by gillnets and hooks & lines in coastal water areas as by catch and incidentally T. albacares caught in fish trawl and hooks & lines also.*" – see paper for full abstract

65. The WPNT **NOTED** that although this paper was not presented by the authors during the session due to their absence, an update on the Bangladesh fishery for neritic tunas under the IOTC mandate would be useful for the next WPNT meeting.

Sri Lanka neritic tuna fisheries

66. The WPNT **NOTED** paper IOTC–2014–WPNT04–18 which provided an overview of the neritic tuna fisheries in Sri Lanka, including the following abstract provided by the author:

> "*This paper reviews on neritic tuna fisheries in Sri Lanka. The major component of Neritic Tuna namely as Auxis thazard (frigate tuna), Auxis rochei (bullet tuna) and Euthynnus affinis (Kawakawa) in the country. It is observed increasing trend in the past decade (from 2003-2012). Neritic Tuna resources are mainly targeted by coastal artisanal fishing crafts in the country. Out of 53,270 fishing crafts operating in Sri Lanka, including MTRB, NTRB, OFRP, IDAY and IMUL. At present there is a trend to use gear combination for fishing. After the Tsunami and the Civil war in the country, an increase tendency of new access with technical improvement are observed and resulted in the production being increased quality with a higher contribution to the total fish production. This paper reviews three main Neritic Tunas, main fishing gears and with some consideration of neritic tuna production of the past decade*."

67. The WPNT **NOTED** the increasing trend towards multi-day, multi-gear fishing by vessels operated by Sri Lanka, in addition to an expansion of the fishing area in recent years.

68. The WPNT **NOTED** the high proportion of bullet tuna and frigate tuna catches from Sri Lanka compared with the species composition of catches from other countries, such as Maldives, and agreed that the difference should be investigated more closely.

Malaysia: neritic tuna fisheries

69. The WPNT **NOTED** paper IOTC–2014–WPNT04–19 which provided an overview of the neritic tuna fisheries of Malaysia, including the following abstract provided by the authors:

    "*Neritic tuna species are among the important pelagic fish caught by commercial and traditional fishing gears. The main neritic tuna found in Malaysian waters were longtail (Thunnus tonggol) and kawakawa (Euthynnus affinis) while frigate tuna (Auxis thazard) were rarely caught because they were mostly found toward the offshore area. About 45% of the neritic tuna catch in Malaysia were from the Malacca Straits (west coast of Peninsular Malaysia) and the rest are from South China Sea and Sulu and Celebes Sea, east coast of Borneo continent. Annual catch of neritic tuna in the Malacca Straits showed increasing trends but the opposite trends occurred in the South China Sea. The purse seine contributed about 82% of the annual catches of neritic tuna and as the most important fishing gear in neritic tuna fisheries*."

70. The WPNT **NOTED** the low catches of bullet tuna which were classified in the 'neritic tuna' category. As bullet tuna are rarely caught in neighbouring Thailand (except for the northern area of the Andaman Sea), further investigation was suggested.

7. Kawakawa – Review of New Information on Stock Status

7.1 Review new information on the biology, ecology, stock structure, their fisheries and associated environmental data for kawakawa

Review of the statistical data available for the neritic tuna species

71. The WPNT **RECALLED** paper IOTC–2014–WPNT04–07 Rev_1 which provided an overview of the standing of a range of information received by the IOTC Secretariat for kawakawa, in accordance with IOTC Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*, for the period 1950–2012. A summary is provided at Appendix IVc.

Indonesia: Kawakawa length frequency and population parameters

72. The WPNT **NOTED** paper IOTC–2014–WPNT04–20 which provided length frequency distribution and population parameters of kawakawa caught by purse seine in the northwest Sumatra, including the following abstract provided by the author:

    "*Kawakawa is an Indo-West Pacific species, found in warm waters including oceanic islands and archipelagos. The aims of this research were to provide length frequency distribution and population parameters of kawakawa caught by purse seine in northwest Sumatra. The data is the time series data from the research before. Data collection was conducted during a period of July 2012 to December 2013. The result showed that from 4,225 fish were collected with ranged from 23.5 – 61.5 cm, the Von Bertalanffy growth function estimates were L∞ = 64.58 cm, K = 1 year-1 and t0 = -0.12872 years. The annual instantaneous rate of total mortality (Z) was 6.47 year-1, the natural mortality (M) was 1.44 year-1 and the fishing mortality (F) was 5.03 year-1. The exploitation rate (E = 0.78) is almost same with the predicted value (Emax = 0.799) indicating that Euthynnus affinis was fully exploited in the northwest Sumatra.*"

73. The WPNT **NOTED** the length-frequency data came from samples collected over a very short time period (1.5 years) and over a small geographic area where FADs were used. As such, larger individuals within the population may have been missed from the data sampling, leading to the low L∞ and high K estimates. As such, the authors were encouraged to expand the sampling to include a longer time period and other areas.

74. The WPNT **NOTED** the effects of sampling exclusively from purse seine associated schools should be examined for possible bias, if any, in terms of the length frequency of samples.

Kenya: Kawakawa seasonality and size frequency

75. The WPNT **NOTED** paper IOTC–2014–WPNT04–21, which provided an analysis of seasonality and size frequency of kawakawa caught by artisanal fishers in Kenya, including the following abstract provided by the authors:

    "*The State Department of Fisheries (SDF) in Kenya had been conducting routine fisheries data collection based on total enumeration. In order to improve the data collection a Catch Assessment Survey (CAS) was* *undertaken aimed at facilitating and assisting in the generation of important fisheries indicators useful for developing, evaluating policies and fishery management plans for the small scale fisheries. 22 primary and secondary landing sites were selected and among the target species whose length frequency data was to be collected was Euthynnus affinis. The paper looks at the seasonality and length frequency of the species during the one year and compares with the other years data from sports fishing clubs which was also collected at species level. During the sampling period, a total of 1,622 fish were measured. The November to March happened to be the peak season for the species while the average length was 35.8 cm with a length range of between 9 and 96 cm*."

76. The WPNT **NOTED** that most of the kawakawa catches are juveniles caught by beach seines; there are currently no size limits on catches or mesh size regulations in Kenya. This is a highly seasonal fishery in which catches are now monitored onboard vessels using beach seines to account for the discarding that takes place.

77. The WPNT **REQUESTED** that data disaggregated by gear type should be presented by Kenya at the WPNT05 meeting.

7.2 Data for input into stock assessments

Indonesia: CPUE of kawakawa

78. The WPNT **NOTED** paper IOTC–2014–WPNT04–23, which provided analyses of catch per unit effort (CPUE) and fishing gear standardisation for the kawakawa (*Euthynnus affinis*) fishery in Bali Province, including the following abstract provided by the authors:

"*Tunas are very important fish species for marine fisheries in Indonesia. Besides large tunas, another important catch for fishermen in Bali province is neritic tuna include kawakawa (Euthynnus affinis). Kawakawa is the dominant catch with almost 50% of total neritic tuna catch. The objectives of this study were to investigate the catch per unit effort (CPUE) and fishing gear standardization of kawakawa fishery in Bali province. Data were collected from fishery statistics of Bali province from 2004 to 2010. Data analyses were using catch per unit effort (CPUE) and fishing power index (FPI) methods. The highest catch was recorded in 2007 around of 7,342 ton which caught by gill net while the highest catch per unit effort (CPUE) recorded in 2009 with 5.44 ton/unit using purse seine. Based on fishing power index (FPI) calculation, purse seine was the standardized fishing gear to catch kawakawa with the highest average catch of 2.83 ton/unit. This result gives recommendation for fishermen to use purse seine for optimizing the catch of kawakawa* (see Fig. 1)."

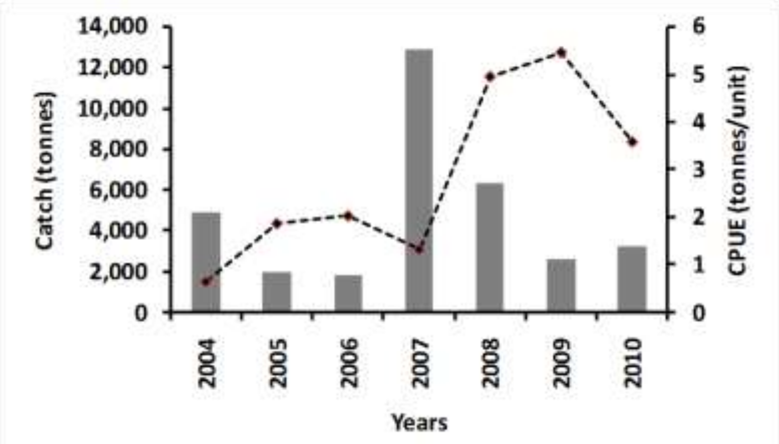

Fig. 1. Kawakawa: Indonesia (Bali province) catch and catch per unit effort (CPUE) of kawakawa (*Euthynnus affinis*) using standardised gear from 2004 to 2010.

79. The WPNT **NOTED** that the results presented provided a good comparison of the relative efficiency of different gear types. It was suggested that finer resolution data from trip reports including information such as area, length of set, vessel size, fishing depth etc., that affect catchability are collected to provide a better indication of abundance.

Maldives: Kawakawa pole and line fishery catch rate standardisation: 2004–12

80. The WPNT **NOTED** paper IOTC–2014–WPNT04–24, which provided a Maldives kawakawa pole-and-line fishery catch rate standardization (2004–12; Fig. 2), including the following abstract provided by the authors:

"*A qualitative description and GLM-based standardization of the Maldivian kawakawa (Euthynnus affinis, KAW) pole and line fishery catch rate data are presented for the period 2004-2012. The raw data consists of around 135,645 records of catch (numbers) and effort (fishing days) by month, atoll and vessel; vessel characteristics were added to the CPUE dataset based on information from the registry of vessels. A subset* *of 24,566 records were extracted from the dataset, identified as records of fishing activity targeting KAW. FAD data was also incorporated into the analysis using the number of active FADS associated with the nearest atoll that landing data is collected from. Techniques similar to those used in the standardization of skipjack tuna were used . The distribution of FADs was split into three regions incorporating the North Atolls, Middle Atoll and South Atolls. Vessel specific data, including hull-type, length of boat (expressed as a vessel size class) and horse power were also used in the analysis. GLM based models using a log response on CPUE were examined."* – see paper for full abstract

81. The WPNT **NOTED** the extremely high proportion of zero catches (65%) which were excluded from the analysis. Use of a zero-inflated model, or including the proportion of skipjack tuna catch along with kawakawa as a covariate should be explored. In addition, using zeros, through a simulation exercise, adding more and more percentage of zeros with positive effort and its effects on the analysis should be examined with the generalised liner model (GLM).

82. The WPNT **NOTED** that although data were filtered to include only vessels which fished for one day per month, exploratory analyses suggested this filter had minimal impact on the results.

83. The WPNT **RECOMMENDED** that the Maldives undertake further investigation of the quality of the catch-and-effort data (i.e., the zero catch records, incidence of one day fishing per month records), and development of a criteria for identifying kawakawa targeted catch, in order to improve the quality of future abundance estimates. Results should be presented at the WPNT05 meeting.

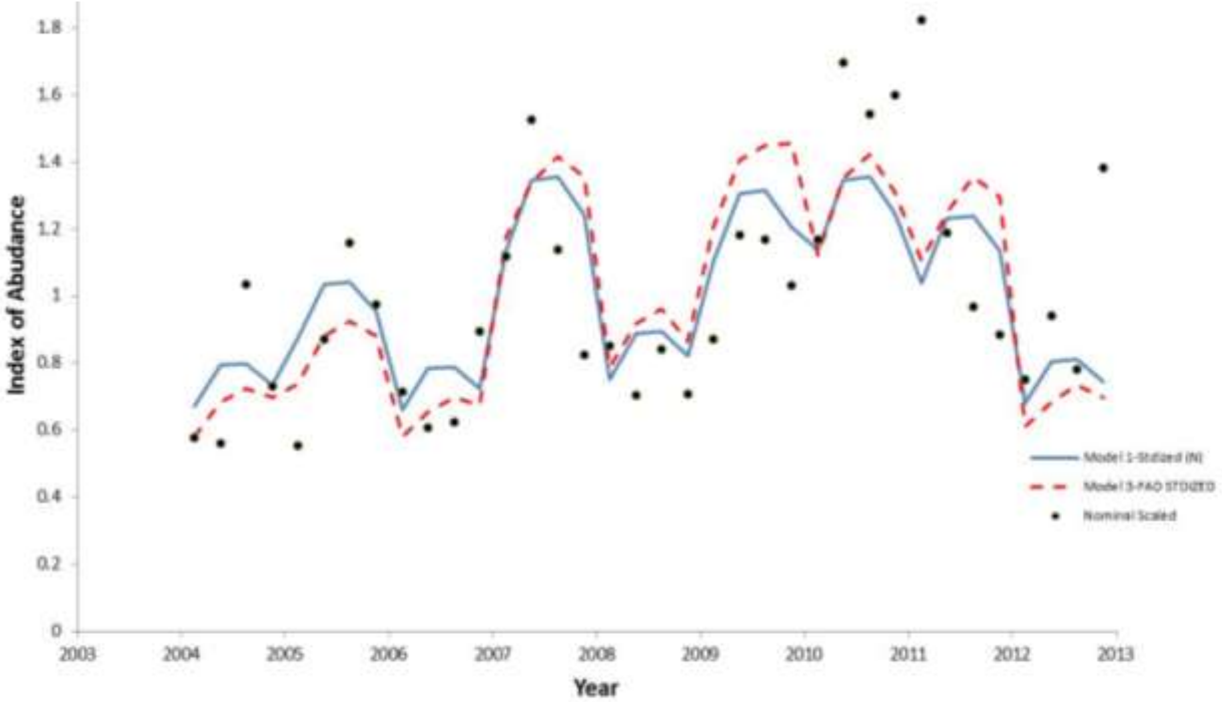

Fig. 2. Kawakawa: Maldives pole-and-line standardised index of abundance (CPUE) using two models (standardised by vessel and atoll; and standardised by FADs), from 2004–2012.

7.3 Stock assessment updates

Summary of stock assessment models in 2014

84. The WPNT **NOTED** that two modelling methods, posterior-focused catch-based assessment method and catch-based stock reduction analysis (SRA) were applied to kawakawa in 2014. Table 2 provides an overview of the key features of each of the stock assessments for kawakawa, while Table 3 provides a summary of the assessment results using the catch reduction approaches. Surplus Production Model (SPM) was also applied to kawakawa CPUE data. However, this classical method had problems in convergence due to non-informative CPUE data so the results from the SPM Model were not included in the final report as it performed poorly and yielded unrealistic results.

85. The WPNT **NOTED** the value of comparing different modelling approaches evaluating alternative hypothesis about the quality of the data used. Evaluating and validating the data is integral in the assessment, as fitting to alternative CPUE indices and assuming different model structures can have a large influence on the assessments. The assessment using SPM was discounted as the CPUE data was not informative and the model had problems in convergence.

Table 2. Kawakawa: Summary of final stock assessment model features as applied in 2014.

Model feature	SRA	PFCRA
Population spatial structure / areas	1	1
Number CPUE Series	0	0
Uses Catch-at-length/age	No	No
Uses tagging data	No	No
Age-structured	No	No
Sex-structured	No	No
Number of Fleets	1 (aggregated catch)	1 (aggregated catch)
Stochastic Recruitment	No	No

Table 3. Kawakawa: Summary of model results for 2014.

Management quantity	SRA	PFSRA
Most recent catch estimate (t) (2012)	156,017 t	156,017 t
Mean catch over last 5 years (t) (2008–2012)	149,917 t	149,917 t
MSY (t) [plausible range]	145 Kt [115–183 Kt]	144 Kt [113–167 Kt]
Data period (catch)	1950–2012	1950–2012
CPUE series	None	None
CPUE period	NA	NA
F_{MSY}	0.45	0.51
B_{MSY}	256 Kt	217 Kt
F_{2012}/F_{MSY} [plausible range]	0.99 (0.54–1.45)	0.97 (0.62–1.61)
B_{2012}/B_{MSY} [plausible range]	1.15 (0.77–1.5)	1.13 (0.64–1.4)
SB_{2012}/SB_{MSY} [plausible range]	n.a.	n.a.
B_{2012}/B_0 [plausible range]	0.58 (0.39–0.75)	0.57 (0.32–0.7)
SB_{2012}/SB_0 [plausible range]	n.a.	n.a
$SB_{2012}/SB_{2012,\ F=0}$	n.a.	n.a.

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

Indian Ocean kawakawa assessment using alternative data poor approaches

86. The WPNT **NOTED** paper IOTC–2014–WPNT04–26 which provided a stock assessment of kawakawa in the Indian Ocean for 2012 using SPM, SRA, and PFSRA including the following abstract provided by the authors:
“*CPUE data derived from the Kawakawa CPUE standardization was used in Surplus Production model assessment. Non-informative priors were used on r, and K, assuming the population was at K when the catch time-series begins in 1950. Catch data was used from 1950 and key reference points, namely SMSY & MSY were estimated using the SIR algorithm. Since there is limited information on the CPUE dataset, the range of estimates on reference points is large. The stock status appears to be healthy and not overfished based on the time-series used, though the model has convergence issues, and has a high degree of confounding in r and K estimates. Informative priors help the model converge, though the model is influenced to large extent by these priors. Due to the lack of contrast in the index of abundance data over*

the period examined, the model has difficulty estimating SMSY, though can still be useful for evaluating stock status and optimal yield targets." – see paper for full abstract

87. The WPNT **AGREED** that the single area model was likely to yield a more robust representation of the current status of the stock given the limitations of and uncertainty associated with the underlying data.

88. **NOTING** the analysis and the non-informative CPUE series used the WPNT **AGREED** not to use the SPM method until better CPUE data that are more representative are developed for the species and applied to the Indian Ocean region.

89. The WPNT **AGREED** to use the catch based methods in the interim and reported advice based on the paper IOTC–2014–WPNT04–25 Rev_1.

Indian Ocean kawakawa assessment using catch-based stock reduction methods

90. The WPNT **NOTED** paper IOTC–2014–WPNT04–25 Rev_1 which included a stock assessment for kawakawa using catch-based stock reduction method, including the following abstract provided by the authors:
"*We conduct stock assessments for three Indian Ocean neritic tuna species, kawakawa, longtail tuna and narrow-barred Spanish mackerel. We used a newly developed posterior-focused catch-based assessment method, and compared them to the traditional SRA approach developed by Kimura et. al. The method is based on a classical biomass dynamics model, requires only catch history but not fishing effort or CPUE. Known population growth rate will improve the assessment result. In this paper, we assume that both species in the whole Indian Ocean belong to a single stock and the population size in 1950 is the virgin biomass equal to their carrying capacities. We use recently updated catch data in the analysis. The preliminary results show that for Kawakawa the median virgin biomass is about 363-469 thousand tonnes depending on the upper depletion level assumed in 2012. The combination of such carrying capacity and growth rate can support a maximum sustainable yield (MSY) of 127-146 thousand tonnes. This means that catch levels in recent year may have exceeded MSY, or is fully exploited."* – see paper for full abstract

91. The WPNT **AGREED** that the approach presented is useful to assess stock status in the near term. Based on the data and assumption of a single Indian Ocean stock in the current region (noting that this assumption may change depending on the results of future studies planned to investigate stock structure), kawakawa is near optimal rate of fishing mortality (F_{MSY}) in recent years and the biomass is at about B_{MSY} levels. However, current catches are probably unsustainable (Table 4, Fig. 3). Nevertheless, given the uncertainty in stock structure in the Indian Ocean, the stock maybe experiencing localised overfishing in some parts of the Indian Ocean.

92. The WPNT **NOTED** that the catch data used has higher uncertainty than tropical tuna and should be acknowledged when presenting results. The assumptions made with depletion levels also drives the analysis, and the depletion levels should be noted, while presenting advice.

Table 4. Kawakawa: Key management quantities from the SRA used in 2014.

Management quantity	Indian Ocean Region
Most recent catch estimate (t) (2012)	156,017 t
Mean catch over last 5 years (t) (2008–2012)	149,917 t
MSY (t) [plausible range]	145 Kt [115–183 Kt]
Data period (catch)	1950–2012
CPUE series	None
CPUE period	n.a.
F_{MSY}	0.45
B_{MSY}	256 Kt
F_{2012}/F_{MSY} [plausible range]	0.99 [0.54–1.45]
B_{2012}/B_{MSY} [plausible range]	1.15 [0.77–1.50]
SB_{2012}/SB_{MSY} [plausible range]	n.a.
B_{2012}/B_0 [plausible range]	0.58 [0.39–0.75]
SB_{2012}/SB_0	n.a.

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

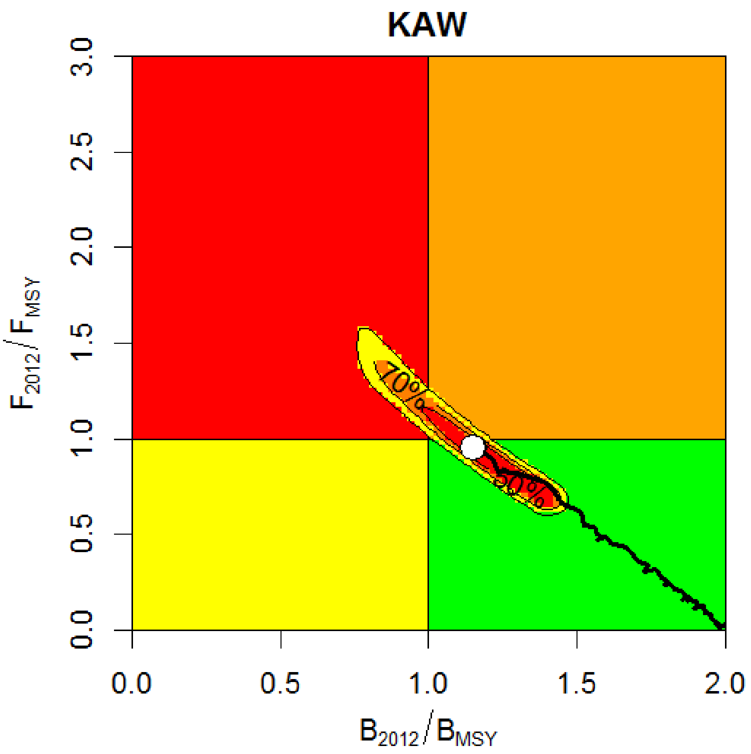

Fig. 3. Kawakawa: SRA Aggregated Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

93. The WPNT **NOTED** that projections for this stock (Table 5) over a 10-year period may not be appropriate bearing in mind the large uncertainties in the outputs from the stock assessment model and the likelihood of increased catch and effort from areas in the northwest Indian Ocean in the near future.

94. The WPNT **NOTED** that considering the uncertainties, the updated stock assessment carried out in 2014 was similar to the results gathered in 2013 which give consistency to the general perception of the stock status. The two assessments in subsequent years indicate similar stock status across years.

Table 5. Kawakawa: 2014 SRA Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of plausible models violating the MSY-based reference points for five constant catch projections (2012 catch level, - 10%, - 20%, - 40% and + 20%) projected for 3 and 10 years. Note: from the 2014 stock assessment using catch estimates at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2012) and weighted probability (%) scenarios that violate reference point**				
	60% (93,610 t)	**70%** (109,212 t)	**90%** (140,415 t)	**100%** (156,017 t)	**120%** (187,220 t)
$B_{2015} < B_{MSY}$	22%	31%	49%	59%	77%
$F_{2015} > F_{MSY}$	3%	14%	41%	56%	88%
$B_{2022} < B_{MSY}$	3%	15%	51%	69%	98%
$F_{2022} > F_{MSY}$	0%	7%	41%	65%	100%

Indian Ocean kawakawa assessment using Posterior Focused Catch Reduction (PFCRA) methods

95. The WPNT **NOTED** that the alternative approach, namely the PFCRA could also be used and would be the preferred form of presenting stock status advice (Table 6, Fig. 4).

Table 6. Kawakawa: Key management quantities from the PFCRA used in 2014.

Management quantity	Indian Ocean Region
Most recent catch estimate (t) (2012)	156,017 t
Mean catch over last 5 years (t) (2008–2012)	149,917 t
MSY (t) [plausible range]	144 Kt [113–167 Kt]
Data period (catch)	1950–2012
CPUE series	None
CPUE period	n.a.
F_{MSY}	0.51
B_{MSY}	217 Kt
F_{2012}/F_{MSY} [plausible range]	0.97 [0.62–1.61]
B_{2012}/B_{MSY} [plausible range]	1.13 [0.64–1.4]
SB_{2012}/SB_{MSY} [plausible range]	n.a.
B_{2012}/B_0 [plausible range]	0.57 [0.32–0.7]
SB_{2012}/SB_0	n.a

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

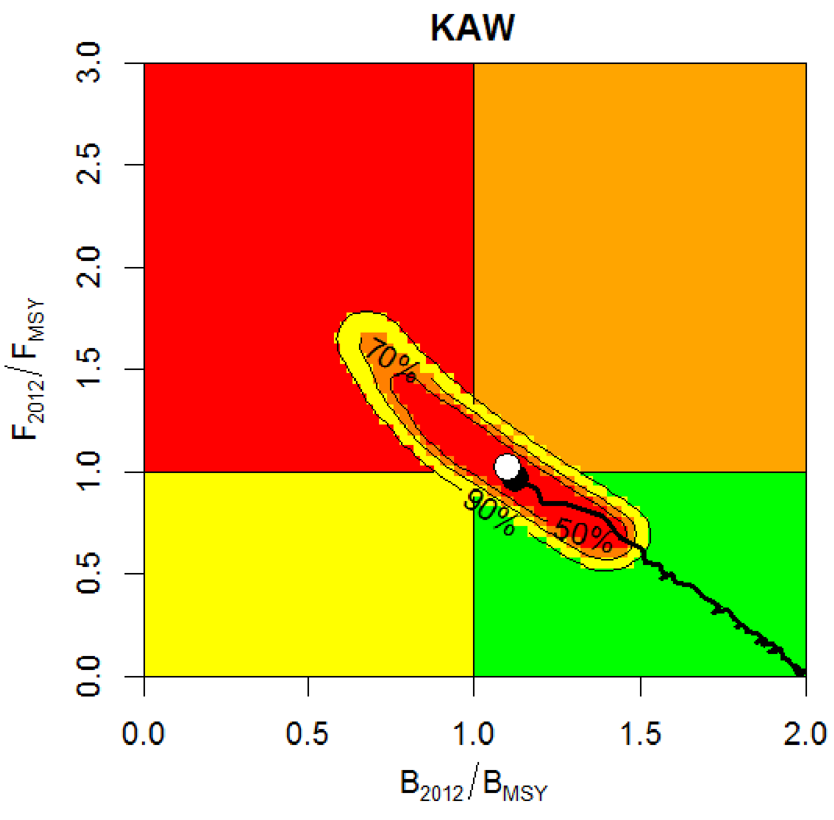

Fig. 4. Kawakawa: PFCRA Aggregated Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the median of the plausible model options is also presented.

96. The WPNT **NOTED** that projections for this stock (Table 7) over a 10-year period may not be appropriate bearing in mind the large uncertainties in the outputs from the stock assessment model and the likelihood of increased catch and effort from areas in the northwest Indian Ocean in the near future.

Table 7. Kawakawa: 2014 PFCRA Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of plausible models violating the MSY-based reference points for five constant catch projections (2012 catch level, -10%, -20%, -40% and +20%) projected for 3 and 10 years. Note: from the 2014 stock assessment using catch estimates at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2012) and weighted probability (%) scenarios that violate reference point**				
	70% (109,212 t)	80% (124,813 t)	**90%** (140,415 t)	**100%** (156,017 t)	**120%** (187,220 t)
$B_{2015} < B_{MSY}$	0%	4%	24%	50%	98%
$F_{2015} > F_{MSY}$	0%	0%	23%	74%	100%
	0%	12%	37%	77%	100%
$B_{2022} < B_{MSY}$	0%	6%	36%	80%	100%
$F_{2022} > F_{MSY}$	0%	4%	24%	50%	98%

7.4 Selection of Stock Status indicators

97. The WPNT **NOTED** that the trajectories for both approaches were very similar and gave similar outcomes, and for reporting and stock status advice would use the PFCRA approach as it was statistically robust.

98. **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 this approach, combined with the weight-of-evidence available (stock status indicators from data poor assessment approaches, species biology, fishery indicators), should be used to determine stock status for kawakawa.

99. The WPNT **AGREED** that stock status management advice for kawakawa should be based on the catch-based stock reduction method, combined with the known species and fishery attributes for status interpretation purposes (PFCRA). The approach presented is useful to assess stock status in the near term, while more traditional stock assessment approaches in the region are deferred until more data are collected and submitted in accordance with the IOTC data recording and reporting requirements for neritic tunas.

7.5 Development of technical advice on the status of kawakawa

100. The WPNT **ADOPTED** the management advice developed for kawakawa (*Euthynnus affinis*) as provided in the draft resource stock status summary – Appendix IX, and **REQUESTED** that the IOTC Secretariat update the draft stock status summary for kawakawa with the latest 2013 catch data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration.

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

8.1 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

101. The WPNT **NOTED** paper IOTC–2014–WPNT04–07 Rev_1 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 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*, for the period 1950–2012. A summary is provided at Appendix IVd.

8.2 Data for input into stock assessments

Reproductive biology of longtail tuna in Thai waters

102. The WPNT **NOTED** paper IOTC–2014–WPNT04–27 Rev_1 which provided the results of a study examining the reproductive biology of longtail tuna in Thai waters, including the following abstract provided by the authors:

"*Reproductive Biology of long tail tuna (Thunnus tonggol) in Thai waters was studied during January to December 2012. Fish samples were collected from purse seiners who had landed at the fishing ports along the Gulf of Thailand and the Andaman Sea. In the Gulf of Thailand, length-weight relationship equations of* *male and female were W = 0.016FL$^{3.039}$ and W = 0.023FL$^{2.936}$ respectively, sex ratio was 1:0.97. Average sizes at the first maturity of male and female were 40.77 and 42.16 cm. Female longtail tuna had fecundity in range 99,773.00 – 3,165,849.00 oocytes. Relation between fecundity and fork length was in equation, F = 6.7*10-9FL$^{7.38756157}$. Spawning season of longtail tuna in the Gulf of Thailand was found all year round, which the peak showed during February to May and July to August. Andaman Sea, length-weight relationship equations of male and female were W = 0.0239FL$^{2.9327}$ and W = 0.0251FL$^{2.9187}$ respectively. While sex ratio between male and female was 1:0.76."* – see paper for full abstract

103. The WPNT **AGREED** that Thailand should present results of an analysis of the age at maturity at the WPNT05 meeting.

104. **NOTING** the higher mean gonadosomatic index of males than females, the WPNT **ENCOURAGED** the authors to investigate this anomalous result further.

105. The WPNT **NOTED** the difference in fecundity between samples from the Gulf of Thailand and the Andaman Sea and the different management taking place in each area based on seasonal and area closures.

Standardisation of longtail tuna catch rates of drift gillnet fisheries in Sultanate of Oman

106. The WPNT **NOTED** paper IOTC–2014–WPNT04–28 which provided a standardisation of longtail tuna catch rates of drift gillnet (fibreglass vessels) fisheries in Sultanate of Oman, including the following abstract provided by the authors:

"*Using available longtail tuna nominal catch and effort data from drift gillnet (fibreglass vessels) fisheries in Oman (2002–2013), we standardized nominal CPUE (N_CPUE) by GLM. Standardized CPUE (STD_CPUE) suggested that it shows continuous decreasing from 2002–2009 then stabilized in the low level (2010–2013).*"

107. The WPNT **NOTED** that while CPUE has fallen to approximately 0.5kg per hour in 2013, the fishery is still profitable due to the mixed species hauls.

108. The WPNT **NOTED** the proportion of records with zero catches (~10%) which were included in this analysis, although it was considered less of a problem than the Maldives dataset as a whole.

109. The WPNT **NOTED** that all data from all boats should have been used rather than a subset. The fits and parameter values should be presented to see whether the catchability or power was increasing over time in the dataset.

8.3 Stock assessment updates

ASPIC stock assessment based on the Oman CPUE

110. The WPNT **NOTED** paper IOTC–2013–WPNT03–34 which provided a stock assessment for longtail tuna in the NW Indian Ocean by ASPIC using standardised CPUE from drift gillnet fisheries in Sultanate of Oman, including the following abstract provided by the authors:

"*We attempted the stock assessment for longtail tuna by ASPIC using the standardized CPUE from Omani drift gillnet fisheries (2001-2012) and the nominal catch (1950-2012). We assumed that there is the NW (Gulf and Oman Sea) stock including waters off Pakistan, Oman, Yemen, Iran and other neighboring countries in the NW region. Results of the ASPIC analysis suggested that the NW longtail tuna stock status is now about entering to the overfishing, i.e., high Fratio (F_{2012}/Fmsy) =1.38 (F2012 is 38% higher than Fmsy) and total biomass (TB) at the MSY level (TB_{2012}/TBmsy) =1.01. The result suggested that if the current F continued, then TB will be in the red zone of the Kobe plot (overfishing status) after 2013.*"

111. The WPNT **NOTED** that there may be a case for localised depletion though there was little genetic evidence to support a separate stock at this stage.

112. The WPNT **NOTED** that the analysis should use a truncated series to avoid convergence issues. The choice of K used was arbitrary and higher values should possibly be used since the bulk of the longtail tuna catch comes from this region.

113. The WPNT **AGREED** that it would be useful to conduct an SRA using the same dataset for the northwest region of the Indian Ocean to compare and further validate the assessment results.

114. The WPNT **AGREED** that while the CPUE from Oman was used in this assessment, in the future, use of a model which includes all CPUE data available (such as the datasets from the Maldives, Thailand, Kenya, Oman and I.R. Iran etc.) should be explored to analyse trends for the entire Indian Ocean.

Indian Ocean longtail tuna assessment using catch-based stock reduction methods

115. The WPNT **NOTED** paper IOTC–2014–WPNT04–25 Rev_1 which included a stock assessment for longtail tuna using catch-based stock reduction method, including the following abstract provided by the authors:

"*We conduct stock assessments for three Indian Ocean neritic tuna species, kawakawa, longtail tuna and narrow-barred Spanish mackerel. We used a newly developed posterior-focused catch-based assessment method, and compared them to the traditional SRA approach developed by Kimura et. al. The method is based on a classical biomass dynamics model, requires only catch history but not fishing effort or CPUE. Known population growth rate will improve the assessment result. In this paper, we assume that both species in the whole Indian Ocean belong to a single stock and the population size in 1950 is the virgin biomass equal to their carrying capacities. We use recently updated catch data in the analysis. The preliminary results show that for Kawakawa the median virgin biomass is about 363-469 thousand tonnes depending on the upper depletion level assumed in 2012. The combination of such carrying capacity and growth rate can support a maximum sustainable yield (MSY) of 127-146 thousand tonnes. This means that catch levels in recent year may have exceeded MSY, or is fully exploited.*" – see paper for full abstract

116. The WPNT **AGREED** that the approach presented is useful to assess stock status in the near term. Based on the data and assumption of a single Indian Ocean stock in the current region, longtail tuna is exceeding the optimal rate of fishing mortality (F_{MSY}) and the biomass is at about B_{MSY} levels (Table 8, Fig. 5).

117. The WPNT **NOTED** that the catch data used has higher uncertainty than tropical tuna and should be acknowledged when presenting results. The assumptions made with depletion levels also drive the analysis, and the depletion levels should be noted, while presenting advice.

Table 8. Longtail tuna: Key management quantities from the SRA used in 2014.

Management quantity	Indian Ocean Region
Most recent catch estimate (t) (2012)	160,531 t
Mean catch over last 5 years (t) (2008–2012)	135,036 t
MSY (t) [plausible range]	135 Kt [99–183 Kt]
Data period (catch)	1950–2012
CPUE series	None
CPUE period	n.a.
F_{MSY}	0.46
B_{MSY}	232.5 Kt
F_{2012}/F_{MSY} [plausible range]	1.08 [0.59–1.58]
B_{2012}/B_{MSY} [plausible range]	1.12 [0.81–1.43]
SB_{2012}/SB_{MSY} [plausible range]	n.a.
B_{2012}/B_0 [plausible range]	0.56 [0.42–0.72]
SB_{2012}/SB_0	n.a.

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

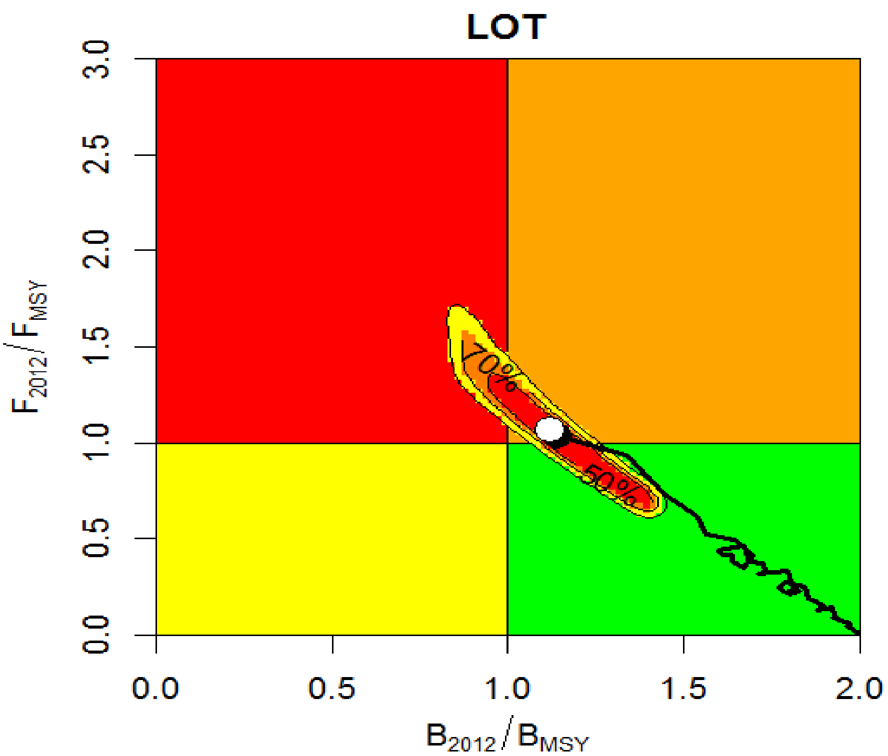

Fig. 5. Longtail tuna: SRA Aggregated Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

118. The WPNT **NOTED** that projections for this stock (Table 9) over a 10-year period may not be appropriate bearing in mind the large uncertainties in the outputs from the stock assessment model and the likelihood of increased catch and effort from areas in the northwest Indian Ocean in the near future.

119. The WPNT **NOTED** that considering the uncertainties, the updated stock assessment carried out in 2014 was similar to the results gathered in 2013 which give consistency to the general perception of the stock status. The two assessments in subsequent years indicate similar stock status across years.

Table 9. Longtail tuna: 2014 SRA Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of plausible models violating the MSY-based reference points for five constant catch projections (2012 catch level, -10%, -20%, -30% and +20%) projected for 3 and 10 years. Note: from the 2014 stock assessment using catch estimates at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2012) and weighted probability (%) scenarios that violate reference point**				
	70% (112,372 t)	**80%** (128,425 t)	**90%** (144,479 t)	**100%** (160,532 t)	**120%** (187,220 t)
$B_{2015} < B_{MSY}$	24%	33%	44%	53%	71%
$F_{2015} > F_{MSY}$	31%	46%	61%	75%	94%
$B_{2022} < B_{MSY}$	22%	40%	59%	75%	96%
$F_{2022} > F_{MSY}$	24%	44%	65%	81%	100%

Indian Ocean longtail tuna assessment using Posterior Focused Catch Reduction (PFCRA) methods

120. The WPNT **NOTED** that the alternative approach, namely the PFCRA was also used and was the preferred method of presenting stock status advice (Table 10, Fig. 6).

Table 10. Longtail tuna: Key management quantities from the PFCRA used in 2014.

Management quantity	Indian Ocean Region
Most recent catch estimate (t) (2012)	160,531 t
Mean catch over last 5 years (t) (2008–2012)	135,036 t
MSY (t) [plausible range]	120 Kt [79–171 Kt]
Data period (catch)	1950–2012
CPUE series	None
CPUE period	n.a.
F_{MSY}	0.39
B_{MSY}	255 Kt
F_{2012}/F_{MSY} [plausible range]	1.23 [0.47–2.11]
B_{2012}/B_{MSY} [plausible range]	1.05 [0.59–1.49]
SB_{2012}/SB_{MSY} [plausible range]	n.a.
B_{2012}/B_0 [plausible range]	0.53 [0.30–0.75]
SB_{2012}/SB_0	n.a.

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

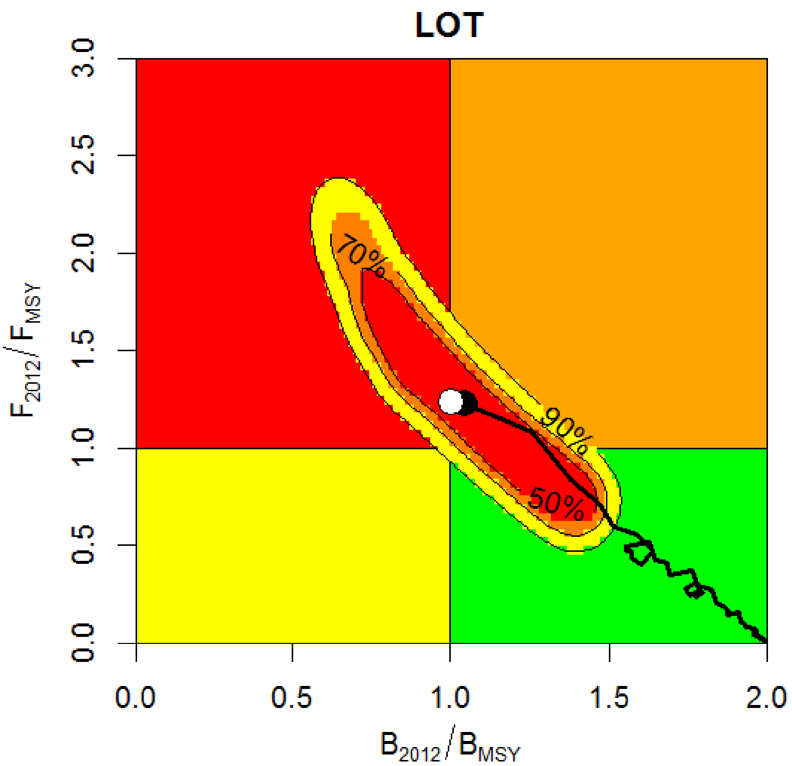

Fig. 6. Longtail tuna: PFCRA Aggregated Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the median of the plausible model options is also presented.

121. The WPTT **NOTED** that projections for this stock (Table 11) over a 10-year period may not be appropriate bearing in mind the large uncertainties in the outputs from the stock assessment model and the likelihood of increased catch and effort from areas in the northwest Indian Ocean in the near future.

Table 11. Longtail tuna: 2014 PFCRA Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of plausible models violating the MSY-based reference points for five constant catch projections (2012 catch level, -10%, -20%, -30% and +20%) projected for 3 and 10 years. Note: from the 2014 stock assessment using catch estimates at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2012) and weighted probability (%) scenarios that violate reference point**				
	70% (112,372 t)	**80%** (128,425 t)	**90%** (144,479 t)	**100%** (160,532 t)	**120%** (187,220 t)
$B_{2015} < B_{MSY}$	17%	37%	67%	87%	96.2%
$F_{2015} > F_{MSY}$	5%	53%	93%	100%	100%
$B_{2022} < B_{MSY}$	24%	56%	80%	95%	100%
$F_{2022} > F_{MSY}$	20%	60%	86%	100%	100%

8.4 Selection of Stock Status indicators

122. The WPNT **NOTED** that the trajectories for both approaches were very similar and gave similar outcomes, and for reporting and stock status advice would use the PFCRA approach as it was statistically robust.

123. **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 this approach, combined with the weight-of-evidence available (stock status indicators from data poor assessment approaches, species biology, fishery indicators), should be used to determine stock status for longtail tuna.

124. The WPNT **AGREED** that stock status management advice for longtail tuna should be based on the catch-based stock reduction method, combined with the known species and fishery attributes for status interpretation purposes. The approach presented is useful to assess stock status in the near term, while more traditional stock assessment approaches in the region are deferred until more data is collected and submitted in accordance with the IOTC data recording and reporting requirements for neritic tunas.

8.5 Development of technical advice on the status of longtail tuna

125. The WPNT **ADOPTED** the 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 2013 catch data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration.

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

9.1 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

126. The WPNT **NOTED** paper IOTC–2014–WPNT04–07 Rev_1 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 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC)*, for the period 1950–2012. A summary is provided at Appendix IVf.

Persian Gulf and Oman Sea: Narrow-barred Spanish mackerel

127. The WPNT **NOTED** paper IOTC–2014–WPNT04–22 Rev_1 which provided a review of the biology, stock status and population dynamic parameters of the narrow–barred Spanish mackerel in the Persian Gulf and Oman Sea, including the following abstract provided by the authors:

"*The narrow–barred Spanish mackerel, Scomberomorus commerson (Lacepède, 1800), forms a large component of catches in the northern part of the Persian Gulf and Oman Sea. It is mainly caught with* *gillnets. In spite of stable fishing effort data about 6500 fishing crafts engaged in tuna fisheries in the last decade, but the S. commerson catch amounts are increasing from 10292 mt in 2008 to 16510 mt in 2012. There are available references related to biology, including reproduction, feeding and population dynamics but the difficulties we face in monitoring and assessment are not these fundamental characteristics of the species, but those that relate to local boundaries are, how large and productive these local stocks are, and, what the real impact is by fishers on local population. It is clear that the primary research problems are about developing methods that yield information on these aspects of the different sub region fishery in the IOTC area.*" – see paper for full abstract

128. The WPNT **NOTED** that while studies are not conclusive, there are potentially two stocks of *S. commerson* in the northwest region of the Indian Ocean. However, this is not an issue only for this region.

129. The WPNT **REQUESTED** that the IOTC Secretariat coordinate a review of the available literature on stock structure across the Indian Ocean to assess the data already available such as the location of spawning grounds to identify potential sub-stocks. The report shall be provided to the WPNT05 meeting in 2015.

Tanzania: Narrow-barred Spanish mackerel

130. The WPNT **NOTED** paper IOTC–2014–WPNT04–29 Rev_1 which provided the results of a study on the growth, mortality and reproductive biology of narrow-bared Spanish mackerel in Tanzania coastal waters, including the following abstract provided by the authors:

"*Scomberomorus commerson samples were collected monthly from April 2012 to August 2013 in the coastal waters of Dar es Salaam (DSM) and Pangani (PN), Tanzania. Growth parameters which included, mortality and spawning patterns were investigated. The estimated growth parameters of the von Bertalanffy function at DSM site was L∞ = 122.59 cm; K = 0.68. The corresponding parameters for the PN site were L∞ = 122.85 cm; K = 0.3. The total mortality estimates were Z = 2.7 yr-1 at DSM and 1.44 yr-1 at PN while natural mortality M was 0.74 and 0.43 yr-1, respectively. Fishing mortality (F) at DSM (1.77 yr-1) and PN (0.9 yr-1) was higher than Fopt and Flimit BRP; indicating that S. commerson along the northern coastal waters of Tanzania is being overexploited. Regional investigation of a number of biological population parameters and ichthyoplankton study is needed for a comprehensive stock assessment of S. commerson.*"

131. The WPNT **NOTED** that catches of *S. commerson* in Tanzanian waters have increased to make up for the shortfall in local fish supply. Given the increased proportion of freshwater fish exported to the EU market, Zambia and D.R.Congo, there has been a shortage of fish in most of the inland areas of the country. The situation has increased demand for *S. commerson* and *E. affinis* given the improved fishing technology in the coastal waters.

132. The WPNT **NOTED** that the estimated value for L∞ was similar, and that the sampling effort for this study should be expanded to increase the sample size and data analysis should use the aggregated samples rather than separating different areas.

133. The WPNT **REQUESTED** information on the genetic structure of *S. commerson* in the coastal waters of Tanzania be presented by Tanzania at the WPNT05 meeting in 2015.

9.2 Data for input into stock assessments

Mozambique: Narrow-barred Spanish mackerel size frequencies

134. The WPNT **NOTED** paper IOTC–2014–WPNT04–30 which provided a comparison between size frequencies of narrow-barred Spanish mackerel caught by artisanal, semi-industrial and sport line fishing in the southern coast of Mozambique, including the following abstract provided by the authors:

"*The narrow-barred Spanish mackerel represent one of main commercial large pelagic fish harvested in the costal fisheries within the Mozambique EEZ. One of the main gear used to exploit this resource is hook and line (simple hand line gear and by Rod and reel), known as linefishing. This type of fishing is performed by all fishing sectors recognized in Mozambique, thus sub-categorized as artisanal linefishing, semi-industrial linefishing, industrial linefishing and Recreational linefishing. In the present study we analyzed the size frequency of narrow-barred Spanish mackerel harvested by these linefishing segments in southern coast of Mozambique. Size frequency distribution of narrow-barred Spanish mackerel harvested by semi-industrial, Industrial and sport linefishing has similar, with all landing large sized fish. It was found in these about 95% of landed fish ranging from 70 cm to 120 cm. Differently, artisanal linefishing showed impacts on both small size individuals and large size individuals with fishes with fork length less than 30 cm representing about 25% of total fish caught.*"

135. The WPNT **NOTED** the relatively high catches of small (<30cm) *S. commerson* by the artisanal fleet in inshore areas.

9.3 Stock assessment updates

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

136. The WPNT **NOTED** paper IOTC–2014–WPNT04–25 Rev_1 which included a stock assessment for narrow-barred Spanish mackerel using catch-based stock reduction method, including the following abstract provided by the authors:

"*We conduct stock assessments for three Indian Ocean neritic tuna species, kawakawa, longtail tuna and narrow-barred Spanish mackerel. We used a newly developed posterior-focused catch-based assessment method, and compared them to the traditional SRA approach developed by Kimura et. al. The method is based on a classical biomass dynamics model, requires only catch history but not fishing effort or CPUE. Known population growth rate will improve the assessment result. In this paper, we assume that both species in the whole Indian Ocean belong to a single stock and the population size in 1950 is the virgin biomass equal to their carrying capacities. We use recently updated catch data in the analysis. The preliminary results show that for Kawakawa the median virgin biomass is about 363-469 thousand tonnes depending on the upper depletion level assumed in 2012. The combination of such carrying capacity and growth rate can support a maximum sustainable yield (MSY) of 127-146 thousand tonnes. This means that catch levels in recent year may have exceeded MSY, or is fully exploited.*" – see paper for full abstract

137. The WPNT **AGREED** that the approach presented is useful to assess stock status in the near term. Based on the data and assumption of a single Indian Ocean stock in the current region, narrow-barred Spanish mackerel is near optimal rate of fishing mortality (F_{MSY}) and the biomass is around B_{MSY} levels. However, current catches are probably unsustainable. Nevertheless, given the uncertainty in stock structure in the Indian Ocean, the stock may be experiencing localised overfishing in some parts of the Indian Ocean (Table 12, Fig. 7). This is the first attempt to undertake an assessment for narrow-barred Spanish mackerel and uses the same approach as in the other two data poor approaches.

138. The WPNT **NOTED** that the catch data used have a higher uncertainty than tropical tuna and should be acknowledged when presenting results. The assumptions made with depletion levels also drive the analysis, and the depletion levels should be noted while presenting advice.

Table 12. Narrow-barred Spanish mackerel: Key management quantities from the SRA used in 2014.

Management quantity	Indian Ocean Region
Most recent catch estimate (t) (2012)	143,333 t
Mean catch over last 5 years (t) (2008–2012)	137,117 t
MSY (t) [plausible range]	136.5 Kt [106–169 Kt]
Data period (catch)	1950–2012
CPUE series	None
CPUE period	n.a.
F_{MSY}	0.46
B_{MSY}	239 Kt
F_{2012}/F_{MSY} [plausible range]	0.92 [0.53–1.42]
B_{2012}/B_{MSY} [plausible range]	1.17 [0.79–1.49]
SB_{2012}/SB_{MSY} [plausible range]	n.a.
B_{2012}/B_0 [plausible range]	0.59 [0.40–0.75]
SB_{2012}/SB_0	n.a.

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

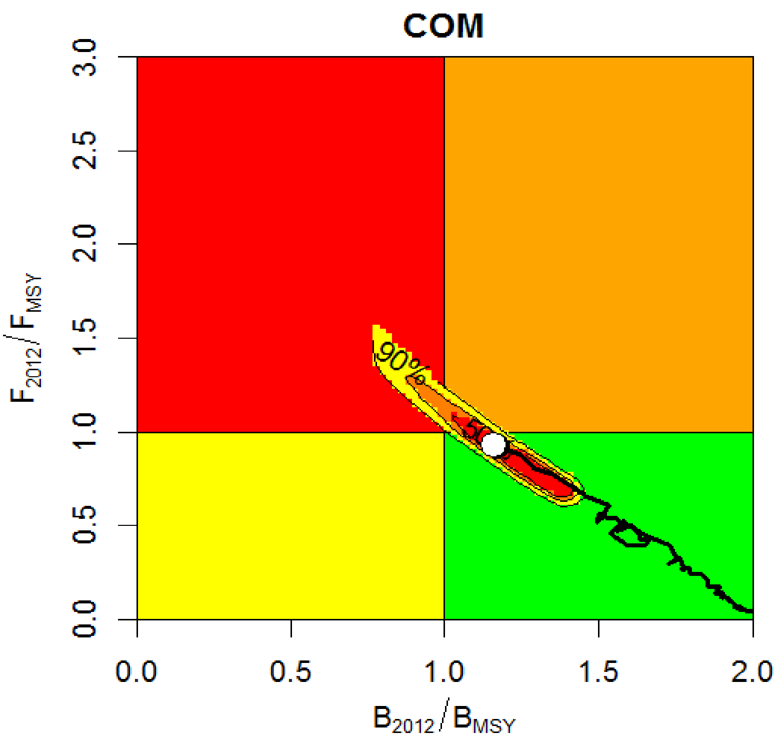

Fig. 7. Narrow-barred Spanish mackerel: SRA Aggregated Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

139. The WPNT **NOTED** that projections for this stock (Table 13) over a 10-year period may not be appropriate bearing in mind the large uncertainties in the outputs from the stock assessment model and the likelihood of increased catch and effort from areas in the northwest Indian Ocean in the near future.

140. The WPNT **NOTED** that considering the uncertainties, the updated stock assessment carried out in 2014 was similar to the results gathered in 2013 which give consistency to the general perception of the stock status. The two assessments in subsequent years indicate similar stock status across years.

Table 13. Narrow-barred Spanish mackerel: 2014 SRA Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of plausible models violating the MSY-based reference points for five constant catch projections (2012 catch level, -10%, -20%, -30% and +20%) projected for 3 and 10 years. Note: from the 2014 stock assessment using catch estimates at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2012) and weighted probability (%) scenarios that violate reference point**				
	70% (100,333 t)	**80%** (114,666 t)	**90%** (129,000 t)	**100%** (143,333 t)	**120%** (172,000 t)
$B_{2015} < B_{MSY}$	10%	18%	25%	34%	53%
$F_{2015} > F_{MSY}$	11%	22%	35%	51%	85%
$B_{2022} < B_{MSY}$	4%	15%	31%	52%	90%
$F_{2022} > F_{MSY}$	5%	18%	35%	59%	99%

Indian Ocean narrow-barred Spanish mackerel assessment using Posterior Focused Catch Reduction (PFCRA) methods

141. The WPNT **NOTED** that the alternative approach, namely the PFCRA could also be used and would be the preferred form of presenting stock status advice (Table 14, Fig. 8).

Table 14. Narrow-barred Spanish mackerel: Key management quantities from the PFCRA used in 2014.

Management quantity	Indian Ocean Region
Most recent catch estimate (t) (2012)	143,333 t
Mean catch over last 5 years (t) (2008–2012)	137,117 t
MSY (t) [plausible range]	137 Kt [93–164 Kt]
Data period (catch)	1950–2012
CPUE series	None
CPUE period	n.a.
F_{MSY}	0.47
B_{MSY}	239 Kt
F_{2012}/F_{MSY} [plausible range]	0.92 [0.41–1.95]
B_{2012}/B_{MSY} [plausible range]	1.17 [0.50–1.51]
SB_{2012}/SB_{MSY} [plausible range]	n.a.
B_{2012}/B_0 [plausible range]	0.59 [0.25—0.75]
SB_{2012}/SB_0	n.a.

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

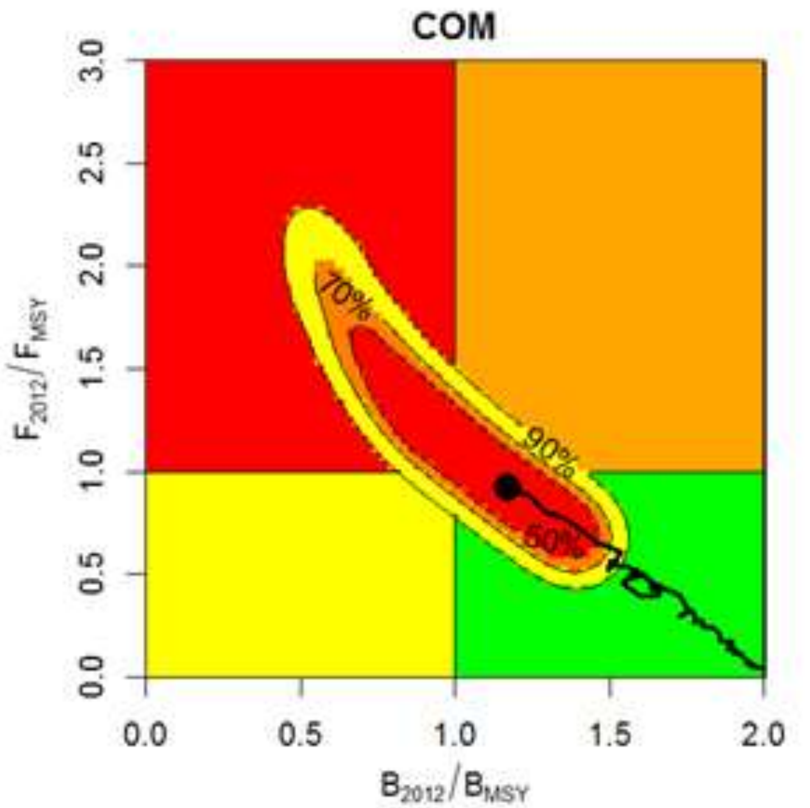

Fig. 8. Narrow-barred Spanish mackerel: PFCRA Aggregated Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

142. The WPNT **NOTED** that projections for this stock (Table 15) over a 10 year period may not be appropriate bearing in mind the large uncertainties in the outputs from the stock assessment model and the likelihood of increased catch and effort from areas in the northwest Indian Ocean in the near future.

Table 15. Narrow-barred Spanish mackerel: 2014 PFCRA Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of plausible models violating the MSY-based reference points for five constant catch projections (2012 catch level, -10%, -20%, -30% and + 20%) projected for 3 and 10 years. Note: from the 2014 stock assessment using catch estimates at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2012) and weighted probability (%) scenarios that violate reference point**				
	70% (100,333 t)	**80%** (114,666 t)	**90%** (129,000 t)	**100%** (143,333 t)	**120%** (172,000 t)
$SB_{2015} < SB_{MSY}$	6%	23%	46%	72%	90%
$F_{2015} > MSY$	0%	10%	54%	90%	99%
$SB_{2022} < SB_{MSY}$	9%	24%	52%	76%	90%
$F_{2022} > MSY$	4%	19%	53%	82%	96%

9.4 Selection of Stock Status indicators

143. The WPNT **NOTED** that the trajectories for both approaches were very similar and gave similar outcomes, and for reporting and stock status advice would use the PFCRA approach as it was statistically robust.

144. **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 this approach, combined with the weight-of-evidence available (stock status indicators from data poor assessment approaches, species biology, fishery indicators), should be used to determine stock status for narrow-barred Spanish mackerel.

145. The WPNT **AGREED** that stock status management advice for narrow-barred Spanish mackerel should be based on the catch-based stock reduction method, combined with the known species and fishery attributes for status interpretation purposes. The approach presented is useful to assess stock status in the near term, while more traditional stock assessment approaches in the region are deferred until more data is collected and submitted in accordance with the IOTC data recording and reporting requirements for neritic tunas.

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

146. 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 2013 catch data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration.

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

10.1 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

147. The WPNT **RECALLED** paper IOTC–2014–WPNT04–07 Rev_1 which provided an overview of the standing of a range of information received by the IOTC Secretariat for bullet tuna, frigate tuna and Indo-Pacific king mackerel, in accordance with IOTC Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*, for the period 1950–2012. Summaries are provided at Appendix IVa, b and e.

10.2 Data for input into stock assessments

India: Neritic tuna fisheries

148. The WPNT **NOTED** paper IOTC–2014–WPNT04–31 which provided a description of the bullet tuna fishery in India, including the following abstract provided by the authors:

"*Auxis rochei the smallest of all tuna species available in Indian waters is distributed along all maritime states but forms a fishery of commercial importance only in the south-west and south east regions*

(Karnataka, Kerala and Tamil Nadu). The fish is in great demand in southern part of the country and targeted fishery is being carried out in southern Kerala and Tamil Nadu. The average annual catch (2006-2013) is estimated at 2,637 t contributing 3.7% of the total tuna landings. The maximum catch of 4,370 was observed during 2011.Commercial exploitation is mainly by gillnets and small hook and lines with the 0-1yr old fishes comprising bulk of the commercial catch. The length weight relationship is given by the formula W=0.0076L 3.249 with no significant different between the sexes. Size at first maturity was estimated at 23.6 cm and fecundity was 12,03,258 eggs. Diet studies indicated a generalist feeding behaviour comprising of zooplankton, fishes and crustaceans as main prey items. Age and growth were estimated using length based methods. The von Bertalanffy growth parameters estimated were L∞ = 42.3 cm, annual K= 0.61 and t0 = -0.0337. Mortality estimates were M= 1.18 and Z= 5.90 and F = 4.72 with a high exploitation ratio of E = 0.80, calling for appropriate management measures to be adopted for continued exploitation at sustainable levels."

149. The WPNT **NOTED** that while there are no species-specific regulations for the multi-species, multi-gear artisanal fisheries, closed seasons are implemented at different times in the east and west for the mechanised units which operate further offshore.

150. The WPNT **NOTED** the high proportion of juvenile catches and the monitoring in place to ensure that the proportion caught above this length does not fall below a target threshold of 30% of the catch.

151. The WPNT **NOTED** the presence of bullet tuna in the Indian catches compared with the absence of bullet tuna landings in the neighbouring Maldives. This is likely to be because of the oceanic island bathymetry of the Maldives which have relatively deep water fisheries compared with Sri Lanka where handlines are often operated in depths shallower than 12 m. The target fisheries are also very different; bullet tuna have been found in the stomach contents of fish in the Lakshadweep islands, but when caught in the fishery the species is generally used as bait for larger fish such as yellowfin tuna so the situation is likely to be similar in the Maldives

Pakistan: Neritic tuna fisheries

152. The WPNT **NOTED** paper IOTC–2014–WPNT04–33 which provided an update on the neritic tuna fisheries of Pakistan, focusing on frigate tuna, including the following abstract provided by the authors:

"*Neritic species contributes substantially to the tuna landings in Pakistan. These species are caught with surface gillnets which are mainly operated in the continental shelf area of Pakistan. Three species i.e. longtail tuna (Thunnus tonggol), kawakawa (Euthynnus affinis) and frigate tuna (Auxis thazard) dominate in the commercial catches. The studies based on analysis of landings data and those collected by on-board observers indicate that neritic tuna species have bimodal seasonal abundance pattern with a major peak in September-October and a minor peak in April-May. A comparison of species composition observed in previous studies was made which reveals a marked difference in species composition in neritic tuna which is primarily dependant on the area of operation of the gillnet vessels*."

153. The WPNT **NOTED** that neritic tuna landings contribute approximately 60% of the total tuna landings (~40,000 t annually) of Pakistan. Gillnets account for the majority of the catch. An improved statistical collection programme established by WWF-Pakistan with the help of the Smart Fishing Initiative reveals that neritic tuna is caught throughout the year and along the entire Pakistan coast. Peak landings occur during October followed by another major peak during April. Longtail tuna is the dominant species followed by kawakawa and frigate tuna.

154. The WPNT **NOTED** the relatively large increases in catch based on the results of the WWF sampling in recent years. This is because in the past, data have been provided by the provinces with no systematic system in place.

155. The WPNT **AGREED** that due to the establishment of the new data collection programme, data provided will now be more compliant with IOTC Resolution 10/02.

156. The WPNT **NOTED** the traditional management measures in place in Pakistan in the form of a two month closed season between June and July which is implemented by all offshore fisheries.

157. The WPNT **NOTED** that WWF-Pakistan has established a database of neritic (and tropical) tuna species and also helping Government of Pakistan in improvement in the collection of landing data through training and improvement in manpower capabilities. WWF-Pakistan plans to involve other regional countries in improvement in data collection and tuna fisheries management through forthcoming GEF funded Areas Beyond National Jurisdiction (ABNJ) Project.

10.3 Stock assessment updates

158. The WPNT **AGREED** that although no stock assessment was undertaken for bullet tuna, frigate tuna and Indo-Pacific king mackerel caught in IOTC fisheries in 2014, further exploratory analysis of the data available should be undertaken and presented at the next WPNT meeting to determine if a data poor approach could be applied.

10.4 Selection of stock status indicators

159. The WPNT **AGREED** that the management advice developed in 2013 shall be rolled over for 2014 with minor updates on species biology and fishery statistics.

10.5 Development of technical advice for other neritic tuna species

160. The WPNT **ADOPTED** the management advice developed for bullet tuna, frigate tuna and Indo-Pacific king mackerel 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, frigate tuna and Indo-Pacific king mackerel with the latest 2013 catch data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration:
    - bullet tuna (*Auxis rochei*) – Appendix VII
    - frigate tuna (*Auxis thazard*) – Appendix VIII
    - Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix IX

11. Research Recommendations and Priorities

161. The WPNT **RECALLED** that the SC, at its 16th Session, requested that all Working Parties provide their work plans with items prioritised based on the requests of the Commission of the SC. (SC16. para. 194). Similarly, at the 18th Session of the Commission, the Scientific Committee was requested to provide its Program of Work on a multi-year basis, with project priorities clearly identified. In doing so, the SC should consider the immediate and longer term needs of the Commission.

11.1 Stock structure of neritic tunas in the Indian Ocean

162. The WPNT **RECALLED** the agreement and recommendation from the WPNT and SC that there was a need for genetic, tagging, and/or microchemistry studies on neritic tunas in order to further define the stock structure of neritic tunas was identified as a high priority. (para. 35 of the SC16 Report)

    "*...the IOTC Secretariat act in a project coordination role, as well as to seek funding for stock structure projects in the Indian Ocean. Initially, this would require the establishment of an intersessional discussion group with participants from the WPNT, and experts in the field of stock structure differentiation. CPCs with current or planned stock structure studies are encouraged to circulate project proposals to the wider group for comment that may be considered for submitting to prospective funding partners with support from the IOTC Secretariat*." (para. 36 of the SC16 Report)

163. The WPNT **AGREED** that at present very little is known about the population structure and migratory range of most of the neritic tuna species. There are likely to be shared stocks among countries and as such, stock assessment and management of these species should be done at the relevant biological scale. Sampling can be done in a phased manner where widely spaced geographical locations are sampled first with addition allocations sampled later, if there is evidence of differentiation among the initial sites. Sampling should initially be focussed on spawning individuals, or very young fish, and multi-year sampling will provide an initial measure of the temporal stability of population structure. If possible standard biological samples (otoliths, gonads, stomachs) should be sampled at the same time to maximise the value of the field component and provide complementary population biology parameters. If population structure is identified across spawning populations, there will be a subsequent need to understand the mixed-stock nature of the fisheries.

164. **NOTING** that a range of papers and projects have been considered on stock structure research at the various IOTC Working Party meetings in recent years, the WPNT **ENCOURAGED** a collaborative approach to the extent feasible to meet the needs of the Commission, which includes a need to determine the level population structure for IOTC species in the Indian Ocean.

165. The WPNT **NOTED** the need to work collaboratively with scientists in the Pacific Ocean to assess stock structure across the two oceans as well as with scientists within the Indian Ocean region.

166. The WPNT **NOTED** an informal presentation by CSIRO who have invested substantially in development of new methods for sustainable harvest and conservation of pelagic fisheries. This has focussed in a few key areas: i) fisheries independent abundance estimation (e.g. close-kin mark-recapture techniques pioneered for southern bluefin tuna; and now being applied to elasmobranchs); ii) genetic tagging as a better alternative to conventional

tagging (again for abundance, fishing/natural mortality, and movement) and; iii) stock structure and provenance for stock assessments and trace-ability.; iv) species identification techniques for processed products.

167. The WPNT **NOTED** the work CSIRO have been doing on tuna population analysis using cost-effective next generation sequencing (NGS) techniques for cost-effective for gathering large-scale fishery-independent data. In parallel, they have developed methods to incorporate the results into management strategy evaluations and fishery assessment models (for southern bluefin tuna).

168. The WPNT **AGREED** that current literature and recent research results presented to the IOTC Scientific Committee, have indicated more structure is present in tuna populations than traditionally assumed. Stock structure in bigeye tuna, yellowfin tuna and skipjack tuna in the Pacific and Indian oceans are being investigated by a range of institutions. For example, two years of sampling bigeye tuna and yellowfin tuna by CSIRO in collaboration with Indonesian colleagues for an ACIAR project have just been completed and initial analysis examining results from otolith microchemistry, parasite load (gill, liver, stomach), and genetic marker data at nine Indonesian locations as well as two out-group populations (Maldives and Solomon Islands) will be complete later this year.

169. The WPNT **NOTED** that another focus of the work has been to minimise the costs involved in sampling, secure the integrity of the material collected and streamline the processing and analysis of DNA using SNP markers and NGS. Costing comparisons to conventional tagging studies in southern bluefin tuna indicate that gene-tagging is currently no more expensive than conventional tagging programs. However, gene tagging offers clear advantages over conventional tags: tag shedding and reporting rate problems are eliminated, tag-induced mortality is reduced, and additional information is collected on stock structure, and sex ratios. Samples that can also be used for Close-kin mark-recapture abundance estimates can be applied to both year class and the adult spawning population.

170. **NOTING** that collaborative efforts with Indonesia (20 years plus) and more recently with the Maldives Fisheries (Marine Stewardship Council pilot project into Skipjack tuna provenance), the WPNT **AGREED** that the timing is right to seek supplementary funding and additional regional partners to extend collaborative model and build capacity in national institutes in the region of the IOTC countries.

171. The WPNT **NOTED** that a concept proposal has been developed to examine population structure of neritic and tropical tunas of interest to the region (and alternative species of interest such as sharks could easily be added). This proposal promotes direct involvement of local countries not only to build local capacity but also to incorporate detailed knowledge on local fisheries often not found in the literature. Often overlooked by short-term studies, this local knowledge can be a key component for successful research projects.

172. The WPNT **AGREED** that there is wide potential for collaborations with other researchers (e.g. sample collection, marker development, marker validation, and analysis). Encouraging capacity building and bringing local knowledge to the project fosters good will and helps to build wider confidence in the results. Furthermore, this approach promotes more effective adoption of the outcomes that are highlighted in objectives of the concept proposal.

173. The WPNT **AGREED** that the IOTC Secretariat shall continue to act in a project coordination role, as well as to seek additional funding, for stock structure projects in the Indian Ocean. CPCs with current or planned stock structure studies are encouraged to circulate project proposals to the wider group for comment that may be considered for submitting to prospective funding partners with support from the IOTC Secretariat.

11.2 Revision of the WPNT Program of Work (2014–2018)

174. The WPNT **NOTED** the range of research projects on neritic tunas and tuna-like species under the IOTC mandate, currently underway, or in development within the IOTC area of competence, and reminded participants to ensure that the projects described are included in their National Reports to the SC, which are due in early November, 2014.

175. The WPNT **RECOMMENDED** that the SC request the Commission further increases the IOTC Capacity Building budget line so that capacity building workshops/training can be carried out in 2015 and 2016 on the collection, reporting and analyses of catch and effort data for neritic tuna and tuna-like species. Where appropriate these training sessions shall include information that explains the entire IOTC process from data collection, reporting, verification, analysis, the development of scientifically based management advice and how the advice is used by the Commission to develop Conservation and Management Measures.

176. The WPNT **RECOMMENDED** that the SC request that the Commission further increases the IOTC Capacity Building budget line so that capacity building training on data analysis and applied stock assessment approaches, with a priority being data poor approaches, can be carried out in 2015 and 2016.

177. The WPNT **RECOMMENDED** that CPCs address issues identified in their current data collection program, such as data shortages, through focusing on the collection of finer scale fishery-dependent data. This might include information on set duration, depth of gear, size etc.

178. The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2014–2018), as provided at Appendix VI.

12. Other Business

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

179. 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 two years as the Invited Expert and his expertise has been greatly appreciated and contributed substantially the stock status determination of three of the neritic tuna species under the IOTC mandate. It was felt that his expertise on data poor approaches in determining stock status should be formalised via a consultant contract for 2015 and 2016.

180. The WPNT **RECOMMENDED** that a consultant be hired to assist in building capacity among the WPNT participants by supplementing the skill set available within IOTC CPCs to develop data poor stock assessment approaches for neritic tuna stocks. An indicative budget is provided at Table 16.

Table 16. Estimated budget required to hire a consultant to carry out data poor stock assessment on neritic tuna and tuna-like species in 2015 and 2016.

Description	**Unit price**	**Units required**	**2015 Total (US$)**	**2016 Total (US$)**
Neritic tuna stock assessments using data poor approaches and/or indicator development (Longtail tuna, kawakawa, narrow-barred Spanish mackerel, Indo-Pacific king mackerel) (fees)	450	25	11,250	11,250
Neritic tuna stock assessment and/or indicator development (travel)	5,000	1	5,000	5,000
		Total estimate	**16,250**	**16,250**

181. 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 2015, 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) Priority species for contribution: kawakawa, longtail tuna or narrow-barred Spanish mackerel, Indo-Pacific king mackerel.

12.2 Date and place of the 5th Working Party on Neritic Tunas

182. The WPNT participants were unanimous in thanking Thailand for hosting the 4th Session of the WPNT and **COMMENDED** Thailand on the warm welcome, the excellent facilities and assistance provided to the IOTC Secretariat in the organisation and running of the Session.

183. **NOTING** that BOBLME covered the entire costs of the meeting within country, including the funding of several participants from BOBLME countries, the WPNT **THANKED** BOBLME and encouraged the IOTC and BOBLME to maintain strong collaborative links, particularly in relation to neritic tuna matters.

184. The WPNT **NOTED** the expression of interest from Tanzania to host the 5th Session of the WPNT in Zanzibar, in early 2015. The IOTC Secretariat shall liaise with Tanzania to confirm the expression of interest. The exact dates and meeting location will be communicated to the Scientific Committee for its consideration at its next session to be held in December 2014.

Meeting participation fund (MPF)

185. The WPNT **RECOMMENDED** that the SC and Commission note the following:
    1) The participation of developing coastal state scientists to the WPNT has increased dramatically in recent years 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 17).

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 17. 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
Total		142	111	52	43

12.3 Review of the draft, and adoption of the Report of the 4th Working Party on Neritic Tunas

186. The WPNT **NOTED** the similarity of the stock assessments for kawakawa, longtail tuna and narrow-barred Spanish mackerel. This is reflective of the source of the data, which is often the same for the three species. Any errors in one dataset are therefore likely to be apparent in the other datasets, raising further questions about the quality of the data provided.

187. The WPNT **AGREED** that better CPUE series and length-frequency sampling estimates are required to enable other assessment models to be used.

188. The WPNT **AGREED** that some CPCs, such as India and I.R. Iran, already have datasets that could provide additional information to inform the stock assessments further and further reduce uncertainty and that these CPCs should share these data with the IOTC Secretariat.

189. The WPNT **AGREED** that a more systematic approach to how data quality is graded should be agreed as more information on data quality is important. While paper IOTC–2014–WPNT04–07 indicates whether data were submitted according to the standards specified in Resolution 10/05, there may be other issues regarding the quality of the data which are not recorded. This includes issues such as years where there might have been missing data, or where certain entries are more uncertain than others.

190. The WPNT **NOTED** the comment that despite all the uncertainties identified, a reduction in effort could be considered as a precautionary approach to manage the stocks.

191. The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT04, 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 three species assigned a stock status in 2014 (Fig. 9):
   - 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

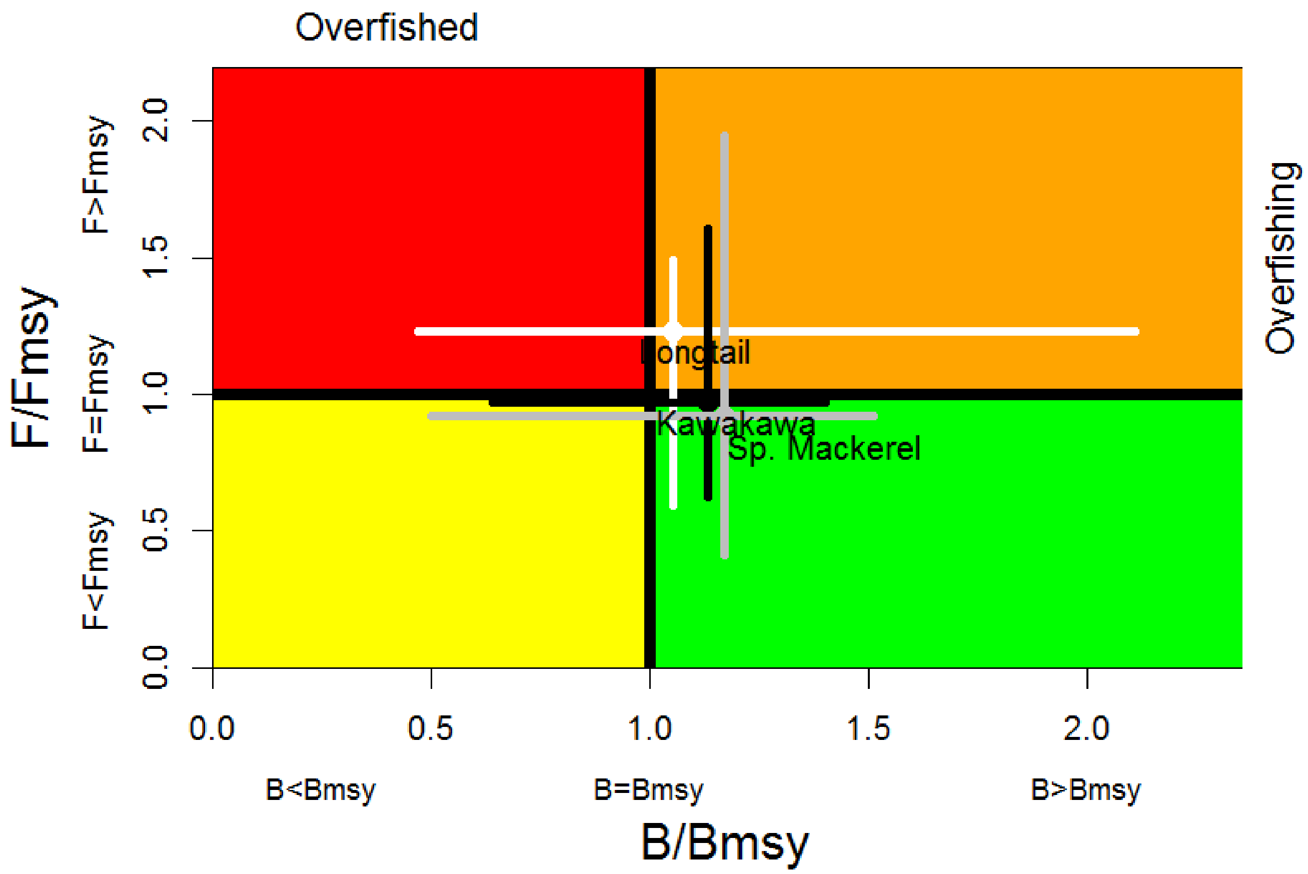

Fig. 9. Combined Kobe plot for kawakawa (black), longtail tuna (white) and narrow-barred Spanish mackerel (grey), showing the 2012 estimates of current stock size (B) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality using the PFCRA approach. Cross bars illustrate the range of uncertainty from the model runs.

192. The report of the 4th Session of the Working Party on Neritic Tunas (IOTC–2014–WPNT04–R) was **ADOPTED** on the 2 July 2014.

APPENDIX I
LIST OF PARTICIPANTS

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APPENDIX II
AGENDA FOR THE 4TH WORKING PARTY ON NERITIC TUNAS

Date: 29 June – 2 July 2014
Location: Phuket, Thailand
Venue: Novotel Phuket Resort, Patong, Phuket, Thailand
Time: 09:00 – 17:00 daily
Chair: Dr. Prathibha Rohit; **Vice-Chair**: Dr. Farhad Kaymaram

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

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

3. **OUTCOMES OF THE 16th SESSION OF THE SCIENTIFIC COMMITTEE** (IOTC Secretariat)

4. **OUTCOMES OF SESSIONS OF THE COMMISSION**
   - 4.1 Outcomes of the 18th Session of the Commission (IOTC Secretariat)
   - 4.2 Review of Conservation and Management Measures relevant for neritic tunas (IOTC Secretariat)

5. **PROGRESS ON THE RECOMMENDATIONS OF WPNT03** (IOTC Secretariat)

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

7. **KAWAKAWA – REVIEW OF NEW INFORMATION ON STOCK STATUS**
   - 7.1 Review new information on the biology, ecology, stock structure, their fisheries and associated environmental data for kawakawa (CPC papers)
   - 7.2 Data for input into stock assessments:
     - o Catch and effort
     - o Catch at size
     - o Growth curves and age-length key
     - o Catch at age
     - o CPUE indices and standardised CPUE indices
     - o Tagging data
   - 7.3 Stock assessment updates
   - 7.4 Selection of Stock Status indicators
   - 7.5 Development of technical advice on the status of kawakawa

8. **LONGTAIL TUNA – REVIEW OF NEW INFORMATION ON STOCK STATUS**
   - 8.1 Review new information on the biology, ecology, stock structure, their fisheries and associated environmental data for longtail tuna (CPC papers)
   - 8.2 Data for input into stock assessments:
     - o Catch and effort
     - o Catch at size
     - o Growth curves and age-length key
     - o Catch at age
     - o CPUE indices and standardised CPUE indices
     - o Tagging data
   - 8.3 Stock assessment updates
   - 8.4 Selection of Stock Status indicators
   - 8.5 Development of technical advice on the status of longtail tuna

9. **NARROW-BARRED SPANISH MACKEREL – REVIEW OF NEW INFORMATION ON STOCK STATUS**
   - 9.1 Review new information on the biology, ecology, stock structure, their fisheries and associated environmental data for narrow-barred Spanish mackerel (CPC papers)
   - 9.2 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

9.3 Stock assessment updates

9.4 Selection of Stock Status indicators

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

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

10.1 Review new information on the biology, stock structure, fisheries and associated environmental data (all)

10.2 Data for input into stock assessments (all)

- Catch and effort
- Catch at size
- Growth curves and age-length key
- Catch at age
- CPUE indices and standardised CPUE indices
- Tagging data

10.3 Stock assessment updates

10.4 Stock status indicators for other neritic tuna species (all)

10.5 Development of management advice for other neritic tuna species (all)

11. RESEARCH RECOMMENDATIONS AND PRIORITIES

11.1 Stock structure of neritic tunas in the Indian Ocean (all)

11.2 Revision of the WPNT Program of Work 2014–2018 (Chair)

12. OTHER BUSINESS

12.1 Development of priorities for an Invited Expert at the next WPNT meeting (Chair)

12.2 Date and place of the 5th Working Party on Neritic Tunas (Chair)

12.3 Review of the draft, and adoption of the Report of the 4th Working Party on Neritic Tunas (Chair)

APPENDIX III
LIST OF DOCUMENTS

Document	Title	Availability
IOTC–2014–WPNT0–01a	Agenda of the 4th Working Party on Neritic Tunas	✓(14 April 2014)
IOTC–2014–WPNT04–01b	Annotated agenda of the 4th Working Party on Neritic Tunas	✓(20 June 2014)
IOTC–2014–WPNT04–02	List of documents	✓(20 June 2014)
IOTC–2014–WPNT04–03	Outcomes of the 16th Session of the Scientific Committee (IOTC Secretariat)	✓(13 June 2014)
IOTC–2014–WPNT04–04	Outcomes of the 18th Session of the Commission (IOTC Secretariat)	✓(13 June 2014)
IOTC–2014–WPNT04–05	Review of current Conservation and Management Measures relating to neritic tuna species (IOTC Secretariat)	✓(13 June 2014)
IOTC–2014–WPNT04–06	Progress made on the recommendations of WPNT03 (IOTC Secretariat)	✓(13 June 2014)
IOTC–2014–WPNT04–07 Rev_1	Review of the statistical data available for the neritic tuna species (IOTC Secretariat)	✓(13 June 2014) ✓(23 June 2014)
IOTC–2014–WPNT04–08	Revision of the WPNT Program of Work (2014–2018) (IOTC Secretariat)	✓(13 June 2014)
IOTC–2014–WPNT04–09	Neritic tuna catch trend in I.R. Iran fishing activities with particular reference to longtail tuna (R.A. Naderi)	✓(11 June 2014)
IOTC–2014–WPNT04–10	An overview of coastal tuna resources and their status along Indian waters (M.K. Sinha, A. Anrose & C. Babu)	✓(12 June 2014)
IOTC–2014–WPNT04–11 Rev_1	Neritic tuna resources of Indian waters, yield trend, biology and population characteristics of major species (E.M. Abdussamad, P. Rohit & K.G. Mini)	✓(17 June 2014) ✓(27 June 2014)
IOTC–2014–WPNT04–12	Importance of neritic tuna in large pelagic fisheries in Sri Lanka (H.A.C.C. Perera, R. Maldeniya & K.H.K. Bandaranayake)	✓(16 June 2014)
IOTC–2014–WPNT04–13	Evaluating catches by FAD and free school purse seiners in the west coast of Malaysia (S. Jamon, S. Basir & E.M.F. Abdullah)	✓(17 June 2014)
IOTC–2014–WPNT04–14 Rev_1	Investigations on the change in catch and effort data collection as a cause of decline in reported neritic catches from 2009 – 2012 (M. Ahusan)	✓(16 June 2014) ✓(20 June 2014)
IOTC–2014–WPNT04–15	Size variation in neritic tuna landings at Male’ fish market (A.R. Jauhary)	✓(17 June 2014)
IOTC–2014–WPNT04–16	Comparison between the composition of by-product of the purse seiners and catch of multi-gear small vessels landed in Madagascar in 2013 (R. Fanazava)	✓(15 June 2014)
IOTC–2014–WPNT04–17	Abundance of tuna fish species in the bay of Bengal of Bangladesh region (R. Bikram Jit, N. Kumar Singha, Md.G. Rahman, S.M. Hasan Ali & Md.F. Alam)	✓(11 June 2014)
IOTC–2014–WPNT04–18 Rev_1	A review on neritic tuna fisheries in Sri Lanka (D.M.H. Damayanthi)	✓(19 June 2014) ✓(27 June 2014)
IOTC–2014–WPNT04–19	Status on neritic tuna in Peninsular Malaysia (E.M. Faizal, S. Basir & S. Jamon)	✓(16 June 2014)
IOTC–2014–WPNT04–20	Length Frequency Distribution and Population Parameters of Kawakawa (*Euthynnus affinis*-Cantor, 1849) Caught by Purse Seine in the Indian Ocean (a Case Study in Northwest Sumatera IFMA 572) (R.K. Sulistyaningsih, I. Jatmiko & A. Wujdi)	✓(13 June 2014)
IOTC–2014–WPNT04–21	Seasonality and size frequency of kawakawa caught by artisanal fishers in Kenya (S. Ndegwa & C. Ndoro)	✓(18 June 2014)
IOTC–2014–WPNT04–22 Rev_1	A review of the biology, stock status and population dynamic parameters of the Narrow – barred Spanish mackerel (*Scomberomorus commerson*) in the Persian Gulf and Oman Sea (F. Kaymaram, N. Niamaimandi, Sh. Ghasemi & A. Vahabnezad)	✓(18 June 2014) ✓(23 June 2014)
IOTC–2014–WPNT04–23	Catch per unit effort (CPUE) and fishing gear standardization for kawakawa (*Euthynnus affinis*) fishery in Bali Province (I. Jatmiko, R.K. Sulistyaningsih & B. Nugraha)	✓(11 June 2014)
IOTC–2014–WPNT04–24	Maldives kawakawa pole and line fishery catch rate standardization: 2004–2012 (R. Sharma, J. Geehan, M.S. Adam & R. Jauhary)	✓(13 June 2014)
IOTC–2014–WPNT04–25 Rev_1	Stock assessment of neritic tuna species in Indian Ocean: kawakawa longtail, and narrow-barred Spanish Mackerel tuna using catch-based stock reduction methods (S. Zhou & R. Sharma)	✓(16 June 2014) ✓(1 July 2014)

Document	**Title**	**Availability**
IOTC–2014–WPNT04–26	Indian Ocean Kawakawa Assessment: Examining alternative data poor approaches (R. Sharma & S. Zhou)	✓(13 June 2014)
IOTC–2014–WPNT04–27 Rev_1	Reproductive biology of longtail tuna in Thai waters (P. Hassadee, A. Yakoh, P. Nootmorn, P. Puntuleng, N. Songkaew & U. Kruanium)	✓(12 June 2014) ✓(13 June 2014)
IOTC–2014–WPNT04–28	Standardization of longtail tuna (*Thunnus tonggol*) catch rates of drift gillnet fisheries in Sultanate of Oman (B. Al-Siyabi, L. Al-kharusi, T. Nishida & H. Al-Busaidi)	✓(25 June 2014)
IOTC–2014–WPNT04–29	Growth, mortality and reproductive biology of narrow-bared Spanish mackerel *Scomberomorus commerson* (Lecepede, 1800) in Tanzania Coastal Waters (M.G. Johnson, Y.D. Mgaya & Y.W. Shaghude)	✓(16 June 2014)
IOTC–2014–WPNT04–30	Comparison between size frequencies of narrow-barred Spanish mackerel caught by artisanal, semi-industrial and sport linefishing in the southern coast of Mozambique (R. Mutombene & C. Chioze)	✓(19 June 2014)
IOTC–2014–WPNT04–31	Distribution and fishery of the bullet tuna *Auxis rochei* (Risso, 1810) along the Indian Coast (P. Rohit, S. Jasmine & E.M. Abdussamad)	✓(11 June 2014)
IOTC–2014–WPNT04–32	Some population parameters of bullet tuna (*Auxis rochei*) in Indian Ocean at Western Part of Sumatera Island, Indonesia (A. Suman & K. Amri)	Withdrawn
IOTC–2014–WPNT04–33	Update on the neritic tuna fisheries of Pakistan with special reference to frigate tuna (*Auxis thazard*) (M. Khan)	✓(16 June 2014)
IOTC–2014–WPNT04–34	Stock assessment of longtail tuna (Thunnus tonggol) in the NW Indian Ocean by ASPIC using standardized CPUE from drift gillnet fisheries in Sultanate of Oman (F.R. Al-Kiyumi, L. Al-Kharusi, T. Nishida & I. Al-Anboori)	✓(25 June 2014)
Information papers		
IOTC–2014–WPNT04–INF01	Guidelines for the presentation of stock assessment models (IOTC Scientific Committee)	✓(13 June 2014)
IOTC–2014–WPNT04–INF01	IOTC-OFCF Project for strengthening and improving statistical systems for tuna resources in the Indian Ocean activities: Phase IV progress report (IOTC Secretariat & K. Sakonju)	✓(24 June 2014)

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

Extract from IOTC–2014–WPNT04–07 Rev_1

Bullet tuna – Fisheries and catch trends

Bullet tuna is caught mainly by gillnet, handline, and trolling, across the broader Indian Ocean area (Table 1; Fig. 1). This species is also an important catch for coastal purse seiners. The catch estimates for bullet tuna were derived from very small amounts of information and are therefore highly uncertain[1].

TABLE 1. Bullet tuna: Best scientific estimates of the catches of bullet tuna by type of fishery for the period 1950–2012 (in metric tonnes) (Data as of May 2014)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Purse seine	-	2	28	278	552	646	612	603	562	635	548	935	1,051	1,372	638	606
Gillnet	41	153	296	531	1,222	1,722	1,525	1,699	1,501	1,840	1,623	2,293	2,577	3,346	2,721	2,872
Line	113	193	325	393	780	1,182	1,034	1,004	999	1,152	1,113	1,881	2,178	2,903	1,165	1,245
Other	5	13	44	242	755	1,278	775	1,239	882	1,390	1,745	1,769	2,000	2,746	3,922	4,155
Total	**159**	**362**	**693**	**1,444**	**3,309**	**4,828**	**3,947**	**4,545**	**3,943**	**5,016**	**5,028**	**6,878**	**7,807**	**10,367**	**8,447**	**8,878**

The catches provided in Table 1 are based on the information available at the IOTC Secretariat and the following observations on the catches cannot currently be verified. 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 (Table 1; Fig. 1).

In recent years the catches of bullet tuna estimated for the fisheries of India, Sri Lanka and Indonesia have represented over 90% of the total combined catches of this species from all fisheries in the Indian Ocean (Fig. 2).

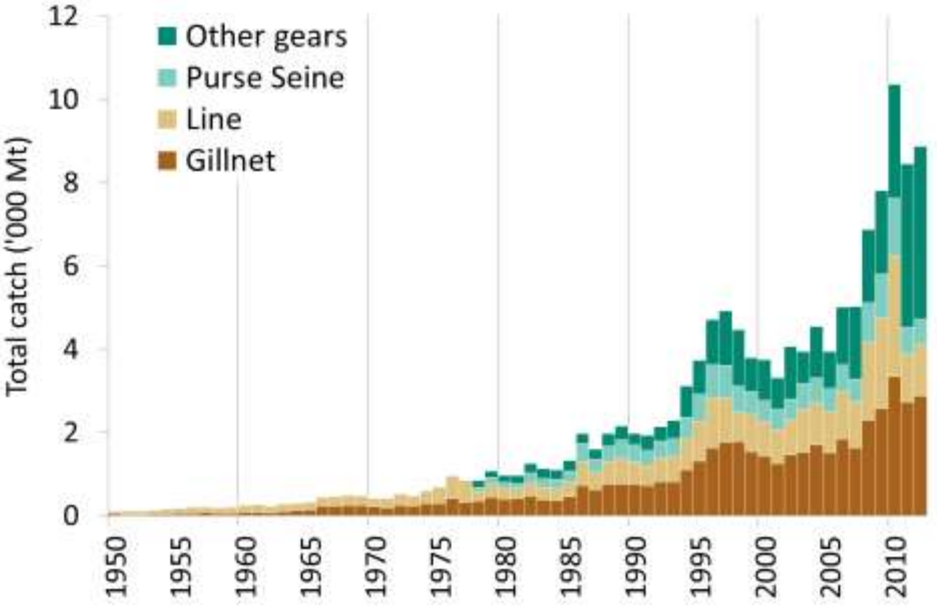


Fig. 1. Bullet tuna: Annual catches of bullet tuna by gear recorded in the IOTC Database (1950–2012)

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

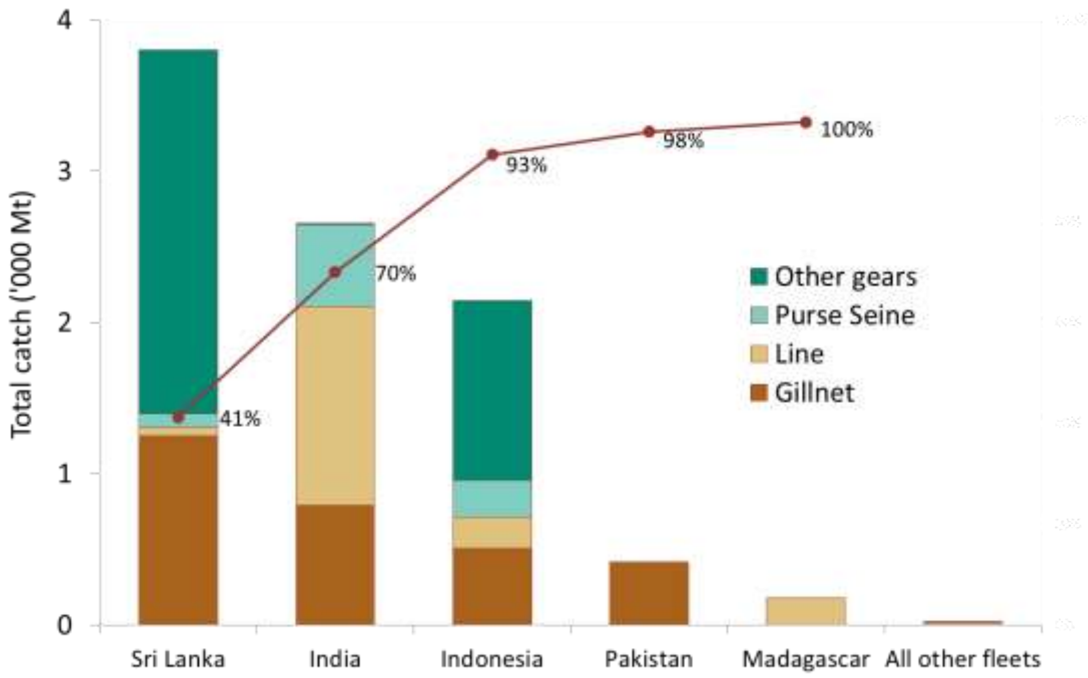


Fig. 2. Bullet tuna**:** average catches in the Indian Ocean over the period 2010–12, by country. Countries are ordered from left to right, according to the importance of catches of bullet tuna reported. The red line indicates the (cumulative) proportion of catches of bullet tuna for the countries concerned, over the total combined catches of bullet tuna reported from all countries and fisheries.

Bullet tuna – Uncertainty of catches

Retained catches are highly uncertain for all fisheries (Fig. 3) 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.
- 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: The catch series of bullet tuna has not changed substantially since the WPNT meeting in 2013.

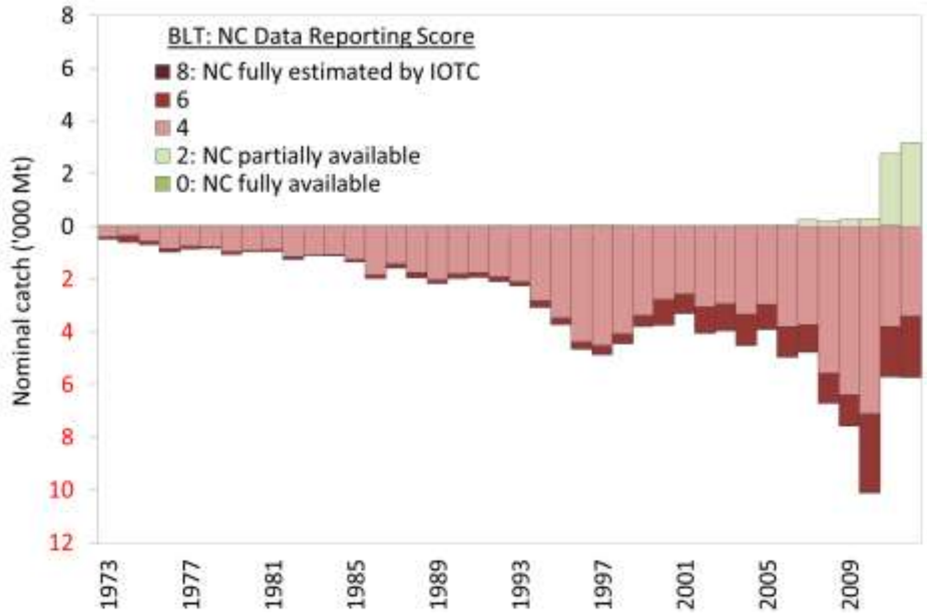


Fig. 3. Bullet tuna: nominal catch; uncertainty of annual catch estimates (1950–2012).

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 2014)

Bullet tuna – Effort trends

Effort trends are unknown for bullet tuna in the Indian Ocean.

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

Catch-and-effort series are not available for most fisheries (Table 2) and, when available, they are usually 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. 4).

TABLE. 2. Bullet tuna: Availability of catches and effort series, by fishery and year (1970–2012)[2]. Note that no catches and effort are available at all for 1950–78.

Gear-Fleet	70		72		74		76		78		80		82		84		86		88		90		92		94		96		98		00		02		04		06		08		10	
PSS-Indonesia																	■																									
GILL-India										■																																
GILL-Indonesia															■	■																										
GILL-Sri Lanka																■	■	■	■	■	■	■			■	■	■	■	■	■	■	■	■	■	■							
LINE-India										■																																
LINE-Indonesia																■																										
LINE-Sri Lanka																	■																									
LINE-Yemen																																		■	■	■	■					
OTHR-Indonesia															■	■		■																								
OTHR-Sri Lanka																						■			■	■	■	■	■	■	■	■	■	■	■							

[2] 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

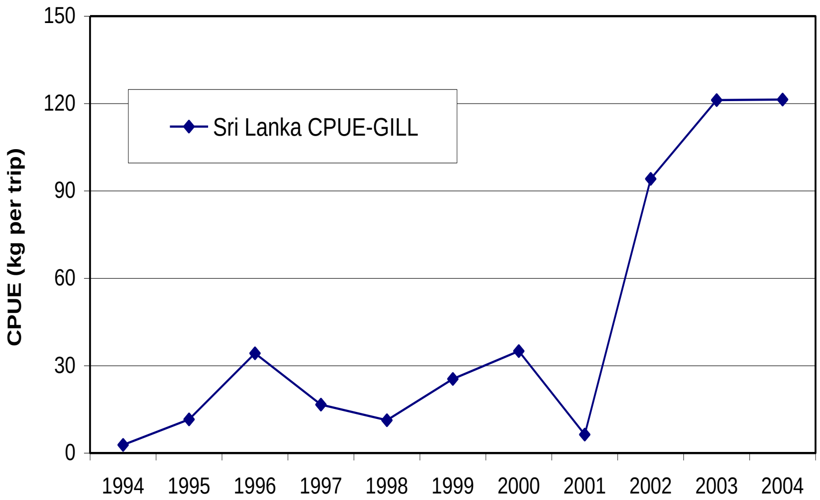
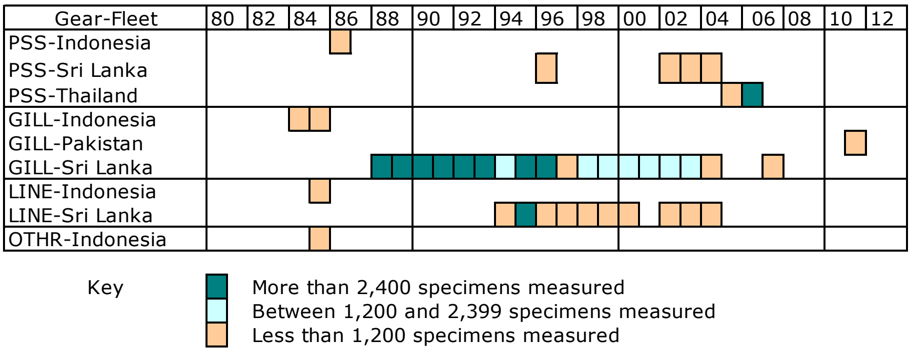


Fig. 4. Bullet tuna: Nominal CPUE series for the gillnet fishery of Sri Lanka derived from the available catches and effort data (1994–2004)

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

- Length frequency data for the bullet tuna is only available for some Sri Lanka fisheries and periods. These fisheries catch bullet tuna ranging between 15 and 35 cm.
- Trends in average weight cannot be assessed for most fisheries. Reasonable long series of length frequency data are only available for Sri Lankan gillnets and lines but the amount of specimens measured has been very low in recent years (Table 3).
- Catch-at-Size(age) data are not available for bullet tuna due to the paucity of size data available from most fleets and the uncertain status of the catches for this species.
- Sex ratio data have not been provided to the Secretariat by CPCs.

TABLE. 3. Bullet tuna: Availability of length frequency data, by fishery and year (1980–2012)[3]. Note that no length frequency data are available at all for 1950–83.



[3] 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–2014–WPNT04–07 Rev_1

Frigate tuna – Fisheries and catch trends

Fisheries and catch trends

Frigate tuna is taken from across the Indian Ocean area using gillnets, handlines and trolling, and pole-and-lines (Table 1; Fig. 1). This 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 1). The catch estimates for frigate tuna were derived from very small amounts of information and are therefore highly uncertain[4].

TABLE 1. 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 2014)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Purse seine	0	13	935	4860	7549	9,838	10145	10341	10096	11004	9649	10054	9571	12038	11237	10105
Gillnet	479	1234	2848	6980	14522	19,734	18662	19251	18316	21524	21941	25217	23579	30874	30476	29771
Line	1270	2413	4420	7423	13751	26,146	22750	25692	22586	25986	27897	34275	34416	38197	38286	29077
Other	1441	2007	2349	3683	9279	13,239	12238	12229	12204	11997	13725	16531	17887	18535	19111	14153
Total	**3,190**	**5,668**	**10,552**	**22,946**	**45,102**	**68,958**	**63,794**	**67,513**	**63,203**	**70,511**	**73,211**	**86,078**	**85,453**	**99,643**	**99,110**	**83,108**

The catches provided in Table 1 are based on the information available at the IOTC Secretariat and the following observations on the catches cannot currently be verified. 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 nearly 100,000 t in 2010 and 2011, with current catches at around 83,000 t. The catches of frigate tuna have been higher in the east since the late 1990's, with ¾ of the catches of frigate tuna taken in the eastern Indian Ocean in recent years.

In recent years, over 90% of catches of frigate tuna have been concentrated in four countries: Indonesia (59%), India (14%), Sri Lanka (11%), and I.R. Iran (7%) (Table 1; Fig. 2).

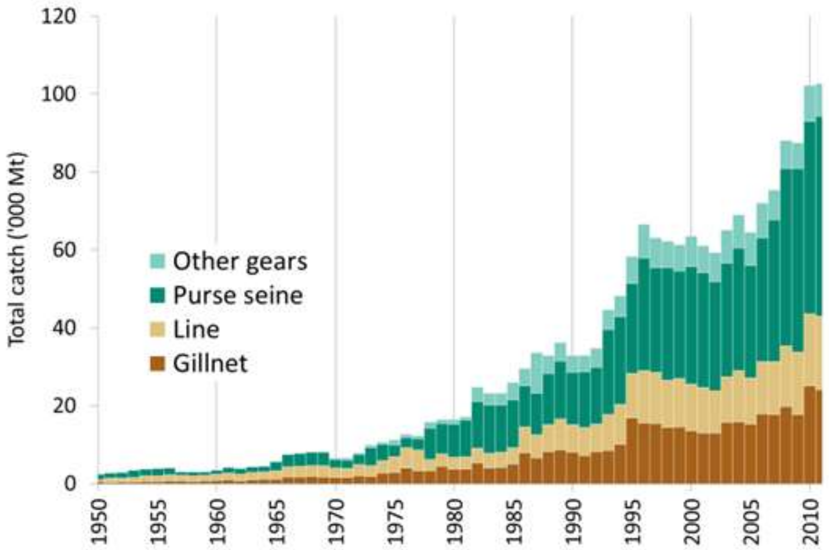


Fig. 1. Frigate tuna: Annual catches of frigate tuna by gear recorded in the IOTC Database (1950–2012)

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

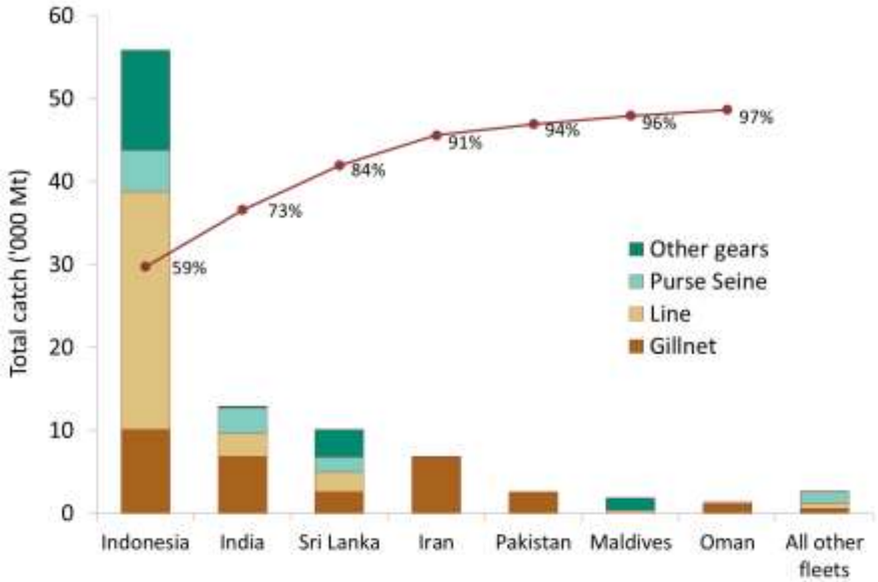


Fig. 2. Frigate tuna: average catches in the Indian Ocean over the period 2010–12, by country. Countries are ordered from left to right, according to the importance of catches of frigate tuna reported. The red line indicates the (cumulative) proportion of catches of frigate for the countries concerned, over the total combined catches of this species reported from all countries and fisheries.

Frigate tuna – uncertainty of catches

Retained catches are highly uncertain (Fig. 3) 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, representing around 59% of the total catches of this species in the Indian Ocean in recent years (2010–12), 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 previous estimates. In recent years, the combined catches of frigate tuna for both countries have represented 24% of the total catches of this species in the Indian Ocean.
- Artisanal fisheries of Myanmar and Somalia: None of these countries have ever reported catches of frigate tuna to the IOTC Secretariat. Catch levels are unknown.
- 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, and 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.
- 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: The overall catch series of frigate tuna has not changed substantially since the WPNT meeting in 2012. The IOTC Secretariat is currently undertaking reviews of the catch series for Indonesia, Malaysia and Thailand which are likely revise the catch estimates for the next WPNT in 2015; however at present the total catches of frigate remain at similar levels when compared to previous estimates.

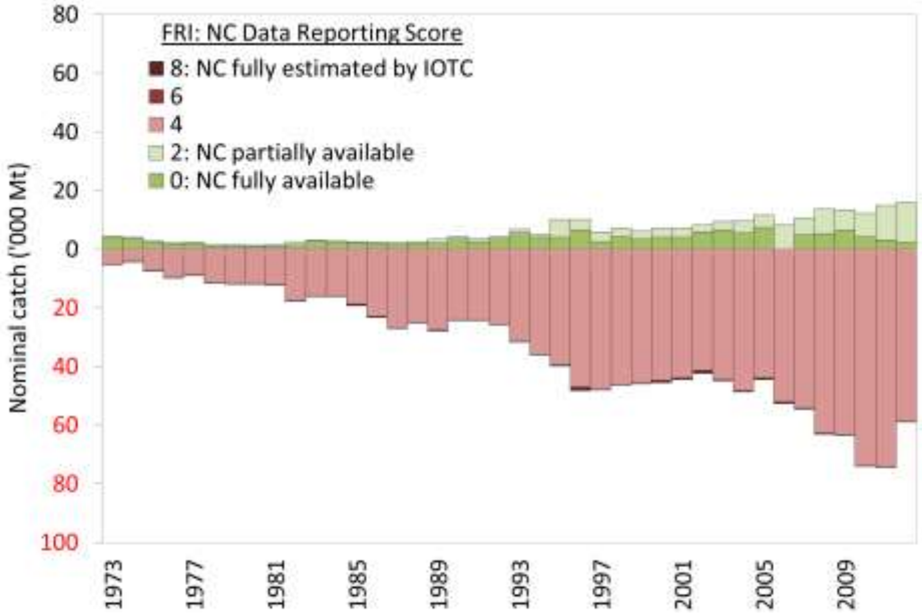


Fig. 3. Frigate tuna: nominal catch; uncertainty of annual catch estimates (1950–2012).

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 2014)

Frigate tuna – Effort trends

Effort trends are unknown for frigate tuna in the Indian Ocean.

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

Catch-and-effort series are available from some fisheries but they are considered highly incomplete (Fig. 5). In most cases catch-and-effort data are only available for short periods. Reasonably long catch-and-effort series (extending for more than 10 years) are only available for Maldives baitboats and hand and troll lines (Fig. 4) and Sri Lanka gillnets. The catches and effort recorded for Sri Lankan gillnets are, however, thought to be inaccurate due to the dramatic changes in CPUE recorded between consecutive years.

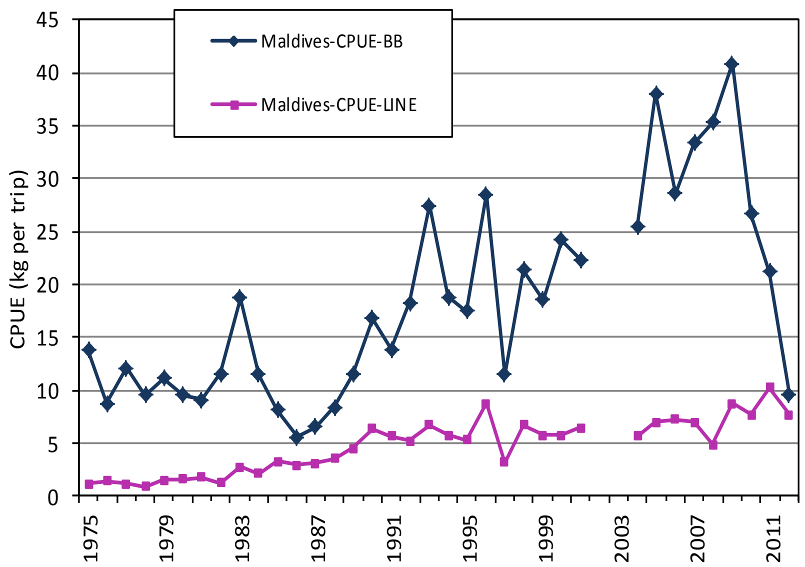
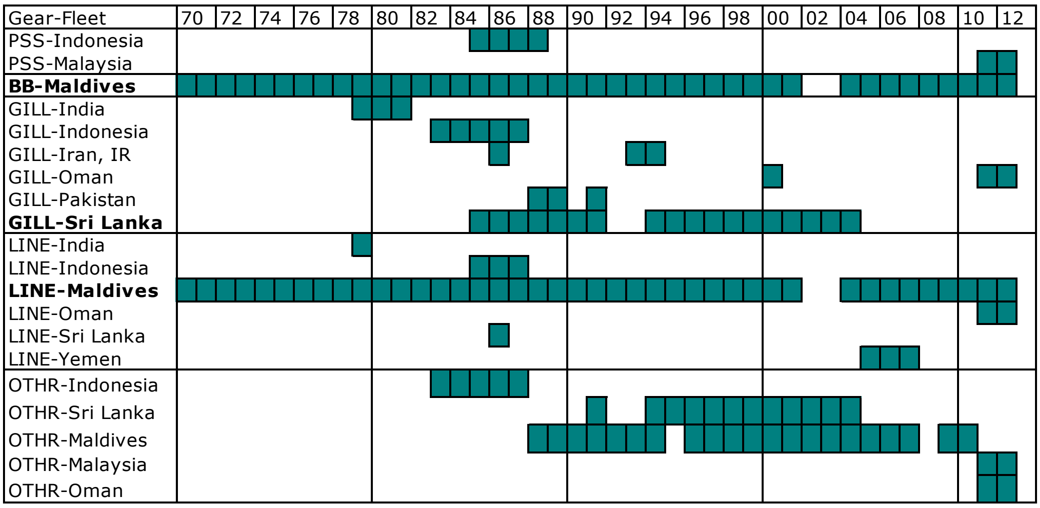


Fig. 4. Frigate tuna: Nominal CPUE series for the baitboat (BB using mechanized boats) and line (LINE, including handlines and trolling using mechanized boats) fisheries of Maldives derived from the available catches and effort data (1975–2012).

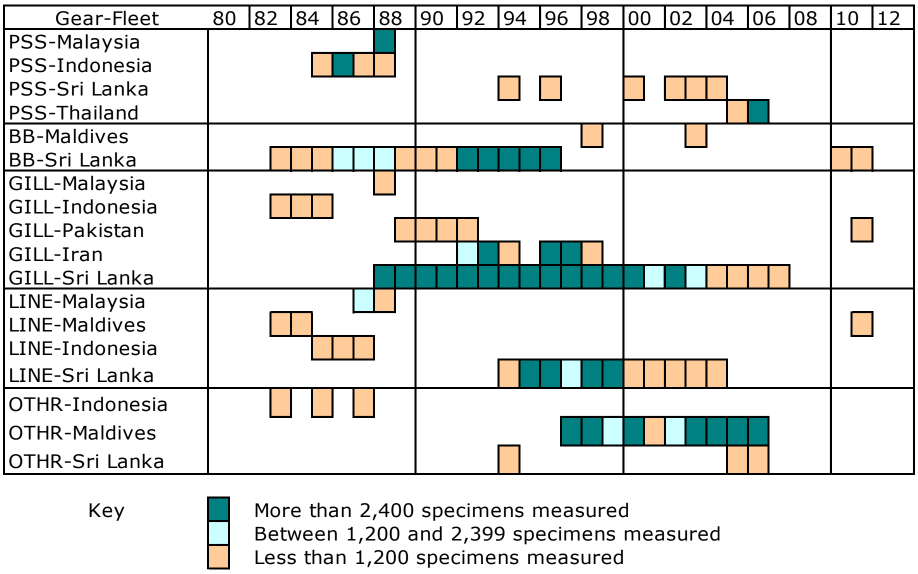
TABLE 2. Frigate tuna: Availability of catches and effort series, by fishery and year (1970–2012) . Note that no catches and effort are available at all for 1950–69.



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

- Trends in average weight can only be assessed for Sri Lankan gillnets and Maldivian pole-and-lines but the amount of specimens measured has been very low in recent years (Table 3). The length frequency data available from the mid-eighties to the early nineties was obtained with the support of the IPTP (Indo-Pacific Tuna Programme). Unfortunately, the data collection did not continue in most countries after the end of the IPTP activities.

TABLE 3: Frigate tuna: Availability of length frequency data, by fishery and year (1980–2012) . Note that no length frequency data are available at all for 1950–82.



- The size of frigate tunas taken by the Indian Ocean fisheries typically ranges between 20 and 50 cm depending on the type of gear used, season and location (Fig. 5). The fisheries operating in the Andaman Sea (coastal purse seines and troll lines) tend to catch frigate tuna of small to medium size (15–40 cm) while the gillnet, baitboat and other fisheries operating in the Indian Ocean catch usually larger specimens (25–50 cm).
- Catch-at-Size(Age) table: Catch-at-Size data are not available for the frigate tuna due to the paucity of size data available from most fleets (Table 3) and the uncertain status of the catches for this species (Fig. 3). Length distributions derived from the data available for gillnet fisheries are shown in Fig. 5. No data available for all other fisheries.Sex ratio data have not been provided to the Secretariat by CPCs.

FRI (Gillnet samples): size (in cm) | FRI (Gillnet): no. of samples ('000)

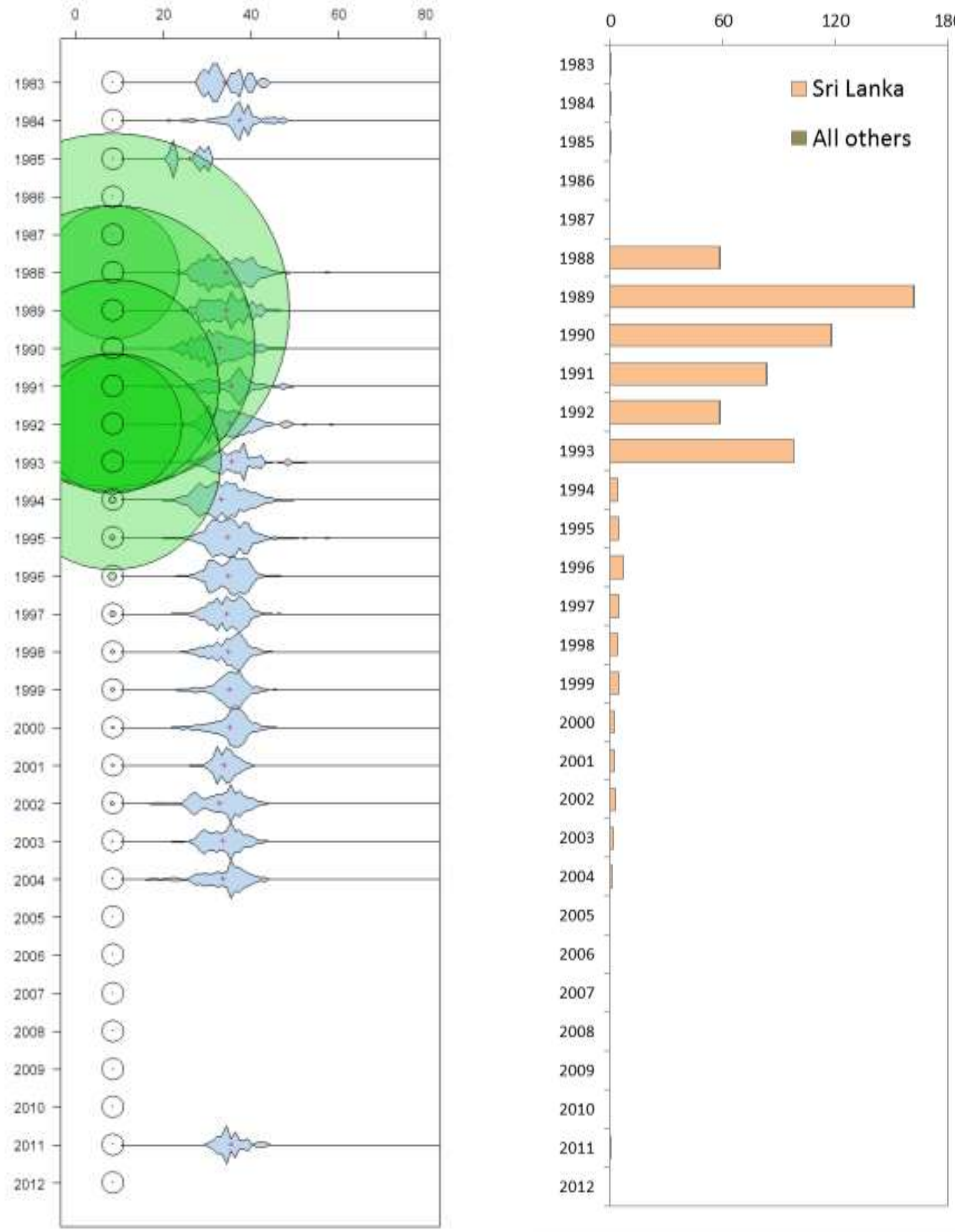


Fig. 5. Frigate tuna: Left - Frigate tuna (gillnet fisheries): Length frequency distributions (total amount of fish measured by 1cm length class) derived from data available at the IOTC Secretariat. The black outline circles (to the left of each distribution) indicate the minimum sampling standard set by IOTC of one fish per metric tonne; the green proportional circles indicate the relative sampling coverage in each year (i.e., circles with areas greater than the minimum sampling standard indicate relatively high sampling coverage in a given year). 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–2014–WPNT04–07 Rev_1

Kawakawa – Fisheries and catch trends

Kawakawa is caught mainly by coastal purse seines, gillnets and, handlines and trolling (Table 1 and Fig. 1); and may be also an important bycatch of the industrial purse seiners. The catch estimates for kawakawa were derived from very small amounts of information and are therefore highly uncertain[5].

TABLE 1. Kawakawa: Best scientific estimates of the catches of kawakawa by type of fishery for the period 1950–2012 (in metric tonnes) (Data as of May 2014)

Fishery	By decade (average)						By year (last ten years)									
	1950s	**1960s**	**1970s**	**1980s**	**1990s**	**2000s**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Purse seine	100	385	2,227	11,362	21,393	28,006	22,121	27,811	28,127	33,739	30,305	34,275	36,743	35,043	42,229	40,883
Gillnet	2,179	4,098	9,187	16,665	29,737	50,264	43,998	45,727	45,953	52,585	55,378	66,102	63,557	57,974	69,937	76,682
Line	2,102	3,642	7,146	11,216	16,739	22,527	19,314	22,780	20,796	22,108	23,439	29,457	29,745	30,005	31,370	29,092
Other	295	719	1,357	2,690	5,129	7,702	6,534	7,511	7,551	7,847	9,151	9,401	10,065	9,991	10,059	9,359
Total	**4,676**	**8,844**	**19,918**	**41,933**	**72,997**	**108,499**	**91,967**	**103,830**	**102,427**	**116,279**	**118,272**	**139,235**	**140,110**	**133,012**	**153,595**	**156,017**

The catches provided in Table 1 are based on the information available at the IOTC Secretariat and the following observations on the catches cannot currently be verified. 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. In recent years the catches of kawakawa have been recorded at similar levels in in the two Indian Ocean basins.

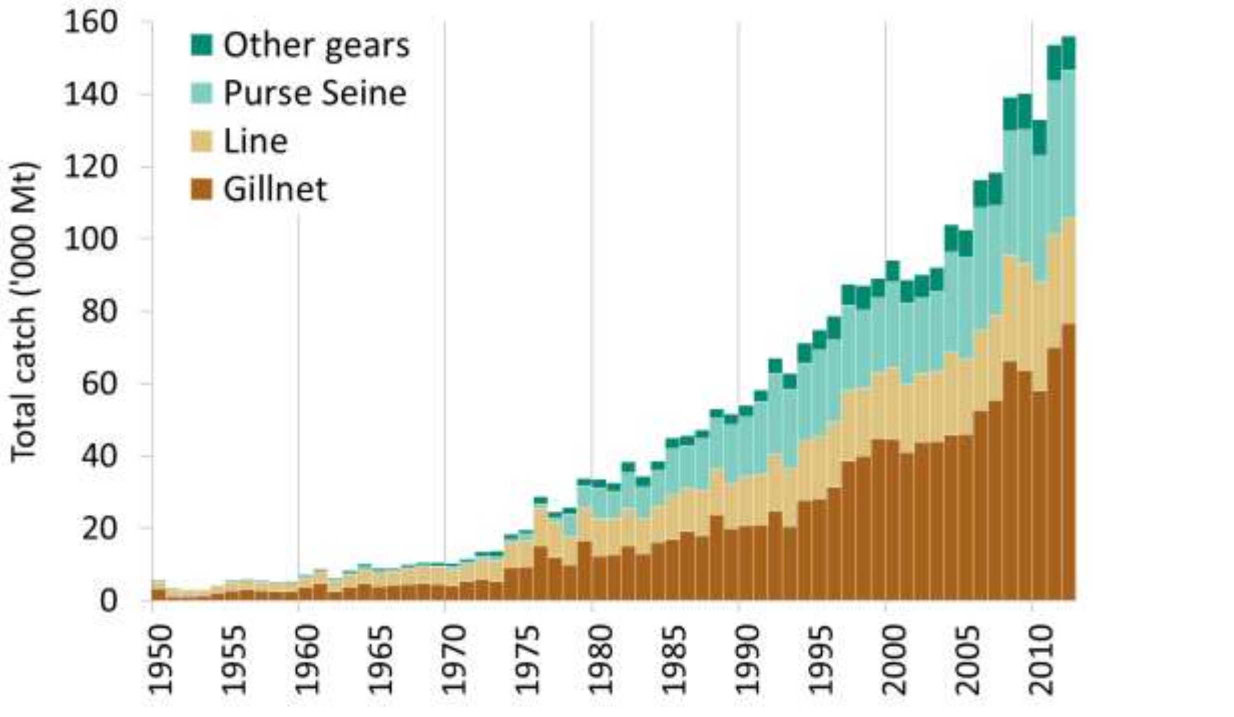


Fig. 1. Kawakawa: Annual catches of kawakawa by gear recorded in the IOTC database (1950–2012)

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

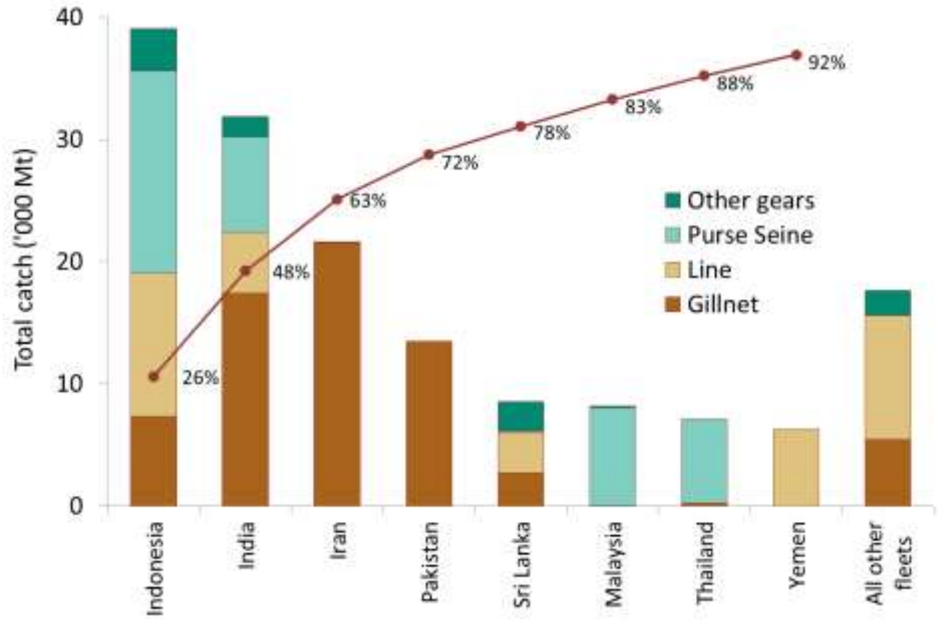


Fig. 2. Kawakawa: Average catches in the Indian Ocean over the period 2010–12, by country. Countries are ordered from left to right, according to the importance of catches of kawakawa reported. The red line indicates the (cumulative) proportion of catches of kawakawa for the countries concerned, over the total combined catches of this species reported from all countries and fisheries.

In recent years, the countries attributed with the highest catches are Indonesia (26%), India (22%), Iran (15%), and Pakistan (9%) and Sri Lanka (6%) and Malaysia (6%) (Fig. 2).

Kawakawa – Uncertainty of catches

Retained catches are uncertain (Fig. 3), 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, representing around 26% of the total catches of this species in the Indian Ocean in 2010–12 (compared to around 38% in previous years, prior to the review of Indonesia's catch series), 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. The catches of kawakawa in India have represented 22% of the total catches of this species in the Indian Ocean in 2010–12 (compared to around 17% in previous years, prior to the review of India's catch series).
- Artisanal fisheries of Myanmar and Somalia: None of these countries have ever reported catches to the IOTC Secretariat. Catch levels are unknown.
- Other artisanal fisheries: The catches of kawakawa are usually not reported by species, being combined with catches of other small tuna species like skipjack tuna and frigate tuna (e.g., coastal purse seiners of Thailand, and until recently Malaysia).
- Industrial fisheries: The catches of kawakawa recorded for industrial purse seiners are thought to be a fraction of those retained on board. Due to this species being a bycatch, its catches are seldom recorded in the logbooks, nor are they monitored in port. The EU recently reported catch levels of frigate tuna for its purse seine fleet, for 2003–07, estimated using observer data.
- 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: The overall catch series of kawakawa has not changed substantially since the WPNT meeting in 2012. The IOTC Secretariat is currently undertaking reviews of the catch series for Indonesia, Malaysia and Thailand which are likely revise the catch estimates for the next WPNT in 2015; however at present the total catches of kawakawa remain at similar levels when compared to previous estimates.

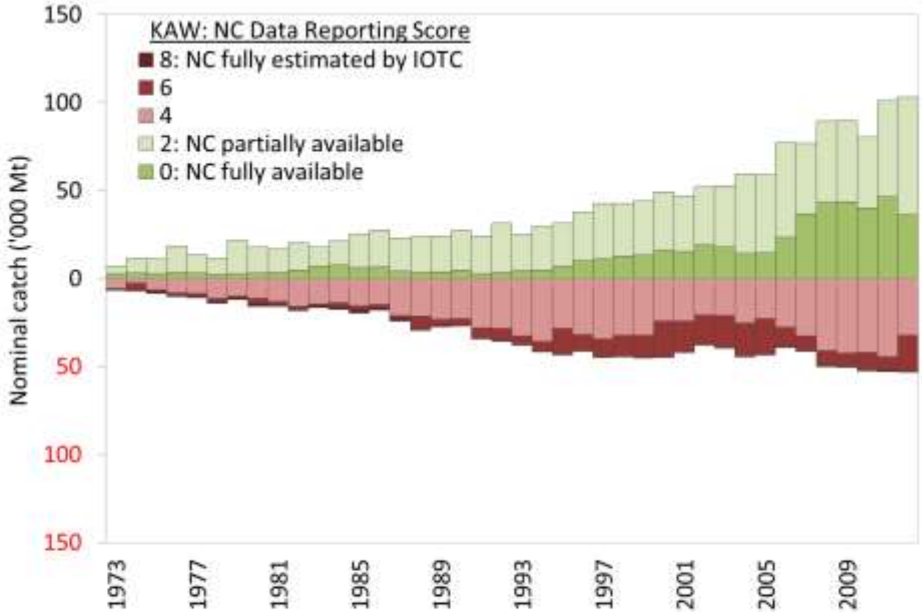


Fig. 3. Kawakawa: nominal catch; uncertainty of annual catch estimates (1950–2012). Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully 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 2014)

Kawakawa – Effort trends

Effort trends are unknown for kawakawa in the Indian Ocean.

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

Catch-and-effort series are available from some fisheries but they are considered highly incomplete (Table 2). In most cases catch-and-effort data are only available for short periods. Reasonably long catch-and-effort data series (extending for more than 10 years) are only available for Maldives baitboats and troll lines and Sri Lanka gillnets (Fig. 4). The catch-and-effort data recorded for Sri Lankan gillnets are, however, thought to be inaccurate due to the dramatic changes in CPUE recorded between consecutive years.

TABLE 2. Kawakawa: Availability of catches and effort series, by fishery and year (1970–2012) . Note that no catches and effort are available at all for 1950–69.

Gear-Fleet	70		72		74		76		78		80		82		84		86		88		90		92		94		96		98		00		02		04		06		08		10		12	
PSS-Indonesia																■	■	■	■	■	■																							
PSS-Malaysia																																										■	■	
PSS-Thailand																											■	■	■							■	■	■	■	■	■	■	■	
PS-France																																		■										
BB-Indonesia																		■																										
BB-Maldives	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			■	■	■	■	■	■	■	■	■	
LL-Portugal																																							■					
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GILL-Sri Lanka																■	■	■	■	■	■	■			■	■	■	■	■	■	■	■	■	■	■									
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LINE-Sri Lanka																	■																											
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LINE-Seychelles																															■	■	■	■	■	■	■	■	■	■	■	■	■	
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OTHR-Maldives																			■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
OTHR-Oman																																										■	■	

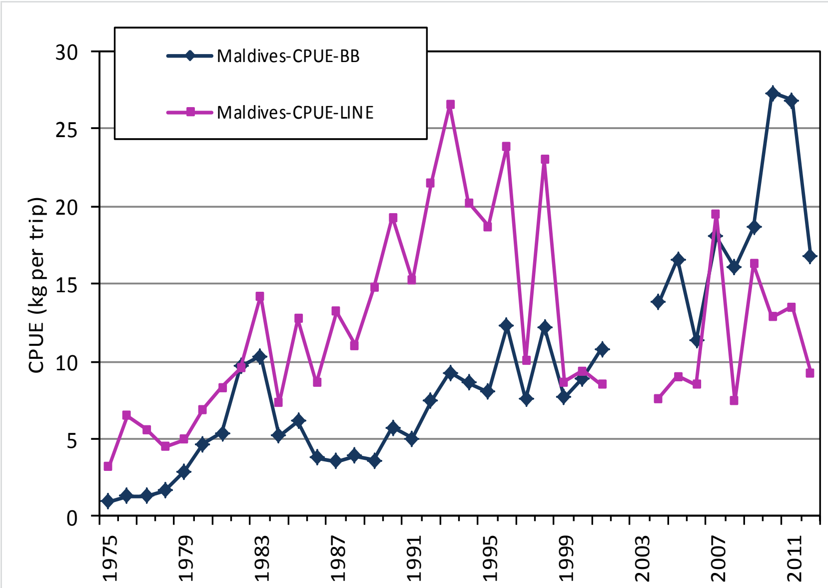
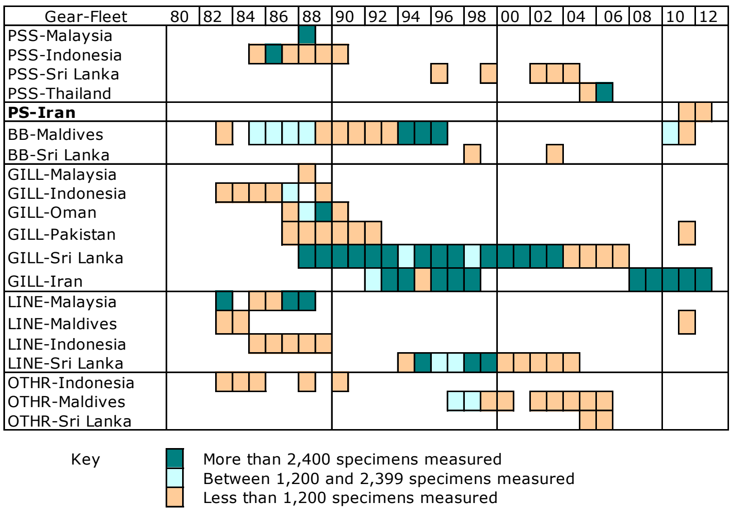


Fig. 4. Kawakawa: Nominal CPUE series for the baitboat (BB) and troll line (TROL) fisheries of Maldives (1975–2012) derived from the available catches and effort data.

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

- 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. 5). 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).
- Trends in average weight can be assessed for Sri Lankan gillnets but the amount of specimens measured has been very low in recent years (Table 3). The length frequency data available from the mid-eighties to the early nineties was obtained with the support of the IPTP (Indo-Pacific Tuna Programme); unfortunately, the data collection did not continue after the end of the IPTP activities. In addition since 1998 there has been some sampling of lengths from Iranian gillnets (collected from vessels operating in the Arabian Sea), although average lengths and distribution of lengths of samples are significantly larger than specimens reported by other fleets.
- Catch-at-Size(Age) data are not available for the kawakawa due to the paucity of size data available from most fleets (Table 3) and the uncertain status of the catches for this species (Fig. 33). Length distributions derived from the data available for gillnet fisheries are shown in Fig. 38. No data available for all other fisheries.
- Sex ratio data have not been provided to the IOTC Secretariat by CPCs.

TABLE 3. Kawakawa: Availability of length frequency data, by fishery and year (1980–2012) . Note that no length frequency data are available at all for 1950–82.



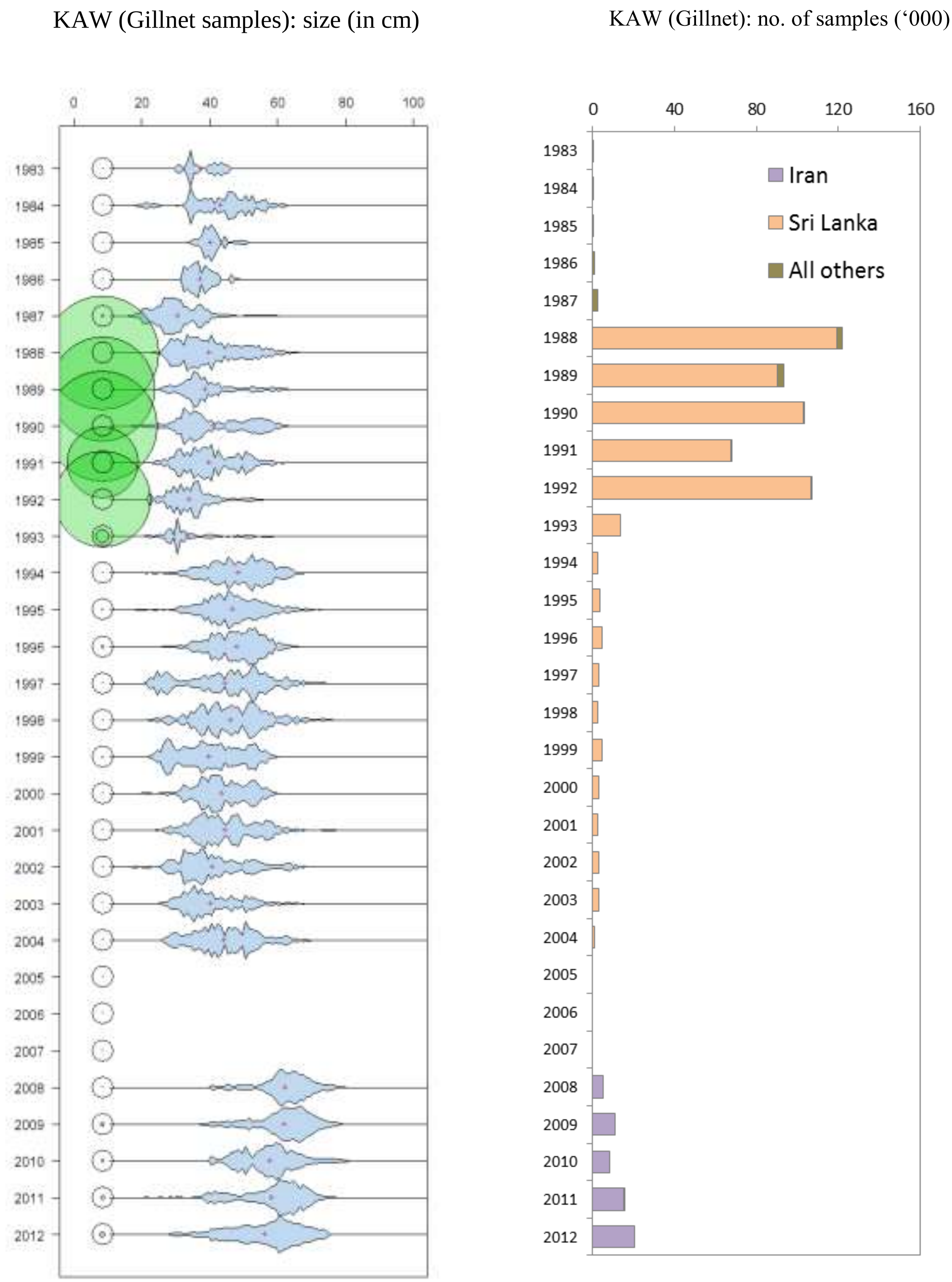


Fig. 5. Kawakawa: Left - Length frequency distributions for gillnet fisheries (total amount of fish measured by 1cm length class) derived from data available at the IOTC Secretariat. The black outline circles (to the left of each distribution) indicate the minimum sampling standard set by IOTC of one fish per metric tonne; the green proportional circles indicate the relative sampling coverage in each year (i.e., circles with areas greater than the minimum sampling standard indicate relatively high sampling coverage in a given year). Right: Number of kawakawa specimens sampled for lengths, by fleet (gillnet only).

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

Extract from IOTC–2014–WPNT04–07 Rev_1

Longtail tuna – Fisheries and catch trends

Longtail tuna is caught mainly by using gillnets and, to a lesser extent, seine nets, and trolling (Table 1; Fig. 1). The catch estimates for longtail tuna were derived from small amounts of information and are therefore uncertain[6]. The catches provided in Table 1 are based on the information available at the IOTC Secretariat and the following observations on the catches cannot currently be verified. Estimated catches of longtail tuna increased steadily from the mid 1950's, reaching around 15,000 t in the mid-1970's, to over 35,000 t by the mid-1980's, and over 96,000 t in 2000. Catches dropped after 2000 to around 72,000 t by 2005 but have increased since then, with the highest catches ever recorded in 2011 at 166,000 t.

In recent years (2010–12), the countries attributed with the highest catches of longtail tuna are Iran (47%), Indonesia (15%), Pakistan (9%), Malaysia (9%) and, to a lesser extent, Oman, Yemen, India and Thailand (19%) (Fig. 2). I.R. Iran, in particular, has reported large increases in the catch of longtail tuna since 2009 where the increase in catches of longtail tuna have coincided with a decrease in catches of skipjack tuna as a consequence of increased gillnet effort in coastal waters and the Arabian Sea due to the threat of Somali piracy in the western tropical Indian Ocean.

TABLE 1. Longtail tuna: Best scientific estimates of the catches of longtail tuna by type of fishery for the period 1950–2012 (in metric tonnes) (Data as of May 2014)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Purse seine	44	204	1,306	5,381	10,937	17,718	19,551	13,313	12,390	16,131	23,835	18,877	20,649	16,538	20,595	21,767
Gillnet	2,593	5,849	8,983	24,872	39,423	58,205	54,974	46,212	43,455	51,570	59,905	67,508	83,300	101,251	118,288	110,825
Line	909	1,160	2,547	5,187	7,220	14,095	11,511	14,095	14,219	16,519	17,666	15,339	15,681	16,628	18,486	20,160
Other	0	0	125	1,091	1,993	3,577	2,527	2,912	2,661	3,370	5,103	5,928	5,221	6,507	8,527	7,779
Total	**3,546**	**7,213**	**12,961**	**36,530**	**59,573**	**93,595**	**88,562**	**76,532**	**72,725**	**87,590**	**106,509**	**107,653**	**124,851**	**140,923**	**165,896**	**160,532**

The size of longtail tunas taken by the Indian Ocean fisheries typically ranges between 20 and 100 cm depending on the type of gear used, season and location. The fisheries operating in the Andaman Sea (coastal purse seines and trolling) tend to catch longtail tuna of small size (20–45cm) while the gillnet fisheries of Iran and Pakistan (Arabian Sea) catch larger specimens (50–100cm).

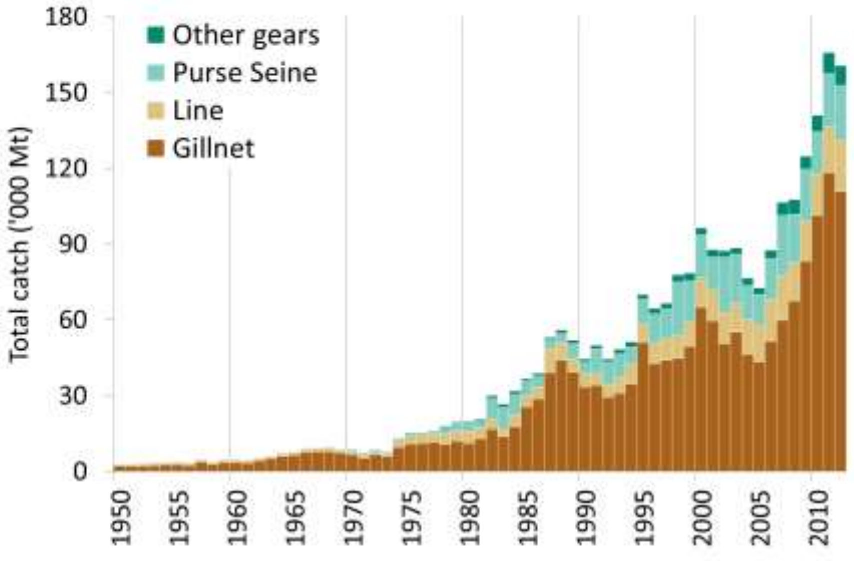


Fig. 1. Longtail tuna: Annual catches of longtail tuna by gear recorded in the IOTC Database (1950–2012)

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

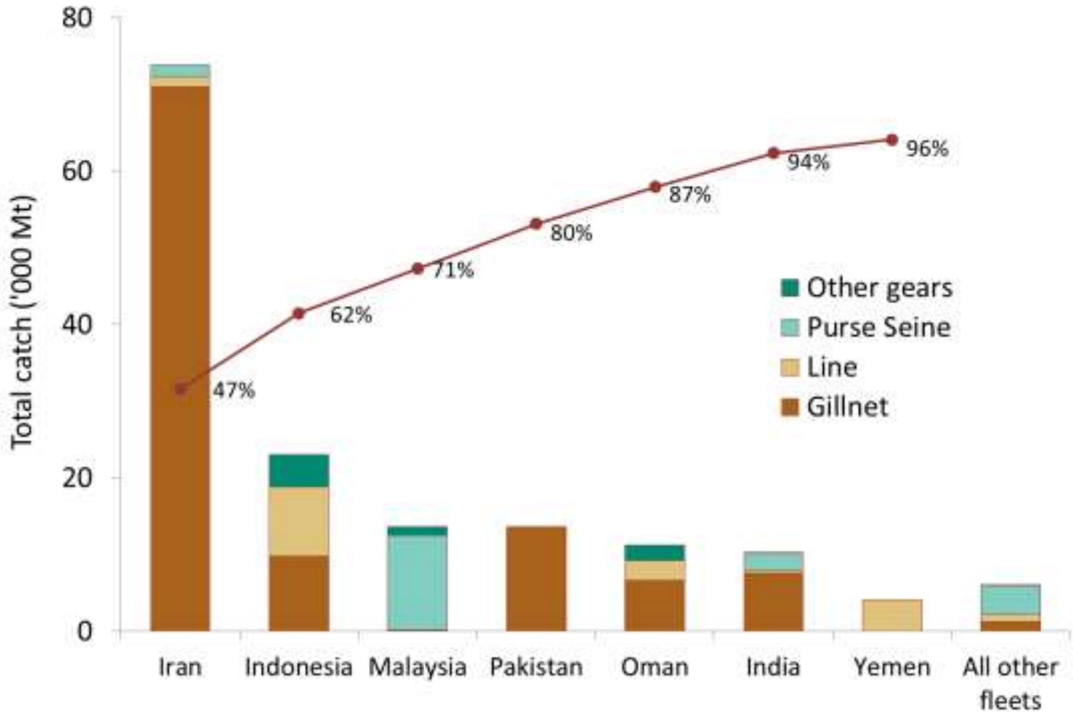


Fig. 2. Longtail tuna: Average catches in the Indian Ocean over the period 2010–12, by country. Countries are ordered from left to right, according to the importance of catches of longtail reported. The red line indicates the (cumulative) proportion of catches of longtail tuna for the countries concerned, over the total combined catches of this species reported from all countries and fisheries.

Longtail tuna: uncertainty of catches

Retained catches are uncertain (Fig. 3), 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; catches of longtail tuna, kawakawa 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, 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, representing around 15% (30% in the past) of the total catches of this species in the Indian Ocean in recent years (2009–11), the new figures are considered more reliable than those existing in the past.
- 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. The catches of longtail tuna from Oman and India represent around 14% of the total catches of this species in recent years (2010–12).
- 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.
- 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).
- Discard levels are believed to be very low although they are unknown for most fisheries.
- Changes to the catch series: Although there have not been significant changes to the total catches of longtail tuna since the WPNT meeting in 2012, the IOTC Secretariat has conducted revisions to the catch series for some fleets, primarily Malaysia following an IOTC-OFCF data mining mission in January 2014. Indonesia is also subject to an on-going review of the catch-series by the IOTC Secretariat, and further improvements to the catch series for longtail in particular are expected for WPNT in 2015.

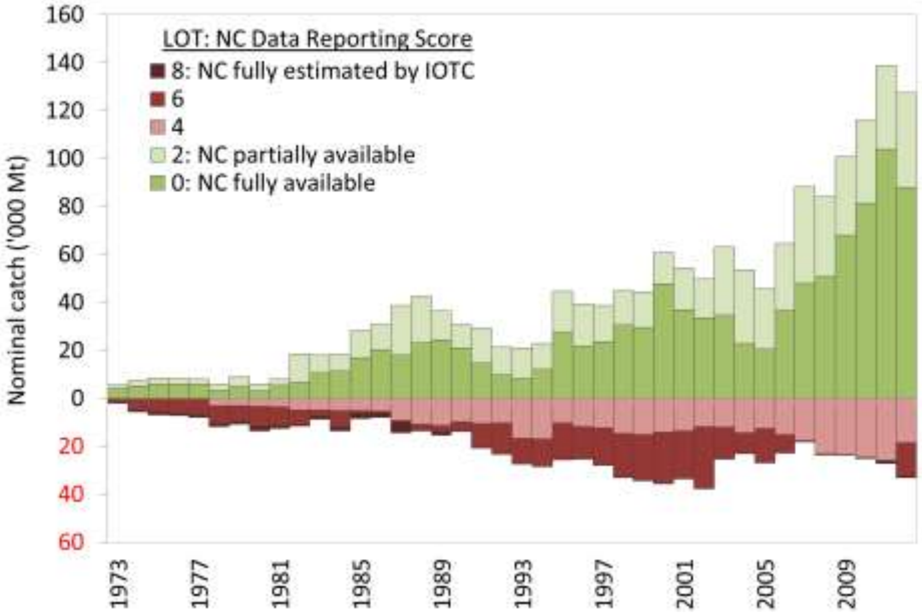


Fig. 3. Longtail tuna: Nominal catch; uncertainty of annual catch estimates (1950–2012). Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data 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 2014)

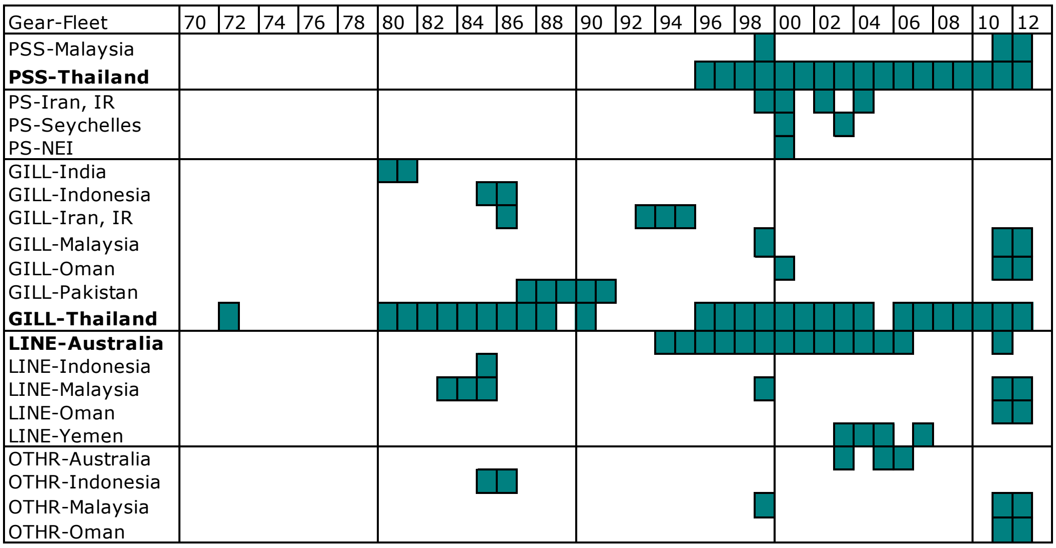
Longtail tuna – Effort trends

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

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

Catch-and-effort series are available from some fisheries but they are considered highly incomplete (Table 2). In most cases catch-and-effort data are only available for short periods of time. Reasonably long catches and effort series (extending for more than 10 years) are only available for Thailand small purse seine vessels and gillnet vessels (Fig. 4).

TABLE 2. Longtail tuna: Availability of catches and effort series, by fishery and year (1970–2012)[7]. Note that no catches and effort are available at all for 1950–1971.



[7] 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.

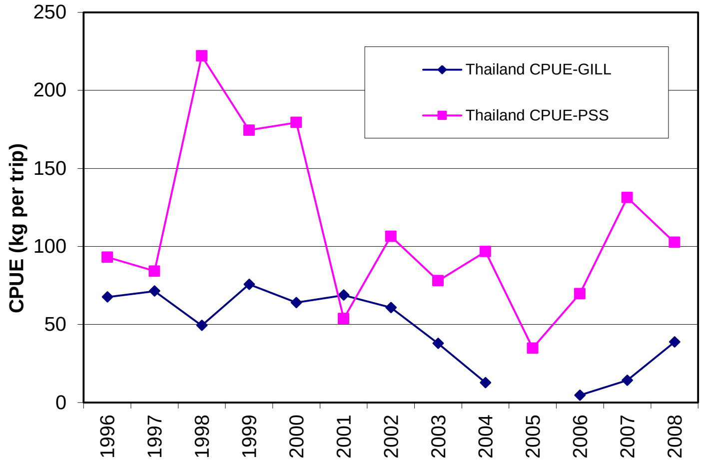


Fig. 4. Longtail tuna: Nominal CPUE series for gillnet (GILL) and coastal purse seine (PSS) fisheries of Thailand derived from the available catches and effort data (1996–2012).

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

- The size of longtail tunas taken by the Indian Ocean fisheries typically ranges between 20 and 100 cm depending on the type of gear used, season and location (Fig. 5). The fisheries operating in the Andaman Sea (coastal purse seines and trolling) tend to catch longtail tuna of small size (20–45 cm) while the gillnet fisheries of Iran and Pakistan (Arabian Sea) catch larger specimens (50–100 cm).
- Catch-at-Size(Age) tables Catches-at-Size are not available for the longtail tuna due to the paucity of size data available from most fleets (Table 3) and the uncertain status of the catches for this species (Fig. 3). Length distributions derived from the data available for gillnet fisheries are shown in Fig. 5. No data available for all other fisheries.
- Sex ratio data have not been provided to the Secretariat by CPCs.
- Trends in average weight can only be assessed for Iranian gillnets but the amount of specimens measured has been very low for a number of years (i.e., below the minimum sampling standard of one fish per tonne of catch recommended by the IOTC Secretariat) (Table 3). The length frequency data available from the mid-eighties to the early nineties was obtained with the support of the IPTP (Indo-Pacific Tuna Programme); unfortunately, the data collection did not continue after the end of the IPTP activities.

TABLE 3. Longtail tuna: Availability of length frequency data, by fishery and year (1980–2012)[8]. Note that no length frequency data are available at all for 1950–1982.

Gear-Fleet	80		82		84		86		88		90		92		94		96		98		00		02		04		06		08		10		12	
PSS-Malaysia									L																									
PSS-Thailand																										L	H							
PS-Iran																									L				H	M		M	H	
GILL-Indonesia						L																												
GILL-Iran													H	H	H	L	H	H	H		M	L	M	M	L		L		H	H	H	H	H	
GILL-Malaysia									L																									
GILL-Oman								H	H	H	L																			H				
GILL-Pakistan								L	L	L	L	L	M	M	M																	L		
GILL-Sri Lanka									L	L	L	L	L	L																				
LINE-Indonesia						L																												
LINE-Iran																															L			
LINE-Malaysia				H		L	L	H	H																									
LINE-Oman																														H				
OTHR-Indonesia						L	L																											

Key
H – More than 2,400 specimens measured
M – Between 1,200 and 2,399 specimens measured
L – Less than 1,200 specimens measured

[8] 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

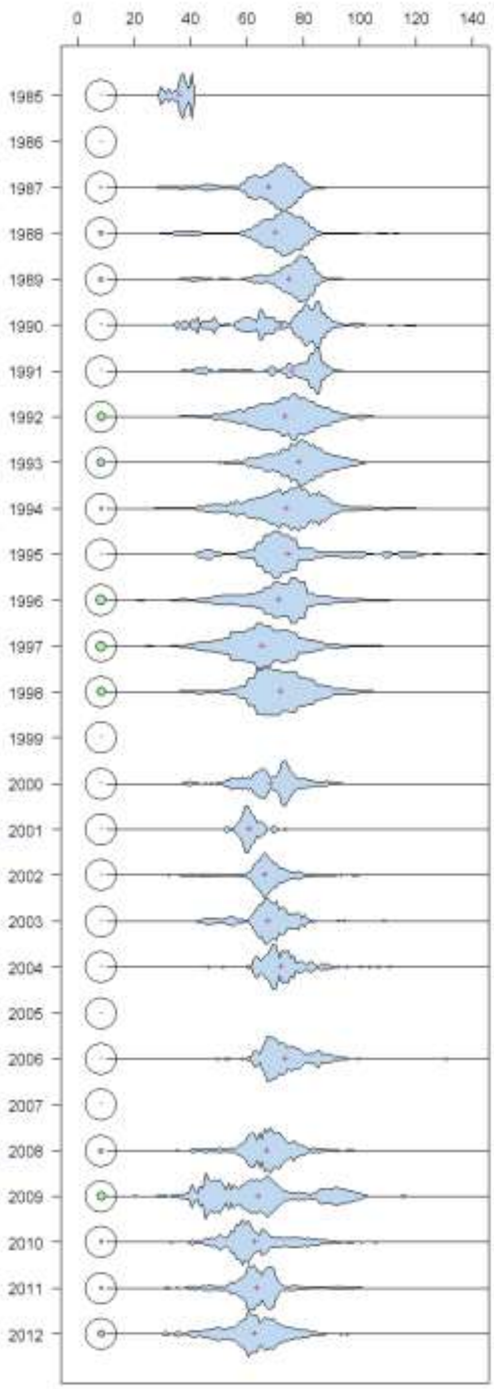
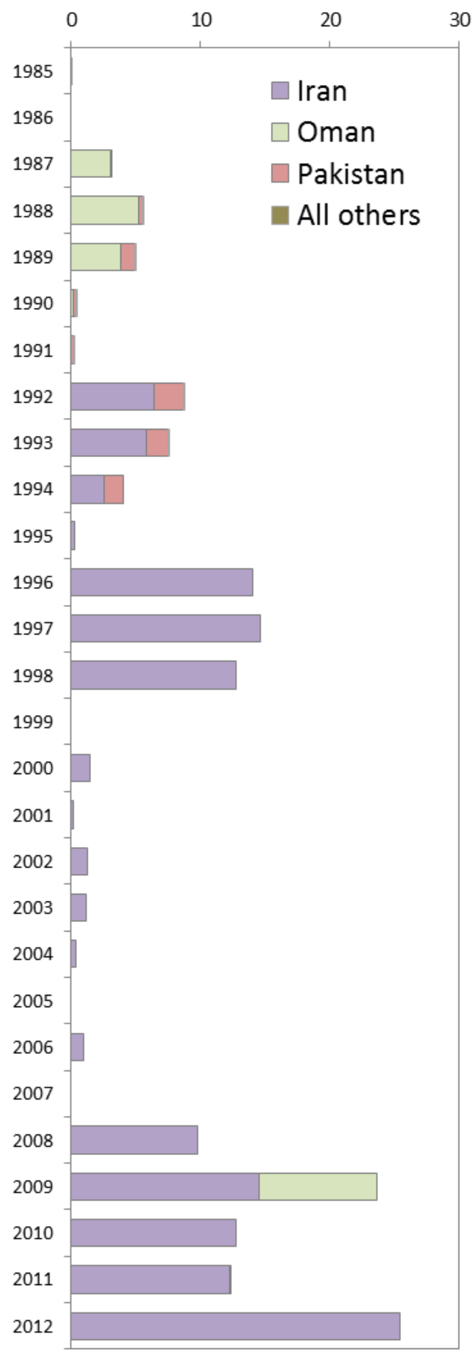
LOT (All samples): size (in cm)	LOT (Gillnet samples): size (in cm)
	

Fig. 5. Longtail tuna: Left - length frequency distributions for gillnet fisheries (total amount of fish measured by 1cm length class) derived from data available at the IOTC Secretariat. The black outline circles (to the left of each distribution) indicate the minimum sampling standard set by IOTC of one fish per metric tonne; the green proportional circles indicate the relative sampling coverage in each year (i.e., circles with areas greater than the minimum sampling standard indicate relatively high sampling coverage in a given year). Right - Number of longtail specimens sampled for lengths, by fleet (gillnet only).

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

Extract from IOTC–2014–WPNT04–07 Rev_1

Indo-Pacific king mackerel – Fisheries and catch trends

The Indo-Pacific king mackerel[9] is mostly caught by gillnet fisheries in the Indian Ocean but significant numbers are also caught trolling (Table 1, Fig. 1). The catch estimates for Indo-Pacific king mackerel were derived from very small amounts of information and are therefore highly uncertain[10].

TABLE 8. Indo-Pacific king mackerel: Best scientific estimates of the catches of Indo-Pacific king mackerel by type of fishery for the period 1950–2012 (in metric tonnes). (Data as of May 2014)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Purse seine	0	0	35	589	781	930	857	788	693	704	1,068	1,276	1,610	1,129	1,263	1,268
Gillnet	4,213	6,748	13,533	16,559	21,254	23,065	21,007	21,846	18,054	20,249	26,173	31,969	31,744	26,113	28,337	29,044
Line	404	500	1,184	1,880	2,286	2,608	2,219	2,346	2,116	2,085	3,027	3,635	3,945	3,197	3,447	3,419
Other	13	21	48	3,879	5,110	9,319	7,743	8,195	7,873	8,127	10,627	12,193	15,768	11,642	12,587	12,700
Total	**4,630**	**7,269**	**14,801**	**22,907**	**29,431**	**35,922**	**31,826**	**33,176**	**28,736**	**31,164**	**40,895**	**49,072**	**53,068**	**42,082**	**45,634**	**46,430**

The catches provided in Table 1 are based on the information available at the IOTC Secretariat and the following observations on the catches cannot currently be verified. 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.

In recent years, the countries attributed with the highest catches are India (40%) and Indonesia (27%) and, to a lesser extent, Myanmar and Iran (19%) (Fig. 2), accounting for over 85% of the total catches of king mackerel. Catches of king mackerel in the eastern Indian Ocean have been higher in recent years.

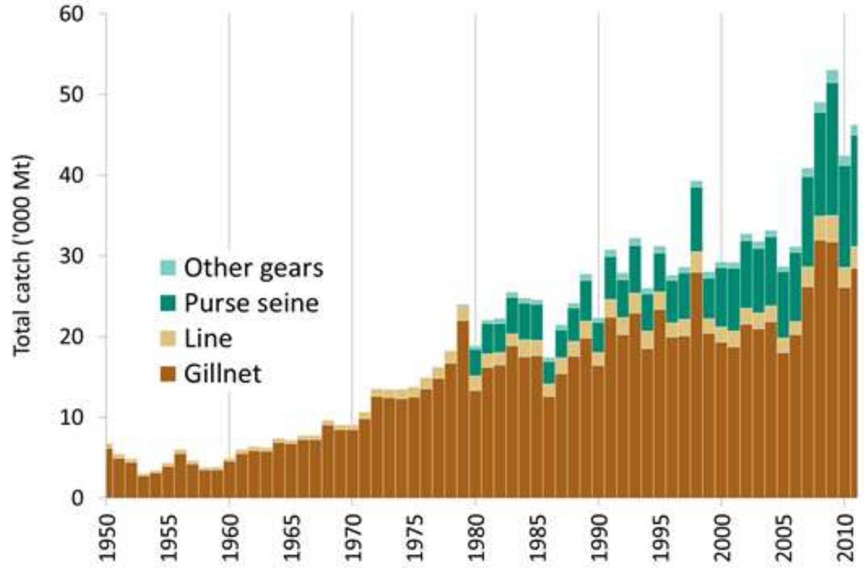


Fig. 1. Indo-Pacific king mackerel: Annual catches of Indo-Pacific king mackerel by gear recorded in the IOTC database (1950–2012).

[9] Hereinafter referred to as King mackerel.

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

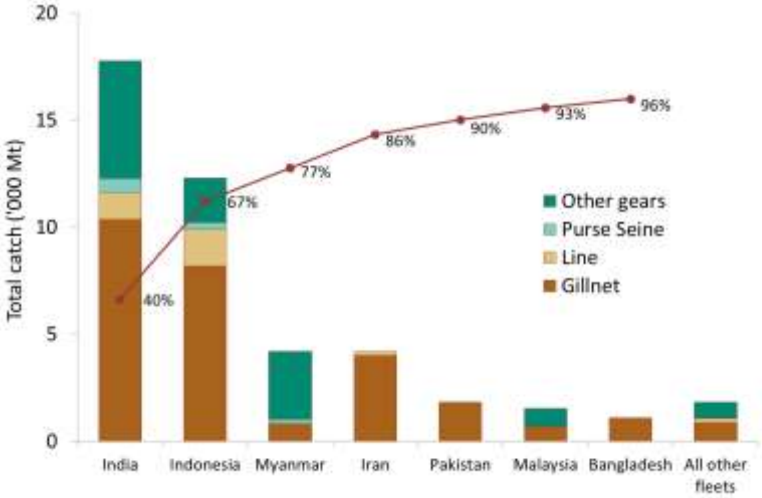


Fig. 2. Indo-Pacific king mackerel: Average catches in the Indian Ocean over the period 2010–12, by country. Countries are ordered from left to right, according to the importance of catches of Indo-Pacific king mackerel reported. The red line indicates the (cumulative) proportion of catches of Indo-Pacific king mackerel for the countries concerned, over the total combined catches of this species reported from all countries and fisheries.

Indo-Pacific king mackerel – Uncertainty of catches

Retained catches are highly uncertain (Fig. 3) for all fisheries due to:

- Aggregation: Indo-Pacific king mackerels are usually not reported by species being aggregated with narrow-barred Spanish mackerel or, less frequently, other small tuna species.
- Mislabelling: Indo-Pacific king mackerels are usually mislabelled as narrow-barred Spanish mackerel, their catches reported under the latter species.
- Underreporting: the catches of Indo-Pacific king mackerel may be not reported for some fisheries catching them as a bycatch.

It is for the above reasons that the catches of Indo-Pacific 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.

- Discard levels are believed to be low although they are unknown for most fisheries.
- Changes to the catch series: There have not been significant changes to the catches of Indo-Pacific king mackerel since the WPNT in 2013.

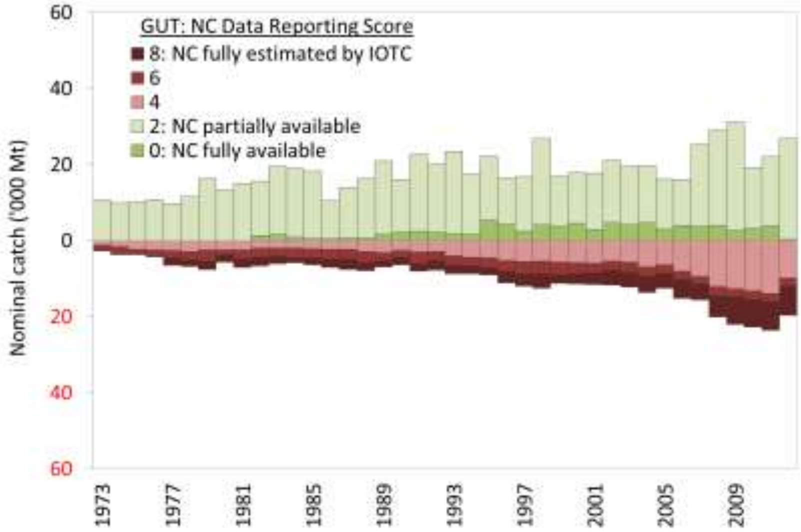


Fig. 3. Indo-Pacific king mackerel: uncertainty of annual catch estimates (1950–2012). Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data fully 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 2014)

Indo-Pacific king mackerel – Effort trends

Effort trends are unknown for Indo-Pacific King mackerel in the Indian Ocean.

Indo-Pacific king mackerel – Catch–per–unit–effort (CPUE) trends

Catch-and-effort series are not available for most fisheries and, when available, they refer to very short periods (Table 2). This makes it impossible to derive any meaningful CPUE from the existing data.

TABLE 2. Indo-Pacific king mackerel: Availability of catches and effort series, by fishery and year (1970–2012)[11]. Note that no catches and effort are available at all for 1950–85

Gear-Fleet	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	00	02	04	06	08	10	12
PSS-Indonesia									■													
LINE-South Africa																		■				
LINE-Yemen																			■			

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

- Trends in average weight cannot be assessed for most fisheries. Samples of Indo-Pacific king mackerel are only available for the coastal purse seiners of Thailand and gillnets of Sri Lanka but they refer to very short periods and the numbers sampled are very small (Table 3).
- Catch-at-Size data are not available for the Indo-Pacific king mackerel due to the paucity of size data available from most fleets (Table 3) and the uncertain status of the catches for this species (Fig. 3).
- Sex ratio data have not been provided to the Secretariat by CPCs.

TABLE 3. Indo-Pacific king mackerel: Availability of length frequency data, by fishery and year (1980–2012)[12]. Note that no length frequency data are available at all for 1950–82).

Gear-Fleet	80	82	84	86	88	90	92	94	96	98	00	02	04	06	08	10	12
PSS-Thailand													▨	▨			
GILL-Sri Lanka					▨ ▨	▨	▨ ▨										

Key
- ■ More than 2,400 specimens measured
- □ Between 1,200 and 2,399 specimens measured
- ▨ Less than 1,200 specimens measured

[11] 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

[12] 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–2014–WPNT04–07 Rev_1

Narrow-barred Spanish mackerel – Fisheries and catch trends

Narrow-barred Spanish mackerel[13] is targeted throughout the Indian Ocean by artisanal and recreational fishers. The main method of capture is gillnet, but significant numbers of are also caught trolling (Table 1, Fig. 1).

TABLE 7. Narrow-barred Spanish mackerel: Best scientific estimates of the catches of narrow-barred Spanish mackerel by type of fishery for the period 1950–2012 (in metric tonnes). (Data as of May 2014)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Purse seine	0	0	284	2,352	4,136	5,435	4,692	4,563	4,695	7,326	5,918	6,654	8,358	8,916	9,020	7,200
Gillnet	8,680	16,862	29,732	51,762	60,008	64,364	63,078	61,989	53,775	65,161	69,222	73,058	72,112	75,172	80,611	80,613
Line	2,581	3,300	7,106	14,464	14,741	19,140	17,365	17,398	16,950	19,272	20,077	24,103	25,714	25,729	27,762	28,730
Other	57	96	468	5,614	9,739	20,995	18,285	19,528	18,327	23,309	24,271	23,652	27,933	25,589	27,869	26,790
Total	**11,318**	**20,258**	**37,590**	**74,192**	**88,624**	**109,934**	**103,420**	**103,478**	**93,747**	**115,068**	**119,487**	**127,467**	**134,116**	**135,406**	**145,261**	**143,333**

The catch estimates for narrow-barred Spanish mackerel were derived from very small amounts of information and are therefore highly uncertain[14]. The catches provided in Table 1 are based on the information available at the IOTC Secretariat and the following observations on the catches cannot currently be verified. The catches of narrow-barred Spanish mackerel increased from around 50,000 t the late-1970's to over 100,000 t by the late-1990's. The highest catches of narrow-barred Spanish mackerel were recorded in 2011, amounting to 145,000 t. Narrow-barred Spanish mackerel is caught in both Indian Ocean basins, with approximately equal proportions of catches recorded in the East and West Indian Ocean since the mid-2000s.

In recent years, the countries attributed with the highest catches of narrow-barred Spanish mackerel are Indonesia (28%) and India (22%) and, to a lesser extent, I.R. Iran, Myanmar, the UAE and Pakistan (26%) (Fig. 2).

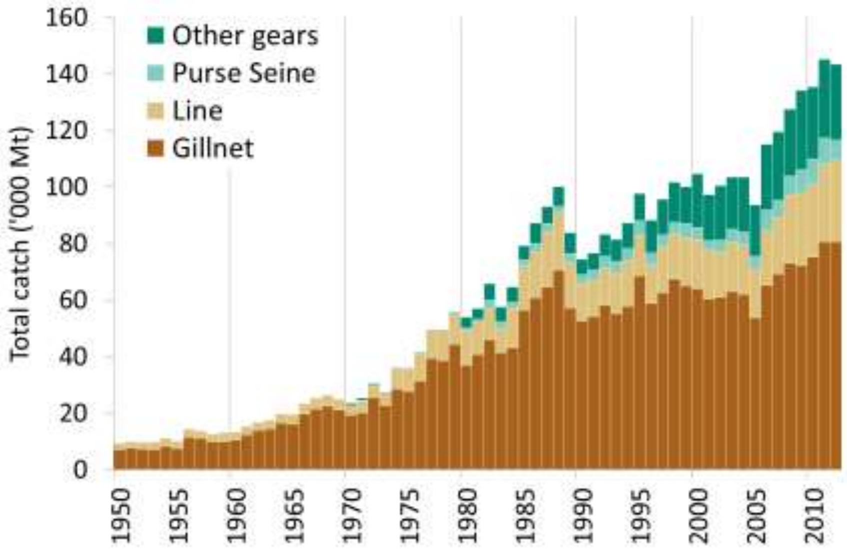


Fig. 1. Narrow-barred Spanish mackerel: Annual catches of narrow-barred Spanish mackerel by gear recorded in the IOTC database (1950–2012)

[13] Hereinafter referred to as Spanish mackerel

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

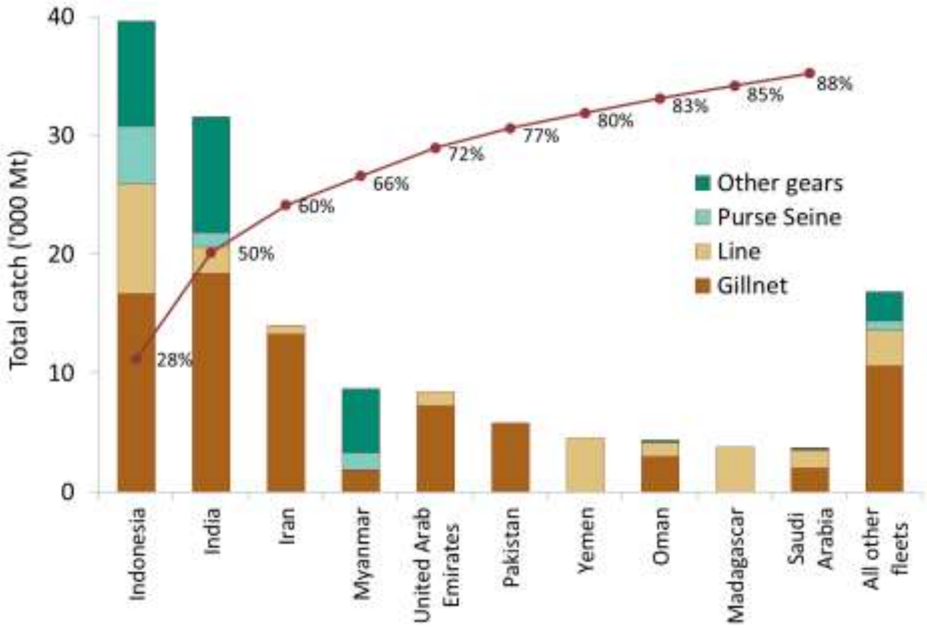


Fig. 2. Narrow-barred Spanish mackerel: Average catches in the Indian Ocean over the period 2010–12, by country. Countries are ordered from left to right, according to the importance of catches of narrow-barred Spanish mackerel reported. The red line indicates the (cumulative) proportion of catches narrow-barred Spanish mackerel for the countries concerned, over the total combined catches of this species reported from all countries and fisheries.

Narrow-barred Spanish mackerel – uncertainty of catches

Retained catches are uncertain (Fig. 3), 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 recent years.
- 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). The new catches estimated are thought to be very 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.
- Discard levels are believed to be low although they are unknown for most fisheries.
- Changes to the catch series: There have been no major revisions to the catch series of narrow-barred Spanish mackerel since the WPNT meeting in 2013.

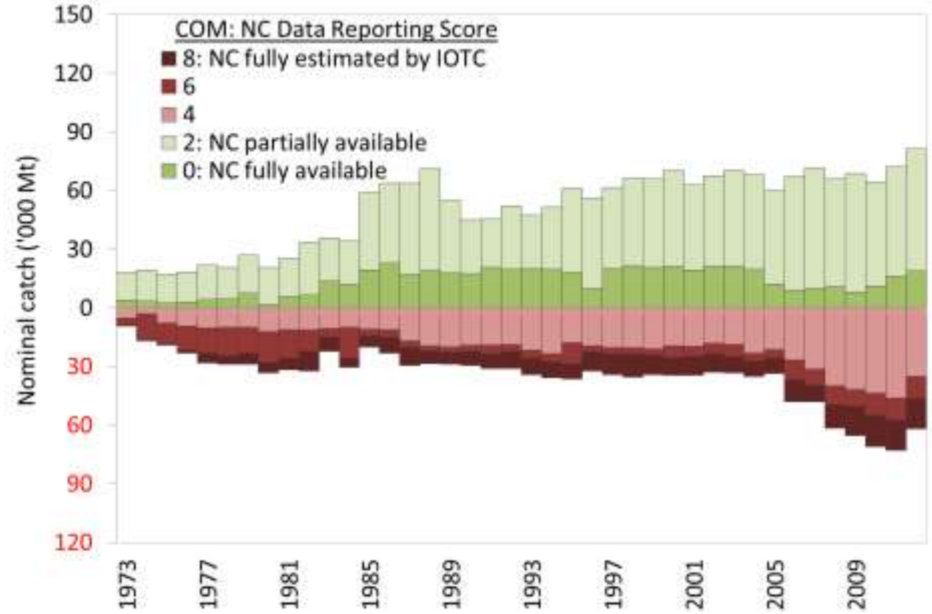


Fig. 3. Narrow-barred Spanish mackerel: Uncertainty of annual catch estimates (1950–2012). Catches are assessed against IOTC reporting standards, where a score of 0 indicates catches that are fully reported according to IOTC standards; catches assigned a score of between 2 – 6 do not report catch data 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 2014)

Narrow-barred Spanish mackerel – Effort trends

Effort trends are unknown for narrow-barred Spanish mackerel in the Indian Ocean.

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

Catch-and-effort series are available from some fisheries but they are considered highly incomplete (Table 2). In most cases catch-and-effort data are only available for short periods. Reasonably long catch-and-effort data series (extending for more than 10 years) are only available for Sri Lanka gillnets (Fig. 4). The catches and effort recorded are, however, thought to be unrealistic due to the dramatic changes in CPUE recorded in 2003 and 2004.

TABLE 2. Narrow-barred Spanish mackerel: Availability of catches and effort series, by fishery and year (1970–2012). Note that no catches and effort are available at all for 1950–84, and 2008–10.

Gear-Fleet	70		72		74		76		78		80		82		84		86		88		90		92		94		96		98		00		02		04		06		08		10	
PSS-Indonesia																	■																									
PSS-Malaysia																														■												
GILL-Indonesia																■	■	■	■	■																						
GILL-Sri Lanka																		■	■	■	■	■			■	■	■	■	■	■	■	■	■	■	■							
GILL-Malaysia																														■												
GILL-Oman																															■											
GILL-Pakistan																		■	■	■	■	■																				
LINE-Australia																										■			■													
LINE-Malaysia																														■												
LINE-Yemen																																		■	■	■	■	■				
LINE-South Africa																■	■	■	■	■	■	■	■	■	■	■																
OTHR-Sri Lanka																						■			■	■	■	■	■	■	■	■	■	■	■							
OTHR-Indonesia																■																										
OTHR-Malaysia																														■												

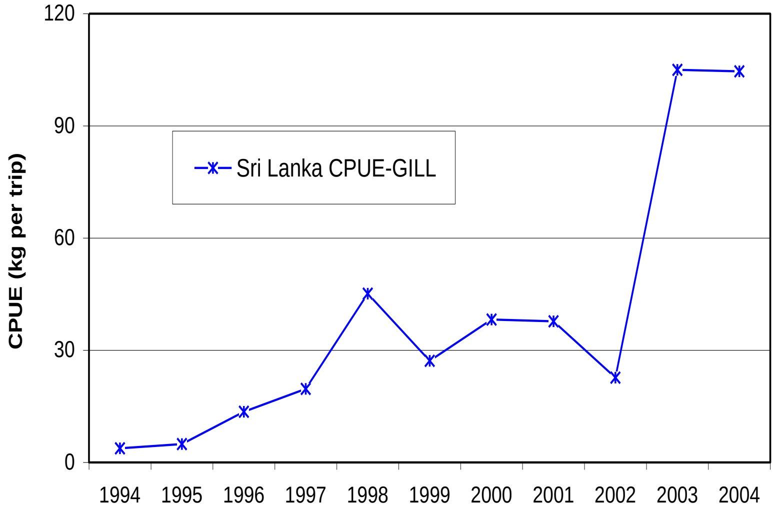
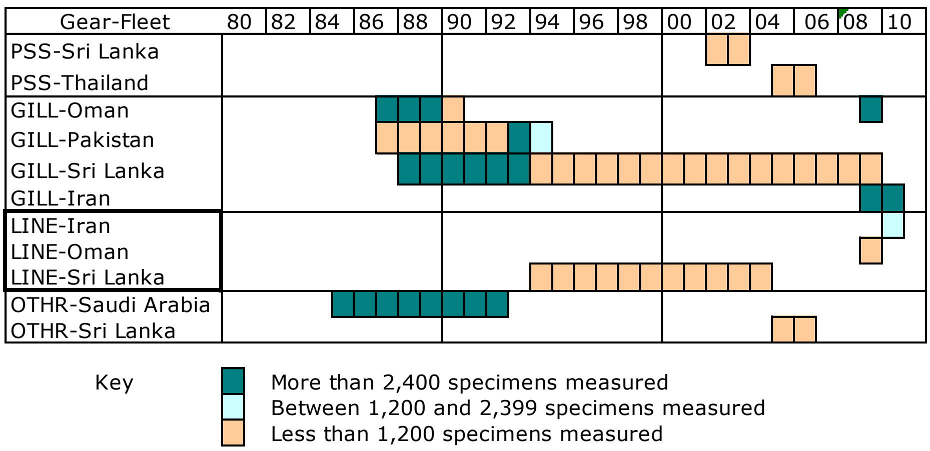


Fig. 4. Narrow-barred Spanish mackerel: Nominal CPUE series for the gillnet fishery of Sri Lanka derived from the available catches and effort data (1994–2004)

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

- The size 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 (Fig. 5). The size of narrow-barred Spanish mackerel taken varies by 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.
- Trends in average weight can only be assessed for Sri Lankan gillnets (from the late-1980s until the early 1990s), and Iranian gillnets from the late 2000s (Fig. 5, Table 3). The length frequency data available from the mid-eighties to the early nineties was obtained with the support of the IPTP (Indo-Pacific Tuna Programme); unfortunately, data collection did not continue after the IPTP activities came to an end.
- Catch-at-Size data are not available for the narrow-barred Spanish mackerel due to the paucity of size data available from most fleets (Table 3) and the uncertain status of the catches for this species (Fig. 3). Length distributions derived from the data available for gillnet fisheries are shown in Fig. 5. No data available for all other fisheries.

TABLE 3. Narrow-barred Spanish mackerel: Availability of length frequency data, by fishery and year (1980–2012)[15]. Note that no length frequency data are available at all for 1950–84.



[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

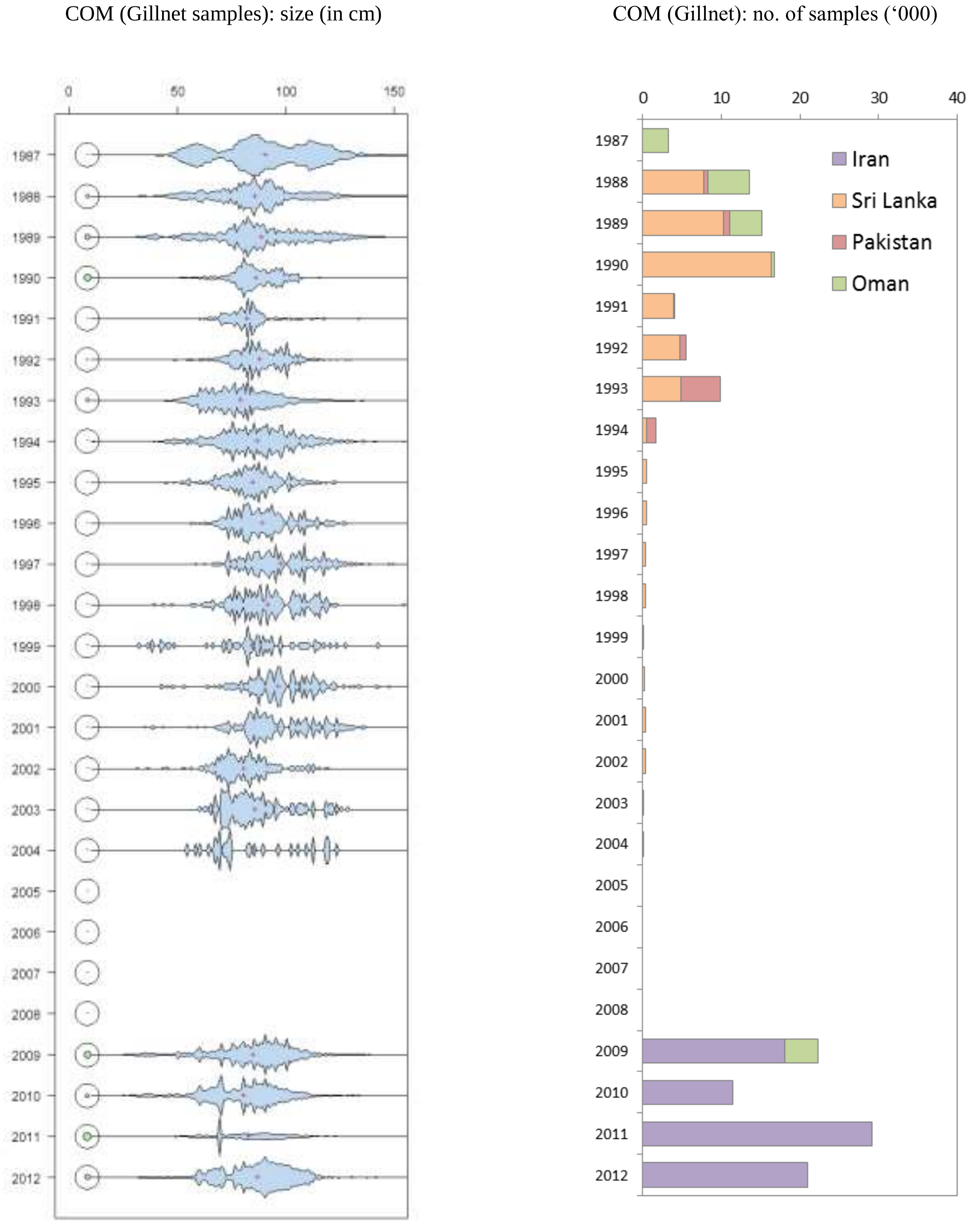


Fig. 5. Narrow-barred Spanish mackerel: Left - Narrow-barred Spanish mackerel: Length frequency distributions for gillnet fisheries (total amount of fish measured by 1cm length class) derived from data available at the IOTC Secretariat. The black outline circles (to the left of each distribution) indicate the minimum sampling standard set by IOTC of one fish per metric tonne; the green proportional circles indicate the relative sampling coverage in each year (i.e., circles with areas greater than the minimum sampling standard indicate relatively high sampling coverage in a given year). Right - Number of narrow-barred Spanish mackerel specimens sampled for lengths, by fleet (gillnet only).

APPENDIX V

MAIN ISSUES IDENTIFIED RELATING TO THE STATISTICS OF NERITIC TUNAS

Extract from IOTC–2014–WPNT04–07 Rev_1

The following list is provided by the IOTC Secretariat for the consideration of the WPNT. The list covers the main issues which the IOTC Secretariat considers affect the quality of the statistics available at the IOTC, by type of dataset and type of fishery.

1. Catch-and-Effort data from Coastal Fisheries:

- **Coastal** fisheries of **Yemen, Madagascar, Mozambique,** and **Myanmar**: The catches of neritic tunas for these fisheries have been estimated by the IOTC Secretariat in recent years. The quality of the estimates is thought to be poor due to the paucity of the information available about the fisheries operating in these countries.
- **Coastal** fisheries of **Sri Lanka, Indonesia, India, Oman, Thailand** and **Malaysia:** These countries do not fully report catches of neritic tunas by species and/or gear, as per the IOTC standards. The IOTC Secretariat allocated catches by gear and species where necessary. In the case of Indonesia, Thailand and Malaysia, the IOTC Secretariat – in collaboration with BOBLME and OFCF – are currently engaged in projects and data mining activities to improve the quality of data collected and estimation of catch-and-effort for fisheries targeting neritic species in each of the three countries.

2. Catch-and-Effort data from Surface and Longline Fisheries:

- **Drifting gillnet** fisheries of I.R. **Iran** and **Pakistan,** and **Gillnet** and **Longline** fishery of **Sri Lanka**: A substantial component of these fleets operate in offshore waters, including waters beyond the EEZs of the flag countries concerned. Although all countries have reported total catches of neritic tunas, they have not reported catch-and-effort data as per the IOTC standards.
- **All industrial tuna 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 do not include amounts of neritic tuna discarded[16]. The same applies to catch-and-effort data.
- **Discard levels for all fisheries**: 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.

3. Size data from All Fisheries:

- **Coastal** fisheries of **Sri Lanka, Indonesia, India, Oman, Thailand, Malaysia, Yemen, Madagascar, Mozambique,** and **Myanmar:** None of these countries has reported length frequency data for neritic tuna species in recent years.
- **Drifting gillnet** fisheries of **I.R. Iran** and **Pakistan,** and **Gillnet** and **Longline** fishery of **Sri Lanka**: A substantial component of these fleets operate in offshore waters, including waters beyond the EEZs of the flag countries concerned. Although all countries have reported total catches, and I.R. Iran and Sri Lanka have provided some data on the sizes of neritic tunas caught by their fisheries, the length frequency data has not been provided as per the IOTC standards.
- **All industrial tuna purse seine** fisheries: There is a generalised lack of length frequency data of neritic tuna species retained catches and discards from industrial purse seine vessels, in particular frigate tuna, bullet tuna and kawakawa (all purse seine fleets).

4. Biological data for all tropical tuna species:

All fisheries: There is a generalised lack of biological data for most neritic tuna species in the Indian Ocean, in particular the basic data that would be used to establish length-weight-age keys, non-standard measurements-fork length keys and processed weight-live weight keys for these species.

[16] This information is available for purse seiners operating under EU flags for 2003-07, as estimated using data collected by observers.

APPENDIX VI
WORKING PARTY ON NERITIC TUNAS PROGRAM OF WORK (2014 TO 2018)

The following is the Draft WPNT Program of Work (2014 to 2018) and is based on the specific requests of the Commission and Scientific Committee as well as topics identified during the WPNT04. 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 tuna species in the Indian Ocean;
- **Table 2a**: High priority topics, by project for neritic tuna species in the Indian Ocean;
- **Table 2b**: Neritic tunas and tuna-like species under the IOTC mandate with potential sub-regions/countries/management unit/sub-stocks identified for collaborative research; and
- **Table 3**: Stock assessment schedule by species.

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 tuna species in the Indian Ocean

Topic	Sub-topic	Priority
Stock structure (connectivity)	Genetic research to determine the connectivity of neritic tunas throughout their distributions	High
	Tagging research to better understand the movement dynamics, possible spawning locations, natural mortality, fishing mortality and post-release mortality of neritic tunas from various fisheries in the Indian Ocean	Med
	Gene-tag methodology	Med
	Otolith microchemistry/isotope research	Low
Biological information (parameters for stock assessment)	Age and growth research	High
	Age-at-Maturity	High
	Fecundity-at-age/length relationships	Medium
Ecological information	Review of literature on life history parameters to assess stock structure on morphometric data	High
	Feeding ecology	Low
	Life history research	Low
CPUE standardisation	Develop standardised CPUE series for each neritic tuna species for the Indian Ocean	High
Stock assessment / Stock indicators	Develop alternative approaches to determining stock status via and indicator based assessment	High

Table 2a. High priority topics, by project for neritic tuna species in the Indian Ocean.

Topic	Sub-topic and project	Priority
Stock structure (connectivity)	Genetic research to determine the connectivity of neritic tunas throughout their distributions ➢ 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. The report shall be provided to the WPNT05 meeting in 2015.	High
Biological information (parameters for stock assessment)	Age and growth research; Age-at-Maturity ➢ Quantitative biological studies are necessary for all neritic tunas throughout their range to determine key biological parameters including age-at-maturity and fecundity-at-age/length relationships, age-length keys, age and growth, which will be fed into future stock assessments.	High
Ecological information	Review of literature on life history parameters to assess stock structure on morphometric data ➢ IOTC Secretariat: Fishery Officer (Science) to undertake a literature review of all available population parameters for kawakawa, longtail tuna and narrow-barred Spanish mackerel, to support further stock assessment of these species in 2015. Summary paper to be made available 30 days before the WPNT05 meeting.	High
CPUE standardisation	Develop standardised CPUE series for each neritic tuna species for the Indian Ocean ➢ There is an urgent need to develop standardised CPUE series for each neritic tuna species for the Indian Ocean as a whole, by sub-region, by fleet, as appropriate.	High
Stock assessment / Stock indicators	Develop alternative approaches to determining stock status via and indicator based assessment ➢ 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. ➢ An examination of a four quadrant Indian Ocean stock structure (NE, SE, NW, SW) using the algorithms presented on Stock Reduction Analysis techniques should be undertaken for consideration at the next WPNT meeting for longtail tuna and kawakawa. ➢ 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 technique (i.e. area fished, gear specifics, depth, environmental condition (near shore, open ocean, etc.) and vessel size (length/horsepower).	High

Table 2b. Neritic tunas and tuna-like species under the IOTC mandate with potential sub-regions/countries/management unit/sub-stocks identified for collaborative research.

<table>
<tr><th rowspan="2">Species / Stock</th><th colspan="5">Possible sub-regions and countries / Management Units</th></tr>
<tr><th>East Africa
(Kenya, Tanzania, Mozambique, Madagascar, Seychelles, Mauritius, La Réunion, Comoros, Somalia)</th><th>Gulf, Oman Sea
(I.R. Iran, Oman, Pakistan, U.A.E., Yemen, Somalia, Qatar)</th><th>West India
(India, Pakistan, Sri Lanka, Maldives)</th><th>East India/Bay of Bengal
(India, Sri Lanka, Malaysia, Indonesia, Thailand, Myanmar, Bangladesh)</th><th>Indonesia and Australia
(Australia, Malaysia, Indonesia, Thailand)</th></tr>
<tr><td>Bullet tuna
(Auxis rochei)</td><td>–</td><td>–</td><td colspan="2">■</td><td>■</td></tr>
<tr><td>Frigate tuna
(Auxis thazard)</td><td>■</td><td>■</td><td colspan="2">■</td><td>■</td></tr>
<tr><td>Kawakawa
(Euthynnus affinis)</td><td colspan="3">■</td><td colspan="2">■</td></tr>
<tr><td>Longtail tuna
(Thunnus tonggol)</td><td>■</td><td colspan="2">■</td><td colspan="2">■</td></tr>
<tr><td>Indo-Pacific king mackerel (Scomberomorus guttatus)</td><td>■</td><td>■</td><td colspan="2">■</td><td>■</td></tr>
<tr><td>Narrow-barred Spanish mackerel
(Scomberomorus commerson)</td><td>■</td><td colspan="3">■</td><td>■</td></tr>
</table>

Black bars refer to potential management units for further examination/research, by species. Countries in red text are not yet Members of the IOTC, however collaborative research is encouraged.

Table 3. Assessment schedule for the IOTC Working Party on Neritic Tunas (WPNT).

Species	**2014**	**2015**	**2016**	**2017**	**2018**
Working Party on Neritic Tunas					
Bullet tuna	Indicators	Indicators	Indicators	Indicators	**Stock assessment**
Frigate tuna	Indicators	Indicators	Indicators	Indicators	**Stock assessment**
Kawakawa	**Stock assessment**	**Stock assessment**	Indicators	**Stock assessment**	Indicators
Longtail tuna	**Stock assessment**	**Stock assessment**	Indicators	**Stock assessment**	Indicators
Indo-Pacific king mackerel	Indicators	**Stock assessment**	Indicators	Indicators	**Stock assessment**
Narrow-barred Spanish mackerel	**Stock assessment**	**Stock assessment**	Indicators	Indicators	**Stock assessment**

APPENDIX VII
BULLET TUNA – DRAFT RESOURCE STOCK STATUS SUMMARY

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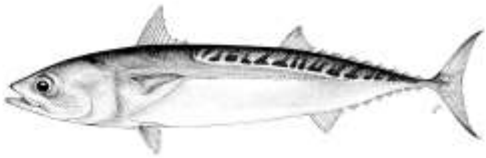

DRAFT: Status of the Indian Ocean bullet tuna (BLT: *Auxis rochei*) resource

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

Area[1]	Indicators		2014 stock status determination
Indian Ocean	Catch[2] 2012: Average catch[2] 2008–2012:	8,878 t 8,475 t	
	MSY: F_{MSY}: B_{MSY}: F_{2012}/F_{MSY}: SB_{2012}/SB_{MSY}: SB_{2012}/SB_0:	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 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 have stabilised over the past three years at around 8,500 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.

APPENDIX VIII
FRIGATE TUNA – DRAFT RESOURCE STOCK STATUS SUMMARY

DRAFT: 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		2014 stock status determination
Indian Ocean	Catch[2] 2012: Average catch[2] 2008–2012:	83,108 t 90,678 t	
	MSY: F_{MSY}: B_{MSY}: F_{2012}/F_{MSY}: SB_{2012}/SB_{MSY}: SB_{2012}/SB_0:	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 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 2010/11 (~99,500), although a decrease was recorded in 2012 (Table 1). 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.

APPENDIX IX
KAWAKAWA – DRAFT RESOURCE STOCK STATUS SUMMARY

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

DRAFT: 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		2014 stock status determination
Indian Ocean	Catch[2] 2012: Average catch[2] 2008–2012:	156,017 t 144,394 t	
	MSY: F_{MSY}: B_{MSY}: F_{2012}/F_{MSY}: B_{2012}/B_{MSY}: B_{2012}/B_0:	144 K t [113–167 Kt] 0.51 217 Kt (168–152 Kt) 0.97 (0.62–1.61) 1.13 (0.64–1.4) 0.57 (0.32–0.7)	

[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. Analysis using a stock-reduction analysis (SRA) approach for a second year indicates that the stock is near optimal levels of F_{MSY}, and stock biomass is near the level that would produce MSY (B_{MSY}). Due to the quality of the data being used, the simplistic approach employed in 2014, combined with 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** (Table 1, Fig. 1). A separate analysis done 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 in preparation for the next WPNT meeting so that more traditional approaches for assessing stock status are 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. The following should be noted:

- The Maximum Sustainable Yield estimate for the whole Indian Ocean is estimated to be between 113,000 and 167,000 t.
- 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 slow the increase in 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.

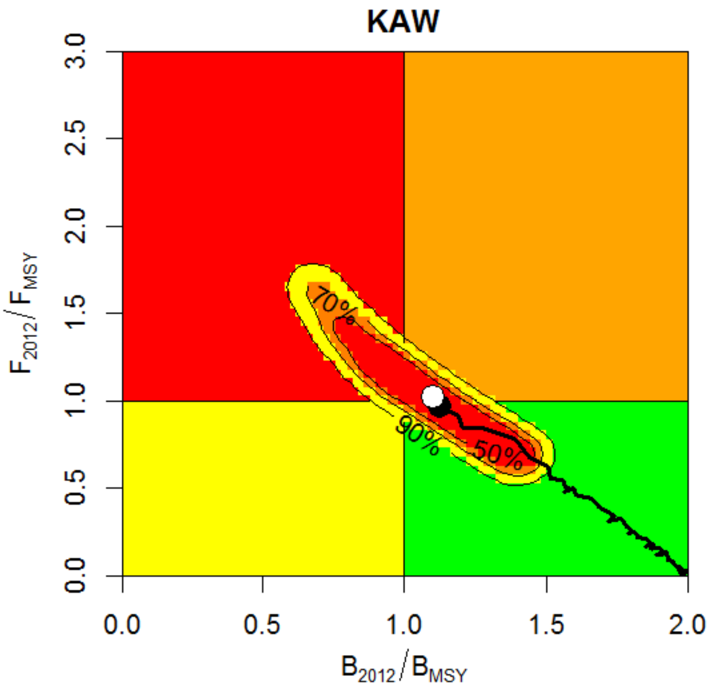

Fig. 1. Kawakawa PFCRA Aggregated Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

TABLE 2. Kawakawa: 2014 PFCRA Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of plausible models violating the MSY-based reference points for five constant catch projections (2012 catch level, -10%, -20%, -30% and +20%) projected for 3 and 10 years. Note: from the 2014 stock assessment using catch estimates at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2012) and weighted probability (%) scenarios that violate reference point**				
	70% (109,212 t)	80% (124,813 t)	**90%** (140,415 t)	**100%** (156,017 t)	**120%** (187,220 t)
$B_{2015} < B_{MSY}$	0%	4%	24%	50%	98%
$F_{2015} > F_{MSY}$	0%	0%	23%	74%	100%
$B_{2022} < B_{MSY}$	0%	12%	37%	77%	100%
$F_{2022} > F_{MSY}$	0%	6%	36%	80%	100%

APPENDIX X
LONGTAIL TUNA – DRAFT RESOURCE STOCK STATUS SUMMARY

DRAFT: 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**		**2014 stock status determination**
Indian Ocean	Catch[2] 2012: Average catch[2] 2008–2012:	160,532 t 139,971 t	(orange)
	MSY: F_{MSY}: B_{MSY}: F_{2012}/F_{MSY}: B_{2012}/B_{MSY}: B_{2012}/B_0:	120 Kt [79–171 Kt] 0.39 (0.27–0.51) 255 Kt (173–377 K t) 1.23 (0.47–2.11) 1.05 (0.59–1.49) 0.53(0.3–0.75)	

[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. Stock Reduction Analysis techniques indicate that the stock is being exploited at a rate that exceed F_{MSY} in recent years (Fig. 1). Whether a four quadrant stock structure of catches in the Indian Ocean or a one stock assumption is used in the analysis, the conclusions remain the same. Another analysis conducted on the NWIO with a Surplus Production Model (ASPIC) also indicates that the stock is subject to overfishing. More traditional methods of stock assessment need to be conducted by developing indices of abundance using catch and effort series from I.R. Iran and Indonesia. Based on the weight-of-evidence available to the WPNT, including that estimated values of current biomass are near the estimated abundance to produce B_{MSY} in 2012, and that fishing mortality has exceeded F_{MSY} values in recent years, the stock is considered to be **not overfished**, but **subject to overfishing** (Table 1; Fig. 1).

Outlook. There remains considerable uncertainty about stock structure and about the total catches in the Indian Ocean. The continued increase of annual catches for longtail tuna in recent years has further increased the pressure on the Indian Ocean stock as a whole. 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 data poor fisheries are warranted. The following should be noted:

- The Maximum Sustainable Yield estimate of 120,000 t is likely being exceeded in recent years.
- 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 longtail tuna catch in recent years, some measures need to be taken to slow or reduce catches in the Indian Ocean (Table 2).
- Improvement in data collection and reporting is required to assess the stock status, primarily abundance index series from I.R. Iran, Oman and Indonesia.
- Limit reference points: The Commission has not adopted limit reference points for any of the neritic tunas under its mandate.

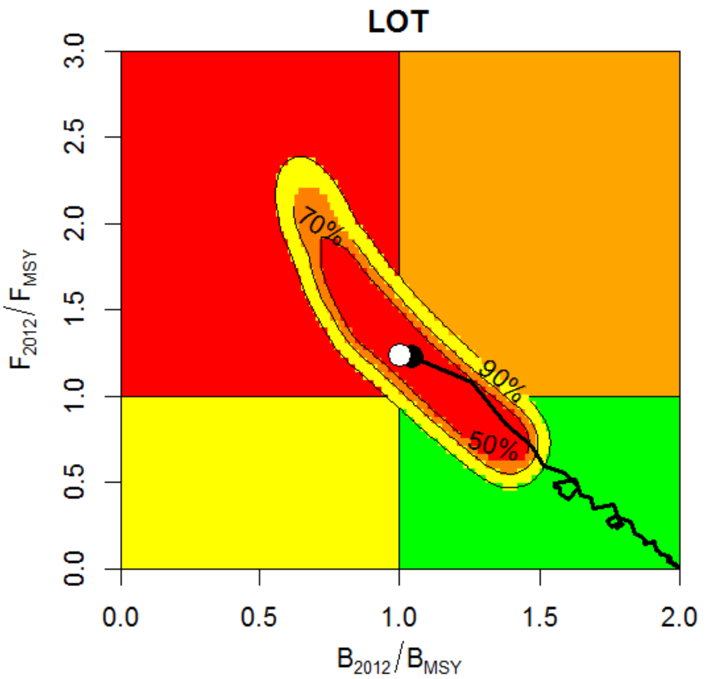

Fig. 1. Longtail tuna: PFCRA Aggregated Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options is also presented.

TABLE 2. Longtail tuna: 2014 PFCRA Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of plausible models violating the MSY-based reference points for five constant catch projections (2012 catch level, -10%, -20%, -30% and +20%) projected for 3 and 10 years. Note: from the 2014 stock assessment using catch estimates at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2012) and weighted probability (%) scenarios that violate reference point**				
	70% (112,372 t)	**80%** (128,425 t)	**90%** (144,479 t)	**100%** (160,532 t)	**120%** (187,220 t)
$B_{2015} < B_{MSY}$	17%	37%	67%	87%	96.2%
$F_{2015} > F_{MSY}$	5%	53%	93%	100%	100%
$B_{2022} < B_{MSY}$	24%	56%	80%	95%	100%
$F_{2022} > F_{MSY}$	20%	60%	86%	100%	100%

APPENDIX XI
INDO-PACIFIC KING MACKEREL – DRAFT RESOURCE STOCK STATUS SUMMARY

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

DRAFT: 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		2014 stock status determination
Indian Ocean	Catch[2] 2012: Average catch[2] 2008–2012:	46,430 t 47,257 t	
	MSY: F_{MSY}: B_{MSY}: F_{2012}/F_{MSY}: SB_{2012}/SB_{MSY}: SB_{2012}/SB_0:	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}≥ 1)
Stock subject to overfishing(F_{year}/F_{MSY}> 1)		
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)		
Not assessed/Uncertain		

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No quantitative stock assessment is currently available for Indo-Pacific king mackerel in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Aspects of the fisheries for Indo-Pacific king mackerel 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 Indo-Pacific king mackerel should be applied.

Outlook. Total annual catches for Indo-Pacific king mackerel have stabilised over the past five years at around 47,000 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.
- 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.

APPENDIX XII

NARROW-BARRED SPANISH MACKEREL – DRAFT RESOURCE STOCK STATUS SUMMARY

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

DRAFT: 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**		**2014 stock status determination**
Indian Ocean	Catch[2] 2012: Average catch[2] 2008–2012:	143,333 t 137,117 t	
	MSY: F_{MSY}: B_{MSY}: F_{2012}/F_{MSY}: B_{2012}/B_{MSY}: B_{2012}/B_0:	137 Kt [93–164 Kt] 0.47 (0.41–1.95) 229 Kt (132–265K t) 0.92 (0.41–1.95) 1.17 (0.5–1.51) 0.59 (0.25–0.75)	

[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. Stock Reduction Analysis techniques indicate that the stock is being exploited at a rate that is near F_{MSY} in recent years, and the stock appears to be fully exploited. NWIO (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 with this stock. Based on the weight-of-evidence available to the WPNT, including the two different SRA approaches pursued in 2014, the stock appears to be **not overfished** and **not subject to overfishing** (Table 1, Fig. 2).

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 probably near full/optimal utilisation. The apparent fidelity of narrow-barred Spanish mackerel to particular areas/regions is a matter for concern as overfishing in these areas can lead to localised depletion. Research emphasis on improving indicators and exploration of stock structure and stock assessment approaches for data poor fisheries are warranted. The following should be noted:

- Maximum Sustainable Yield estimate for the whole Indian Ocean is 137,000 (range 93,000 t–64,000 t).
- 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 narrow-barred Spanish mackerel catch in recent years, some measures need to be taken to slow or 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.

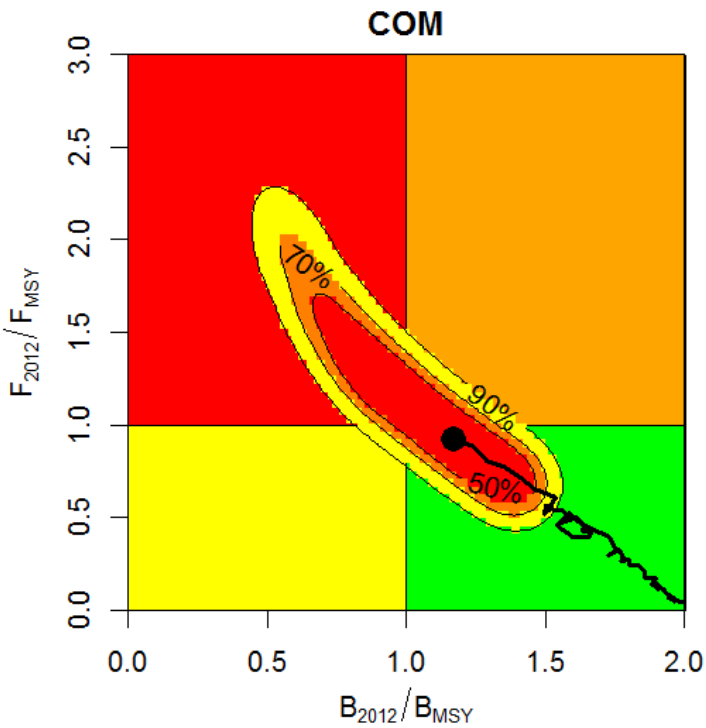

Fig. 1. Narrow-barred Spanish mackerel: PFCRA Aggregated Indian Ocean assessment Kobe plot. The Kobe plot presents the trajectories for the range of plausible model options included in the formulation of the final management advice. The trajectory of the geometric mean of the plausible model options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

TABLE 2. Narrow-barred Spanish mackerel: 2014 PFCRA Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of plausible models violating the MSY-based reference points for five constant catch projections (2012 catch level, -10%, -20%, -30% and +20%) projected for 3 and 10 years. Note: from the 2014 stock assessment using catch estimates at that time.

Reference point and projection timeframe	**Alternative catch projections (relative to 2012) and weighted probability (%) scenarios that violate reference point**				
	70% (100,333 t)	**80%** (114,666 t)	**90%** (129,000 t)	**100%** (143,333 t)	**120%** (172,000 t)
$B_{2015} < B_{MSY}$	6%	23%	46%	72%	90%
$F_{2015} > F_{MSY}$	0%	10%	54%	90%	99%
$B_{2022} < B_{MSY}$	9%	24%	52%	76%	90%
$F_{2022} > F_{MSY}$	4%	19%	53%	82%	96%

APPENDIX XIII
CONSOLIDATED RECOMMENDATIONS OF THE 4TH SESSION OF THE WORKING PARTY ON NERITIC TUNAS

Note: Appendix references refer to the Report of the 4th Session of the Working Party on Neritic Tunas (IOTC–2014–WPNT04–R)

Identification cards for tuna and tuna-like species

WPNT04.01 (para. 11) **NOTING** the excellent work undertaken by the IOTC Secretariat and other experts to develop and finalise the cards for the *Identification of tuna and tuna-like species in the Indian Ocean fisheries*, the WPNT **RECOMMENDED** that the cards be translated, in priority order to the following languages, according to the proportion of total catches of neritic tuna species reported by country, and that the IOTC Secretariat utilise funds from both the 2014 and 2015 IOTC budget, as well as external funding sources to translate and print the identification cards. Number in brackets represents the recent proportion of the total neritic tuna catch in the IOTC area of competence:

1) Bahasa (Indonesia 29%) and Malaysian (Malaysia 4%)
2) Persian (Farsi-I.R. Iran 20%) and Arabic (Oman 3%)
3) Hindi (India 18%) and Sinhala (Sri Lanka 5%)
4) Urdu (Pakistan 7%)

Kawakawa – Maldives pole and line fishery catch rate standardisation: 2004–12

WPNT04.02 (para 83) The WPNT **RECOMMENDED** that the Maldives undertake further investigation of the quality of the catch-and-effort data (i.e., the zero catch records, incidence of one day fishing per month records), and development of a criteria for identifying kawakawa targeted catch, in order to improve the quality of future abundance estimates. Results should be presented at the WPNT05 meeting.

Revision of the WPNT Program of Work (2014–2018)

WPNT04.03 (para 175) The WPNT **RECOMMENDED** that the SC request the Commission further increases the IOTC Capacity Building budget line so that capacity building workshops/training can be carried out in 2015 and 2016 on the collection, reporting and analyses of catch and effort data for neritic tuna and tuna-like species. Where appropriate these training sessions shall include information that explains the entire IOTC process from data collection, reporting, verification, analysis, the development of scientifically based management advice and how the advice is used by the Commission to develop Conservation and Management Measures.

WPNT04.04 (para 176) The WPNT **RECOMMENDED** that the SC request that the Commission further increases the IOTC Capacity Building budget line so that capacity building training on data analysis and applied stock assessment approaches, with a priority being data poor approaches, can be carried out in 2015 and 2016.

WPNT04.05 (para 177) The WPNT **RECOMMENDED** that CPCs address issues identified in their current data collection program, such as data shortages, through focusing on the collection of finer scale fishery-dependent data. This might include information on set duration, depth of gear, size etc.

WPNT04.06 (para 178) The WPNT **RECOMMENDED** that the SC consider and endorse the WPNT Program of Work (2014–2018), as provided at Appendix VI.

WPNT04.07 (para 180) The WPNT **RECOMMENDED** that a consultant be hired to assist in building capacity among the WPNT participants by supplementing the skill set available within IOTC CPCs to develop data poor stock assessment approaches for neritic tuna stocks. An indicative budget is provided at Table 16.

Table 16. Estimated budget required to hire a consultant to carry out data poor stock assessment on neritic tuna and tuna-like species in 2015 and 2016.

Description	Unit price	Units required	2015 Total (US$)	2016 Total (US$)
Neritic tuna stock assessments using data poor approaches and/or indicator development (Longtail tuna, kawakawa, narrow-barred Spanish mackerel, Indo-Pacific king mackerel) (fees)	450	25	11,250	11,250
Neritic tuna stock assessment and/or indicator development (travel)	5,000	1	5,000	5,000
		Total estimate	**16,250**	**16,250**

Meeting participation fund (MPF)

WPNT04.08 (para 185) The WPNT **RECOMMENDED** that the SC and Commission note the following:

4) The participation of developing coastal state scientists to the WPNT has increased dramatically in recent years 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 17).
5) 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.
6) 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 17. 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
Total		142	111	52	43

Review of the draft, and adoption of the Report of the 4th Working Party on Neritic Tunas

WPNT04.09 (para 191) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT04, 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 three species assigned a stock status in 2014 (Fig. 9):

- 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

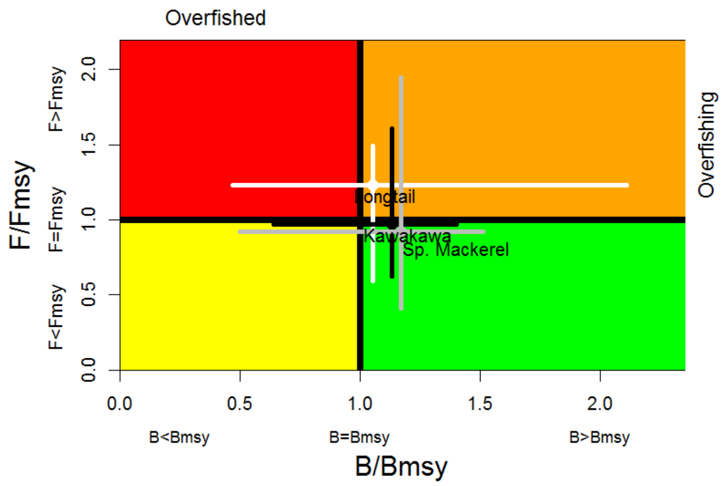

Fig. 9. Combined Kobe plot for kawakawa (black), longtail tuna (white) and narrow-barred Spanish mackerel (grey), showing the 2012 estimates of current stock size (B) and current fishing mortality (F) in relation to optimal spawning stock size and optimal fishing mortality using the PFCRA approach. Cross bars illustrate the range of uncertainty from the model runs.