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

Bali, Indonesia, 2–5 July 2013

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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
GCC	Gulf Cooperation Council
GLD	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
NTAD	Non-target and dependent (species)
PS	Purse-seine
ROP	Regional Observer Programme
SC	Scientific Committee of the IOTC
SB	Spawning biomass (sometimes expressed as SSB)
SB_{MSY}	Spawning stock biomass which produces MSY
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)

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EXECUTIVE SUMMARY

The Third Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT03) was held in Bali, Indonesia, from 2 to 5 July 2013. A total of 42 participants (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 WPNT03 to the Scientific Committee, which are provided at Appendix XIII.

Meeting participation fund

NOTING that the IOTC Meeting Participation Fund (MPF), 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*), was used to fund the participation of 11 national scientists, including the Chair and Vice-Chair, to the WPNT03 meeting (10 in 2012), the WPNT **RECOMMENDED** that this fund be maintained into the future, as neritic tunas are very important resources for many of the coastal countries of the Indian Ocean. (para. 3)

NOTING that the MPF was established for the purposes of supporting scientists and representatives from IOTC Members and Cooperating non-Contracting Parties (CPCs) who are developing States to attend and/or contribute to the work of the Commission, the Scientific Committee and its Working Parties, and that the Commission had directed the Secretariat to ensure that the MPF would be utilized, as a first priority, to support the participation of scientists from developing CPCs in scientific meetings of the IOTC, including Working Parties, rather than non-science meetings, the WPNT **RECOMMENDED** that the SC consider making a request to the Commission to provide additional direction to the Secretariat regarding the use of the funds. The direction should clarify what proportion of the MPF should be used for scientific versus non-scientific meetings each budget cycle. (para 4)

IOTC database

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 **RECOMMENDED** that the CPCs listed in the Appendix, make efforts to remedy the data issues identified and to report back to the WPNT at its next meeting. (para 20)

General discussion on data

The WPNT **RECOMMENDED** that the SC request the Commission increase the IOTC Capacity Building budget line so that capacity building workshops/training can be carried out in 2014 and 2015 on the collection, reporting and analyses of catch and effort data for neritic tuna and tuna-like species. Where appropriate this training session shall include information that explains the entire IOTC process from data collection to analysis and how the information collected is used by the Commission to develop Conservation and Management Measures. (para 24)

Revision of the WPNT work plan

The WPNT **RECOMMENDED** that the SC consider and endorse the workplan for the WPNT for 2014, and tentatively for future years, as provided at Appendix XII. (para 175)

Review of the draft, and adoption of the Report of the Third WPNT

The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT03, 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: (para 184)

- bullet tuna (*Auxis rochei*) – Appendix VI
- frigate tuna (*Auxis thazard*) – Appendix VII
- kawakawa (*Euthynnus affinis*) – Appendix VIII
- longtail tuna (*Thunnus tonggol*) – Appendix IX
- Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix X
- narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix XI

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.

Stock	Indicators	2009	2010	2011	2012	2013	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 2011: 8,547 t Average catch 2007–2011: 7,763 t MSY: 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. Therefore stock status remains **uncertain**. However, 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. Click on each species below for a full stock status summary: • Bullet tuna (*Auxis rochei*) • Frigate tuna (*Auxis thazard*)
Frigate tuna *Auxis thazard*	Catch 2011: 102,194 t Average catch 2007–2011: 91,155 t MSY: Unknown						
Kawakawa *Euthynnus affinis*	Catch 2011: 145,001 t Average catch 2007–2011: 130,758 t MSY: 126,000–132,000 t F_{2011}/F_{MSY}: 0.9–1.06 B_{2011}/B_{MSY}: 1.09–1.17 SB_{2011}/SB_0: Unknown						Preliminary analysis using a stock-reduction analysis (SRA) approach indicates that the stock in near optimal levels of F_{MSY}, or exceeding these targets, although stock biomass remains above the level that would produce MSY (B_{MSY}). Due to the quality of the data being used, the simplistic approach used here, and the rapid increase in kawakawa catch in recent years, some measures need to be taken to slow the increase in catches in the IO Region, despite the stock status remaining classified as **uncertain**. Click below for a full stock status summary: • Kawakawa (*Euthynnus affinis*)
Longtail tuna *Thunnus tonggol*	Catch 2011: 164,537 t Average catch 2007–2011: 121,061 t MSY: 110,000–123,000 t F_{2011}/F_{MSY}: 1.11–1.77 B_{2011}/B_{MSY}: 1.11–1.25 SB_{2011}/SB_0: Unknown					(orange)	Stock Reduction Analysis techniques indicate that the stock is being exploited at rates that exceed F_{MSY} in recent years. 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. Given estimated values of current biomass are above the estimated abundance to produce B_{MSY} in 2011, 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 2011: 46,274 t Average catch 2006–2010: 46,354 t MSY: 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. Therefore stock status remains **uncertain**. However, 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. Click on each species below for a full stock status summary:

Stock	Indicators	2009	2010	2011	2012	2013	Advice to the Commission
							• Indo-Pacific king mackerel (*Scomberomorus guttatus*)
Narrow-barred Spanish mackerel *Scomberomorus commerson*	Catch 2011: 143,652 t Average catch 2007–2011: 133,660 t MSY: 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. Therefore stock status remains **uncertain**. However, 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. 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 Third Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Neritic Tunas (WPNT03) was held in Bali, Indonesia, from 2 to 5 July 2013. A total of 42 participants (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 Bali, Indonesia, including the Invited Expert, Dr. Shijie Zhou from CSIRO, Australia.

2. The meeting was addressed by Prof. Dr. Hari Eko Irianto, Head of Research Center for Fisheries Management and Conservation, Indonesia, who welcomed participants to Indonesia and formally opened the Third Session of the IOTC Working Party on Neritic Tunas.

Meeting participation fund

3. **NOTING** that the IOTC Meeting Participation Fund (MPF), 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*), was used to fund the participation of 11 national scientists, including the Chair and Vice-Chair, to the WPNT03 meeting (10 in 2012), the WPNT **RECOMMENDED** that this fund be maintained into the future, as neritic tunas are very important resources for many of the coastal countries of the Indian Ocean.

4. **NOTING** that the MPF was established for the purposes of supporting scientists and representatives from IOTC Members and Cooperating non-Contracting Parties (CPCs) who are developing States to attend and/or contribute to the work of the Commission, the Scientific Committee and its Working Parties, and that the Commission had directed the Secretariat to ensure that the MPF would be utilized, as a first priority, to support the participation of scientists from developing CPCs in scientific meetings of the IOTC, including Working Parties, rather than non-science meetings, the WPNT **RECOMMENDED** that the SC consider making a request to the Commission to provide additional direction to the Secretariat regarding the use of the funds. The direction should clarify what proportion of the MPF should be used for scientific versus non-scientific meetings each budget cycle.

5. The WPNT **EXPRESSED** its thanks to the BOBLME project that provided financial support to an additional five national scientists to attend the WPNT03 meeting (six in 2012), and asked the Secretariat to continue to liaise with BOBLME in the hope that such funding may be offered in 2014.

2. Adoption of the Agenda and Arrangements for the Session

6. The WPNT **ADOPTED** the Agenda provided at Appendix II. The documents presented to the WPNT03 are listed in Appendix III.

3. Outcomes of the Fifteenth Session of the Scientific Committee

7. The WPNT **NOTED** paper IOTC–2013–WPNT03–03 which outlined the main outcomes of the Fifteenth Session of the Scientific Committee (SC15), specifically related to the work of the WPNT and **AGREED** to consider how best to progress these issues at the present meeting.

8. The WPNT **NOTED** the statement from the SC 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. As very little is known about the population structure and migratory range of most neritic tunas in the Indian Ocean, research needs to be undertaken along two separate lines; i) genetic research to determine the connectivity of neritic tunas throughout their distributions, and ii) tagging research to better understand the movement dynamics, possible spawning locations, and post-release mortality of neritic tunas from various fisheries in the Indian Ocean.

9. The WPNT **NOTED** the endorsement by the SC that, upon request of CPCs, 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.

10. The WPNT **NOTED** that the neritic tuna and tuna-like species under the IOTC mandate continue to be as important or more important as the three tropical tuna species (bigeye tuna, skipjack tuna and yellowfin tuna) to most IOTC coastal states with a total estimated catch of 610,731 t being landed in 2011 (554,544 t in 2010), and as a result, should receive appropriate management resources from the IOTC.

4. OUTCOMES OF SESSIONS OF THE COMMISSION

4.1 Outcomes of the Seventeenth Session of the Commission

11. The WPNT **NOTED** paper IOTC–2013–WPNT03–04 which outlined the main outcomes of the Seventeenth Session of the Commission, specifically related to the work of the WPNT.

12. The WPNT **NOTED** the 11 Conservation and Management Measures (CMMs) adopted at the Seventeenth Session of the Commission (consisting of 11 Resolutions and 0 Recommendations), and in particular the following three CMMs which have a direct impact on the work of the WPNT: Resolution 13/02 *Concerning the IOTC record of vessels authorised to operate in the IOTC area of competence*; Resolution 13/03 *On the recording of catch and effort by fishing vessels in the IOTC area of competence*; Resolution 13/11 *On a ban on discards of bigeye tuna, skipjack tuna, yellowfin tuna and non-targeted species caught by purse seine vessels in the IOTC area of competence*.

13. The WPNT **NOTED** that the Report of the Seventeenth Session of the Commission is currently being adopted via correspondence and is expected to be available for download from the IOTC website in English and French in the coming weeks.

14. **NOTING** that the Commission at its 17th Session approved a new Fishery Officer (Science) position at the IOTC Secretariat and that funding was provided for 6 months, starting on 1 July, 2013, the WPNT **REQUESTED** that the Secretariat expedite the recruitment process so that the successful candidate can commence work, including matters relevant to the WPNT.

4.2 Review of Conservation and Management Measures relating to neritic tunas

15. The WPNT **NOTED** paper IOTC–2013–WPNT03–05 which aimed to encourage the WPNT to review the existing Conservation and Management Measures (CMMs) relating to neritic tunas, and as necessary to 1) provide recommendations to the SC on whether modifications may be required; and 2) recommend whether other CMMs may be required. Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*, which sets out mandatory minimum requirements for the annual submission of fisheries statistics to the IOTC Secretariat was reviewed by the WPNT.

16. The WPNT **RECOMMENDED** that the SC consider proposing the following amendments to Resolution 10/02, for the Commission's consideration in 2014:

1) The Resolution would be easier to interpret if a set of 'Definitions' was added, including those for coastal fisheries, longline fisheries and purse seine fisheries.

2) Change paragraph 3 a) from:

> **"For coastal fisheries:** available catch by species, fishing gear and fishing effort shall be submitted frequently and may be provided using an alternative geographical area if it better represents the fishery concerned."
>
> to the following:
>
> **"Coastal fisheries:**
>
> Available catch by species, fishing gear and fishing effort, by month shall be submitted and may be provided using an alternative geographical area if it better represents the fishery concerned. The data shall be extrapolated to the total monthly catches, for each gear and for the geographical area of concern. A description of the extrapolation procedures (including raising factors corresponding to the sampling coverage) shall also be submitted."

3) Change paragraph 5, under a new heading "**Fish aggregating devices (FADs) and support vessels data**", and then split the paragraph into two sections "Purse seine fisheries" and "Other fisheries", so that coastal fisheries report the following:

Other fisheries

Given that Anchored Fish Aggregating Devices (AFADs) are an integral part of the fishing effort exerted by the coastal fisheries using them, the following data shall be provided:

a) Type of AFADs used in the country, including specification (i.e. dimensions, materials used).
b) Total number of active AFADs by 1° grid area and month.

5. Progress on the Recommendations of WPNT02

17. The WPNT **NOTED** paper IOTC–2013–WPNT03–06 which provided an update on the progress made in implementing the recommendations from the Second Session of the WPNT, and also provided alternative recommendations for those recommendations yet to be completed, for the consideration and potential endorsement by participants.

18. The WPNT **REQUESTED** that the Secretariat 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

IOTC database

19. The WPNT **NOTED** paper IOTC–2013–WPNT03–07 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 (CPC's)*, for the period 1950–2011. A summary is provided at Appendix IVa–IVf.

20. 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 **RECOMMENDED** that the CPCs listed in the Appendix, make efforts to remedy the data issues identified and to report back to the WPNT at its next meeting.

21. The WPNT **AGREED** that the data held by the IOTC Secretariat on neritic tuna species remains poor, despite the mandatory reporting requirements that were adopted by the Members of the Commission under Resolution 10/02 *Mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)* (and superseded Resolutions) and **URGED** all participants to ensure their national reporting organisation improves their data collection and reporting for these species as per IOTC requirements.

22. The WPNT **NOTED** that reliable data collection for these neritic tuna species, following the IOTC standards, is more difficult than for oceanic tuna species, as neritic species are mainly targeted and caught by small scale artisanal vessels. In particular, catches of neritic tuna on board artisanal vessels are often made using several gears (seine, handline, nets, etc.) and are difficult to assign by species and by gear as per IOTC requirements.

23. The WPNT **RECALLED** that presenting data at a working party meeting does not constitute a formal submission to the IOTC. These data should be submitted formally to the IOTC Secretariat in accordance with the IOTC mandatory statistical requirements, outlined in Resolution 10/02.

General discussion on data

24. The WPNT **RECOMMENDED** that the SC request the Commission increase the IOTC Capacity Building budget line so that capacity building workshops/training can be carried out in 2014 and 2015 on the collection, reporting and analyses of catch and effort data for neritic tuna and tuna-like species. Where appropriate this training session shall include information that explains the entire IOTC process from data collection to analysis and how the information collected is used by the Commission to develop Conservation and Management Measures.

25. **NOTING** that some CPCs do not currently have a sampling scheme dedicated to the recording of 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 developed these data collections systems.

26. **NOTING** that some CPCs, in particular from India, Indonesia and Thailand, have collected large data sets on neritic tuna species over long time periods, the WPNT reiterated its previous **RECOMMENDATION** 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 stock status indicators or comprehensive stock assessments of neritic tuna species in the future.

27. The WPNT **NOTED** the following two capacity building projects currently underway in Sri Lanka, Comoros and Madagascar, with the aim of strengthening the implementation of data collection programs:

- 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.
- Comoros/Madagascar (joint IOTC-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, improvements to catch sampling.

28. The WPNT **NOTED** the following proposals for activities to be carried out in 2013 and 2014 and expressed its strong **SUPPORT** for these projects:

- Indonesia: Review of the coastal fisheries (joint IOTC-OFCF project). Implementation of a pilot project 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 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.
- Malaysia and Thailand: Data mining for neritic tunas (joint IOTC-OFCF project). Review of catch-and-effort data collected from the coastal purse seine fisheries operated by Malaysia and Thailand 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.
- Maldives: Pilot project on the implementation of electronic data collection system, using tablets or pens (joint IOTC-World Bank project – under review). Assist Maldives in the collection, processing and reporting of data from its pole-and-line fishery, in close-to real time. The expected outputs would include improvements in data capture and validation of catch estimates, and assess the feasibility of implementing such a system in Maldives and other countries of the region.

29. **NOTING** that monofilament gillnets are recognised to have highly detrimental impacts on fishery ecosystems, as they are non-selective, and that the use of monofilament gillnets have already been banned in a large number of IOTC CPCs, the WPNT **RECOMMENDED** that each CPC using monofilament gillnets to estimate total catch and bycatch, etc., taken by monofilament gillnets in comparison to other net material, and to report the findings at the next WPNT meeting.

Maldives neritic tuna fisheries

30. The WPNT **NOTED** paper IOTC–2013–WPNT03–08 which provided a review of the data collection challenges in the Maldives neritic tuna fishery, including the following abstract provided by the authors:

> "*Neritic tuna (kawakawa and frigate tuna) are caught in the Maldives using a number of different types of gears operated on a range of vessels. These fish are caught in the inshore (inside the atoll) and near shore waters by pole-and-line, handline and trolling. The vessels include the small (often sailing) trolling boats (4m) to large (30m) pole-and-line boats. The small boats (trolling boats) target the neritic tuna in the inshore waters and on the outer edge of the atoll. The larger pole-and-line boats targeting mainly skipjack take neritic tuna as a non-target and dependent species (NTAD) around anchored FADs and drifting objects. Fishermen fishing for reef fish using handline and the sports fishermen casting and trolling on the edge of the reef also catch neritic tuna. Fish caught by handline, sports fishermen and some small trolling vessels are often consumed on the islands. The catch landed by some trolling vessels and the pole-and-line fleet are sold for local consumption and to the processors who make dried fish for the local market and for export to Sri Lanka.* – see paper for full abstract."

31. The WPNT **NOTED** that although a large proportion of the reported catch (through logbooks), is taken by pole-and-line gear, a large portion of the catch taken is thought to remain unreported by the numerous sports fishers and small trolling vessels operating in the Maldives EEZ. In order to fully account for the neritic tuna catches in the Maldives, and to ensure a detailed and reliable estimate is available for stock assessment purposes, it is

important to develop a data collection system whereby catch and effort from the small trolling vessels and the sports fishers is collected.

32. The WPNT **AGREED** that the Maldives would benefit from the experience of other monitoring programs implemented for small scale fisheries in the Indian Ocean and that the Secretariat could assist by linking program coordinators with those from the Maldives.

33. The WPNT **NOTED** that the logbooks are currently being revised and awareness campaigns being conducted to increase the recording and reporting of catch by fishers, and **AGREED** that this system would be highly valuable for the collection of accurate data on neritic tuna species in the Maldives.

34. 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 AFADs.

India neritic tuna fisheries

35. The WPNT **NOTED** paper IOTC–2013–WPNT03–09 which provided an overview of the status and of neritic tunas fisheries in India, including the following abstract provided by the authors:

“*India has a coastline of 8,118 km in length with a continental shelf area of 0.53 million sq.km. Small scale fishing for tuna and tuna-like species is carried out by operating drift gillnets, troll line, hook and line, pole-and-line, purse seine, ring seine etc. The tuna catch is mainly composed of ten species. The average neritic tuna landing during 2007-11 was 41,271 t which is 12.03% of the total neritic tuna landings of Indian Ocean countries. India's highest contribution of neritic tuna was 27.7% during 1972-81.Tuna production from the Indian EEZ have fluctuated between 92,079 t in 2008 and 53,009 t in 2010. Average tuna landing during 2008-11 was of 73,265 t. Kawakawa dominated the tuna catch with 38%, followed by skipjack tuna (17%), yellowfin tuna (16%) and longtail tuna (11%). Since neritic tuna are mainly caught by multi-gear and multiday fishing operations, the availability of gear-wise data on the resources are limited. Hence, for regular monitoring of the resources, detailed data, specific to craft and gear is required for adopting sustainable tuna fishery management based on scientific methods*.”

36. The WPNT **RECALLED** the efforts by India in 2012 to revise its catch data from 2007 for all species, by including catch from Lakshadweep and the Andaman islands. During 2012 the catch series of India was further revised by an independent consultant, using information from several sources, mainly the CMFRI repository and a historical review conducted under the Sea Around Us Project of the University of British Columbia.

I.R. Iran neritic tuna fisheries

37. The WPNT **NOTED** paper IOTC–2013–WPNT03–10 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:

“*In the Islamic Republic of Iran about 6,500 out of 12,000 fishing vessels are engaged in tuna fishing activities. The catch quantity of tuna and tuna-like species in 2012 is equal to 206,000 t, of which 144,000 t are attributed to neritic tuna species. Neritic tuna fishes are important to the livelihood of coastal communities and is considered as one of the most valuable opportunities for developing employment and income and long-term sustainable exploitation of those marine resource in line with responsible fishery were always pursued by country fisheries management. An analysis of tuna catch trends since 2005 shows that the catch of this group of species during recent years has gradually increased. According to characteristics and importance of tuna catches, there have been formulated and enforced suitable managerial and operational program for improving related activities in the country inter alia… –* see paper for full abstract.”

38. 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 have moved back to the EEZ of I.R. Iran and are now targeting 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.

39. The WPNT **NOTED** that the data from the I.R. Iran appears to be useful for catch rate standardisation. At the very least, calculating nominal catch series from the I.R. Iran would be important. This would be compiling catch by species and gear type with effort at the same resolution over time. Once this exercise is done, using operational data for a particular gear type could be analysed to standardise the abundance index signal over time for some neritic tuna species, or at the very least for longtail tuna.

40. The WPNT **AGREED** that 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).

41. The WPNT **AGREED** that given the importance of accurate age determination to growth and mortality estimates, age validation techniques using otoliths should be explored.

42. The WPNT **RECALLED** its agreement from 2012, that in addition to ageing studies, the priority areas of research for I.R. Iran on neritic tunas are:
    - To identify if neritic tunas in the Gulf and Oman Sea are part of a larger homogeneous Indian Ocean genetic population/stock or whether a separate population/stock is in existence which may warrant delineation of neritic tunas into separate management units
    - To identify if neritic tunas spawning grounds in the Gulf and Oman Sea are suitable candidates for area-based management (i.e. closed time-area restrictions)

43. The WPNT **NOTED** the continued efforts by I.R. Iran to improve the management of neritic tuna resources around Iran, which included the implementation of a logbook program for all tuna and tuna-like species, implementing a scientific observer scheme; and developing species identification guides in Persian.

Malaysia: neritic tuna fisheries

44. The WPNT **NOTED** paper IOTC–2013–WPNT03–11 Rev_1 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 purse seine vessels contributed more than 80% of the annual catches of neritic tuna and as the most important fishing gear in neritic tuna fisheries. Two types of purse seines operate in Malaysia; using FADs and light luring; and large purse seines > 70 GRT contribute more than 61% of total neritic tuna catches and their catch rates were higher than of small purse seines. The Strait of Malacca contributed 45% of the neritic tuna in Malaysia and the rest from the South China Sea and Sulu and Celebes seas, east coast of Borneo continent. The main species of neritic tuna found in the Malacca Strait are longtail (<u>Thunnus tonggol</u>) and kawakawa (<u>Euthynnus affinis</u>) while frigate tuna (<u>Auxis thazard</u>) were rarely caught. The fishing areas for Malaysian purse seine vessels concentrated within one area near the border of Thailand and Indonesia. A few months of size data collection show that length distributions of kawakawa declined and the average size gradually decreased from 339 mm in March to 235 mm in June….* – see paper for full abstract."

45. 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. Similarly, mid-water trawls, with wide-mouth nets are catching increasing numbers of neritic tuna species.

46. The WPNT **AGREED** that neritic tuna in the Malacca Strait would require shared management among the various bordering countries, i.e. Thailand, Malaysia, Indonesia, and if possible with other neighbouring countries of the Bay of Bengal, i.e. Bangladesh, India, Myanmar and Sri Lanka.

Tanzania: Socio-economics of neritic tuna fisheries

47. The WPNT **NOTED** paper IOTC–2013–WPNT03–12 which provided an overview of a baseline study on Socio-economic benefits of artisanal tuna and tuna-like fisheries in the United Republic of Tanzania, including the following abstract provided by the authors:

    "*Tuna and tuna-like species are important fisheries resources for food and have a valuable contribution to the country's economy. In most of the developing countries the fishery is mainly artisanal and dominated by men. The overall objective of this study was to access the socio-economic benefit of artisanal tuna and tuna-like fishery along the Tanzania coastline. Findings from this study indicated the main fishing gears for tuna and tuna-like species in the order of preference is gillnet, hand-line/long-line, and ring-net, operated by either sail or motorized boat. Fishing is carried out between 5 and 20 kilometers away from the shoreline. The most targeted species are wahoo (Nguru-maskati), kawakawa (Sehewa), tuna (Jodari) and skipjack tuna (Zunuba). The preference for these species is determined by their availability and high economic returns. The fishery generates a significant amount of income to fishers, middle men and hotels along the market chain. Nationally the fishery generates between 4 and 8 million TZS annually from the royalties charged on exports….* – see paper for full abstract."

48. The WPNT **RECALLED** paragraph 2(d), Article V of the IOTC Agreement which states that in order to achieve its objectives, "*the Commission shall have the following functions and responsibilities, in accordance with the principles expressed in the relevant provisions of the United Nations Convention on the Law of the Sea:*

2(d) to keep under review the economic and social aspects of the fisheries based on the stocks covered by this Agreement bearing in mind, in particular, the interests of developing coastal states".

49. The WPNT **NOTED** that paper IOTC–2013–WPNT03–12 was the first presented at the WPNT which considers the economic and social aspects of IOTC fisheries and encouraged other participants to consider undertaking and then presenting the results of similar studies for their own fisheries for neritic tuna species under the IOTC mandate.

50. The WPNT **NOTED** that Tanzanian fisheries for neritic tunas are currently poorly monitored, although efforts are being made to rectify this deficiency. As a result, the total reported catches for neritic tunas have been increasing, with 2,000 t reported in 1994 and 4,000 t reported in 2010. The increase identified is thought to be a result of improved data collection and reporting in recent years.

Madagascar: neritic tuna fisheries

51. The WPNT **NOTED** paper IOTC–2013–WPNT03–13 which provided an overview of neritic tuna catch estimates from the trip reports of Malagasy observers in 2012, including the following abstract provided by the authors:

> *"The observer program in Madagascar concerns the industrial and artisanal fishing fleets including the fleets of the three fisheries namely purse seine fishery, pelagic longliner fishery and the demersal fish longline fishery. Specific compositions of the catches of these three fisheries were analyzed from trip reports provided by the observers. Traces of neritic tuna species are observed in the catches of these three types of fisheries with a rate relatively low (less than 1%). Acanthocybium solandri, Euthynnus affinis and Auxis rochei included in the purse seiner and only Acanthocybium solandri is reported for the pelagic longliner and demersal fish longliner. The average size (total length) of Acanthocybium solandri, Euthynnus affinis and Auxis rochei sampled aboard purse seiners are 94.51, 42.02 and 45 cm respectively (for number of individuals 125, 95 and 3 respectively).*"

52. The WPNT **NOTED** the efforts by Madagascar to establish an observer program, which is now producing useful information on neritic tuna. Observer reports show that three fisheries (purse seine, surface longline and bottom longline) are catching neritic tunas in Malagasy waters.

53. The WPNT **NOTED** that other traditional fishing gears may also be catching neritic tuna species and that Madagascar was in the process of developing data collection systems for its artisanal fisheries.

Indonesia: climate change anomaly

54. The WPNT **NOTED** paper IOTC–2013–WPNT03–14 which provided an overview of the impact of a climate anomaly on catch composition of neritic tuna in Sunda Strait (eastern part of Indian Ocean), including the following abstract provided by the authors:

> "*Tongkol komo/kawakawa (Euthynnus affinis) and tenggiri/Indo-Pacific king mackerel (Scomberomerus guttatus) are commonly caught by mini purse seiners operating in the Sunda Straits and landed in Labuan, West Java. These species inhabit coastal waters and have a preference for relatively warm water. Oceanographic parameters which commonly influence the distribution of Euthynnus affinis are temperature, water currents and salinity. The oceanography of Sunda Strait is influenced by water masses coming from the north that mainly originated from the Java water mass and water masses from the south mainly originated from Indian Ocean. The internal oceanography of Sunda Strait is also influenced by upwelling and the monsoon as regional climate anomaly (ENSO and Indian Ocean Dipole Mode). This paper describe the influence of Dipole Mode (Positive and negative event) and ENSO (El-Nino/La-Nina) to the catch dynamics of neritic tunas particularly in Sunda Straits by time series from 1994 to 2009.* – see paper for full abstract."

55. The WPNT **NOTED** the results of the study which suggested that catches of kawakawa (*Euthynnus affinis*) are likely to be higher in water masses with increased water temperature. However, it was also suggested that increases in abundance may be related to other factors, such as short term migrations, feeding and spawning movements. Thus, additional research was suggested to determine if there were other factors influencing the observed changes in local abundance.

Thailand: catch and size distribution from purse seine fisheries

56. The WPNT **NOTED** paper IOTC–2013–WPNT03–15 which provided an overview of catch and size distribution of neritic tunas from purse seine in Andaman sea coast of Thailand (2012), including the following abstract provided by the authors:

> "*Neritic tunas are caught mainly by purse seine vessels: Thai purse seine, light luring purse seine, purse seine with aggregating devices and tuna purse seine along the Andaman Sea Coast of Thailand in 2012.*

Four species of neritic tunas were caught longtail tuna (Thunnus tonggol) 9.33 % kawakawa (Euthynnus affinis) 7.33%, frigate tuna (Auxis thazard) 3.62 % and bullet tuna (Auxis rochei) 2.99 % of total catch, although bullet tuna are caught mainly in the northern area while frigate tuna are caught mainly in the southern part of Andaman Sea. Total CPUE of neritic tunas was 545.59 kg/day, which was composed of kawakawa 170.36 kg/day, longtail tuna 217.00 kg/day, bullet tuna 69.47 kg/day and frigate tuna 84.16, kg/day. The highest CPUE was caught from tuna purse seine vessels. Mean of folk length of kawakawa was 24.88 cm (10-59.5cm), longtail tuna was 36.69 cm (14.0-30.0cm), bullet tuna was 23.39 cm (12.0-39.0cm) and frigate tuna was 30.86 cm (11.5-43.5cm). Tuna purse seine vessels caught the larger size of neritic tunas than other gears. (see Fig. 1 and Fig. 2).”

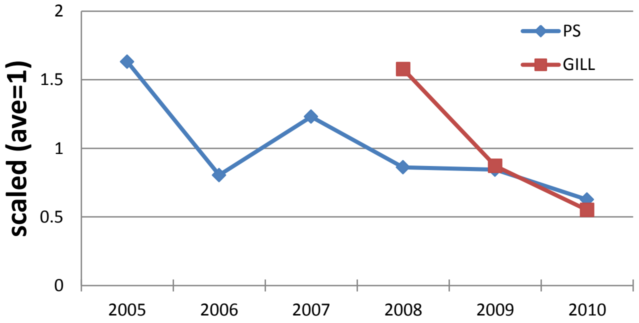

Fig. 1. Kawakawa: Nominal CPUE (scaled with mean=1) of Thailand purse seine vessels and king mackerel gillnet fisheries in the Andaman Sea.

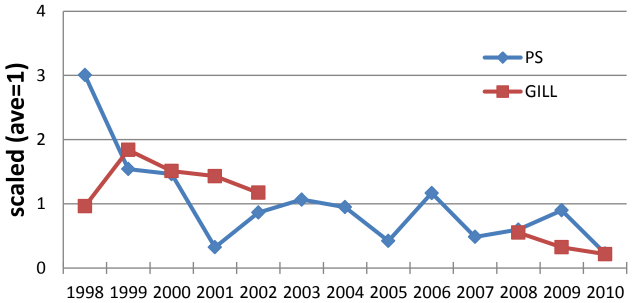

Fig. 2. Longtail tuna: Nominal CPUE (scaled with mean=1) of Thailand purse seine vessels and king mackerel gillnet fisheries in the Andaman Sea.

57. The WPNT **NOTED** that neritic tunas are targeted by two main fishing methods, purse seine and drifting gillnet. Lights are sometimes used as a luring/attracting technique, as are FADs and advanced fish finder equipment.

58. The WPNT **NOTED** that neritic tunas are becoming more important to the Thailand economy and have been the primary target species for Thailand artisanal fishers since 1982 due to high prices offered by Thai tuna canneries.

59. The WPNT **NOTED** the catches of small fishes reported in the Andaman sea by Thai vessels and that these sizes are not reported in Andaman and Nicobar islands by Indian vessels. It was thought that this was probably due to the difference in the gear used, i.e. purse seine by Thailand and gillnets in the Andaman and Nicobar islands by India.

60. The WPNT **AGREED** that nominal CPUE data maybe misleading for an index of abundance. In cases of the purse seine fleets, it is very difficult to standardise the data and examine the operational level data to account for factors such as an effort creep. Undertaking this type of analysis is not a trivial task as it requires collating operational data to account for changes in fleet dynamics that may cause a CPUE index to increase over time. Analysing operational data will be more likely to provide a representative abundance index that changes over time.

Indonesia: efficacy of fishing gears for neritic tunas

61. The WPNT **NOTED** paper IOTC–2013–WPNT03–16 which reviewed the catch performance of fishing gears for neritic tuna in the Indian Ocean based on Palabuhanratu fishing port, including the following abstract provided by the authors:

“*Neritic tuna species landed in South Java Indian Ocean were caught by gillnet, danish seine, purse seine and troll line. The pelagic danish seine contributed about 77 % of its neritic tuna catch in Palabuhanratu south of west Java. The fish species consisted of Kawakawa (Euthynnus affinis (Cantor 1849)), longtail tuna (Thunnus tonggol (Bleeker, 1851)), and bullet tuna (Auxis rochei (Risso, 1810)). Landing statistical data in last 2 years indicated that most of the catch consisted of bullet tuna. The peak season occurred during SE monsoon from June to November. Annual catch of neritic tuna based on national and*

Palabuhanratu fishing port statistical data shows an increasing trend. The estimate CPUE of purse seine tend increasing significantly in last two years. Using CPUE result Neritic tuna resources in South Java water still at a sustainable level. – see paper for full abstract."

62. The WPNT **NOTED** that pelagic Danish seine contribute about 77% of neritic tuna to the total catch in Palabuhanratu. Catches of the main species caught, bullet tuna, peak from June to November.

63. The WPNT **NOTED** that nominal CPUE series for purse seine data are often not representative of abundance. Having an increasing CPUE is usually simply a reflection of improved fleet efficiency over time, rather than abundance. Thus, more information is required about fleet dynamics, along with high resolution effort data.

Sudan: neritic tuna fisheries

64. The WPNT **NOTED** paper IOTC–2013–WPNT03–17 which provided an overview of neritic tuna catches by Sudan.

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 Sudanese fishery for neritic tunas under the IOTC mandate should be presented at the next WPNT meeting.

India: biology and population characteristics of longtail tuna and frigate tuna

66. The WPNT **NOTED** paper IOTC–2013–WPNT03–18 Rev_2 which provided an overview of the biology and population characteristics of longtail tuna and frigate tuna caught in the Indian EEZ, including the following abstract provided by the authors:

"*Neritic tuna fishery in 2012 was dominated by five species: Kawakawa (Euthynnus affinis), frigate tuna (Auxis thazard), bullet tuna (Auxis rochei), longtail tuna (Thunnus tonggol) and bonito (Sarda orientalis). Their catch was 57,078 t and constitute 70.3 % of the total tuna catch of the country. Landings during 2008-12 varied between 37,785 t (2010) and 57,078 t (2012) with an average of 48,172 t. Neritic tunas mainly form non-targeted catch in most gears throughout the area. Despite their distribution and abundance along the entire coast, the fishery is mainly centered around the south and northwest coasts where traditionally high fishing activities occur. The extent of neritic tuna fishing varies depending on prevailing fishing practices of the area and local demand for tuna. Evaluation of spatio-temporal distribution pattern, abundance and fishery suggested that resource are being under-utilized from large areas of the Indian mainland coast and Island territories.* – see paper for full abstract."

67. The WPNT **NOTED** the key biological parameters determined in the study, which may be useful updates for the species Executive Summaries. It was suggested that growth and age studies be carried out using otoliths.

68. The WPNT **REQUESTED** that the authors undertake a CPUE standardisation for the next WPNT meeting, but to provide the results as trends overtime, rather than as a data point for one year. Comparing changes in effort overtime will also enable an examination of whether the exploitation targets calculated match effort trajectories.

69. 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–2013–WPNT03–INF05).

Indonesia: Biological aspects of Frigate Tuna (Auxis thazard), Bullet Tuna (Auxis rochei), and Kawakawa (Euthynnus affinis)

70. The WPNT **NOTED** paper IOTC–2013–WPNT03–19 which provided biological aspects of kawakawa (*Euthynnus affinis*), frigate tuna (*Auxis thazard*) and bullet tuna (*Auxis rochei*) off the West Coast of Sumatera, Indonesia, including the following abstract provided by the authors:

"*Frigate tuna (Auxis thazard Lacepede 1800), bullet tuna (Auxis rochei Risso 1810), and kawakawa (Euthynnus affinis Cantor 1849) exist in the west Coast of Sumatra, eastern Indian Ocean. These species are commercially exploited by several fishing gears such as purse seine, troll line, liftnet, gillnet, seine and pelagic danish seine. Observations on the some biological aspects of three species of neritic tuna were carried out based on fish landing caught by purse seiner. A short period of Sampling from January-April 2013, shows the size of Auxis thazard ranged from 21-40 cm (FL), Auxis rochei 15-32 cm, and Euthynnus affinis 18-54 cm. The result of t test of length-weight measurements primarily indicated that growth of three species are categorized as isometric. Sex ratio of male to female of Auxis thazard is 1:1, Auxis rochei 1.3:1, and Euthynnus affinis1.2:1. The result of chi-square test shows that male and female ratio for three species are significant difference (p> 0:05).* – see paper for full abstract."

71. The WPNT **NOTED** the stomach contents of bullet tuna consisted of sardines, crustaceans, anchovy, and squid. Understanding the dietary composition of neritic tuna may assist in interpreting localised migration patterns.

Indonesia: Size structure of bullet tuna caught by small scale and industrial purse seine fisheries

72. The WPNT **NOTED** paper IOTC–2013–WPNT03–30 which provided size structure of bullet tuna (*Auxis rochei*) caught by small scale and industrial purse seine fisheries in the Indian Ocean - south of Java based on trial scientific observer data, including the following abstract provided by the authors:

> "*The bullet tuna (Auxis rochei Risso, 1810) is a commercially important Scombrid widely distributed in tropical and subtropical waters around the world, including Indian Ocean. As country which significantly contribute on landing, yet its biological aspect were still far limited available on publication. This paper expected to reveals some of the biological aspect of bullet tuna (Auxis rochei) based on trial scientific observer data conducted in May and September 2012. The result showed that the composition of the catch both from small scale or industrial purse seine vessel was dominated by Indian scad and yet only bullet tuna (Auxis rochei) which able to be identified. Size distribution of bullet tuna caught by small scale purse seiner was bigger than industrial and all bullet tuna samples both scale of purse seiner were found at immature stage*."

73. The WPNT **NOTED** that the size distribution of bullet tuna caught by small scale (artisanal/coastal) purse seiner was larger than the industrial fleet. All bullet tuna sampled were immature.

74. The WPNT **NOTED** the preliminary nature of the study, and encouraged the authors to provide further updates at the next WPNT meeting.

Pakistan: Neritic tuna fisheries

75. The WPNT **NOTED** paper IOTC–2013–WPNT03–INF06 which provided an update on the neritic tuna fisheries of Pakistan, including the following abstract provided by the authors:

> "*Neritic tuna contribute significantly to the total scombrid landings of Pakistan. Dominated by longtail (Thunnus tonggol), neritic tuna fish species include kawakawa (Euthynnus affinis), skipjack (Katsuwonus pelamis) and frigate tuna (Auxis thazard). Small quantities of striped bonito (Sarda orientalis) and bullet tuna (Auxis rochei) are also represented in catches. Detailed information about neritic tuna fisheries including fishing gears, boats, fishing operations and disposition is given in Moazam (2012). Present paper gives some additional details about neritic tuna fisheries of Pakistan with an update on the status of this important fishery*."

76. 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 November/December followed by another major peak during April. Longtail tuna is the dominant species followed by kawakawa and frigate tuna.

77. The WPNT **NOTED** that WWF is endeavouring to develop a programme for the conversion of gillnet fisheries to longline as well as for immediate reduction in the length of gillnets being used in Pakistan. WWF-Pakistan and the Smart Fishing Initiative are planning to initiate a number of programmes for tuna fisheries improvement in Northern Indian Ocean countries including in I.R. Iran, Pakistan, Sri Lanka, Yemen, Somalia and the Maldives. These programmes intend to implement Fisheries Improvement Plans (FIP's) for selected fisheries and human resources development to cope with the challenges of tuna fisheries management.

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

78. The WPNT **NOTED** paper IOTC–2013–WPNT03–07 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 1950–2011. A summary is provided at Appendix IVc.

Sri Lanka: kawakawa

79. The WPNT **NOTED** paper IOTC–2013–WPNT03–34 Rev_1, which provided an analysis of kawakawa (*Euthynnis affinis*) landings in Sri Lanka and estimation of the length-weight and length-length relationships, including the following abstract provided by the authors:

“*Large pelagic fish landings, including neritic tuna landings made by the fishing vessels operating in Sri Lankan waters and high seas were monitored during 2005-12 at fishery harbours and major fish landing centres. Neritic tunas are one of the important groups in the commercial marine fish landings of Sri Lanka since it contributes more than 10% of the total landings of tuna and tuna-like species. Three species of neritic tunas are frequently found in Sri Lankan waters, namely, Auxis thazard (frigate tuna), Auxis rochei (bullet tuna), Euthynnis affinis (kawakawa) with one prominent neritic tuna associated species Scomberomorus commerson (narrow- barred Spanish mackerel). Kawakawa contributes only about 15% to the neritic tuna production. Gillnet has effectively been contributing for catching kawakawa since around 68% of the total landings are from gillnets. Ring net and gillnet - long line combination contribute about 17% and 8% of the total kawakawa landings respectively.* – see paper for full abstract.”

80. The WPNT **NOTED** that in 2011, neritic tuna species represented 10% of the total tuna production by Sri Lanka, with frigate tuna (*Auxis thazard*) contributing more than half of neritic tuna catches. The proportion of neritic tuna was higher from the southeast and southern coastal waters of Sri Lanka.

81. The WPNT **NOTED** that Sri Lanka is currently in the process of strengthening existing data collection and reporting system on both coastal and offshore large pelagic fisheries with the assistance of IOTC and BOBLME project. Where possible, the data collection programme should be expanded into the northern areas of the country.

82. **RECALLING** that a small pole-and-line fishery has restarted in the area of Trincomali, Sri Lanka, the WPNT **ENCOURAGED** Sri Lanka to monitor and collect data on this fishery, as per IOTC minimum requirements for pole-and-line vessels described in IOTC Resolution 12/03, and to provide detailed information on this fishery (catch by species, effort) at the next WPNT meeting.

Indonesia: Population parameters of kawakawa

83. The WPNT **NOTED** paper IOTC–2013–WPNT03–20, which provided the results of a study on population parameters of kawakawa, *Euthynnus affinis*, off northwest Sumatra, including the following abstract provided by the authors:

“*Kawakawa (Euthynnus affinis) is the one of the most important catches for Indonesian fishermen in the Indian Ocean. To enhance the basic information on population dynamics, this study was carried out to investigate the estimation of growth rates, mortality coefficients and the exploitation rate of kawakawa based on length frequency data using FiSAT II software. Kawakawa were sampled from purse seine in Sibolga Fishing Port from July 2012 to February 2013. A total of 1,325 fish were collected with ranged from 30 to 60 cm. The von Bertalanffy growth function estimates were L∞ = 63.53 cm, K = 0.63 year-1 and t¬0 = -0.21 years. The annual instantaneous rate of total mortality (Z) was 2.40 year-1, the natural mortality (M) was 1.07 year-1 and the fishing mortality (F) was 1.33 year-1. The exploitation rate (E = 0.55) was lower than the predicted value (Emax = 0.75) indicating that E. affinis was under exploited in the Indian Ocean.*”

84. The WPNT **NOTED** the as the length-frequency data came from samples collected over a small geographic area, that extrapolation of the results to wider areas should be treated with caution. As such, the authors were encouraged to expand the sampling to other areas within the range of the species and fisheries.

85. The WPNT **NOTED** that while the ELEFAN (Electronic Length Frequency Analysis) was developed to make it possible to use length-frequency data to estimate the growth and mortality of fishes, it is no longer considered appropriate to use it in a sub-regional context as it cannot take into account the biology of the species.

Tanzania: feeding habits of kawakawa

86. The WPNT **NOTED** paper IOTC–2013–WPNT03–21, which provided the results of a study on the fishery and feeding habits of kawakawa (*Euthynnus affinis*) and narrow-barred Spanish mackerel (*Scomberomorus commerson*) in the coastal waters of Dar es Salaam Tanzania, including the following abstract provided by the authors:

“*Euthynnus affinis and Scombermorus commerson are two of the most important commercial species in the western Indian Ocean region. However, information on the fishery and feeding habits are limited, to enable responsible fishing patterns. Data on fishery and feeding habit of S. commerson and E. affinis were collected from artisanal fishermen fleets in the coastal waters of Dar es Salaam Tanzania from 2008 to 2009. Hooks and lines, ring nets and gillnets operated mostly from both mechanized and non-mechanized* *crafts were observed as the major exploitation gears used by artisanal fishermen. Fishing for E. affinis and S. commerson were carried out throughout the year; however the peak landings were recorded from November to February and from June to July. The study observed a higher catch per unit effort of E. affinis and S. commerson during northeast and southeast monsoon seasons, respectively (p<0.05). The presence of a wide variety of prey (i.e. fishes, crustaceans and cephalopods and gastropods) in the stomach of these two fish species indicates carnivorous feeding habits.–* see paper for full abstract."

87. The WPNT **NOTED** that Tanzanian scientists are currently undertaking research examining the population genetic structure and migration patterns of *Euthynnus affinis* and *Scomberomorus commerson* in the coastal waters of Tanzania, and **REQUESTED** that an update on this research be presented at the next WPNT meeting.

88. The WPNT **NOTED** the request for assistance and collaboration for conducting such studies in the region.

7.2 Data for input into stock assessments

89. The WPNT **REMINDED** the authors of all CPUE and stock assessment papers that the SC, in 2012, agreed to revised '*Guidelines for the presentation of stock assessment models*, which includes CPUE analysis, and that these guidelines need to be followed in any future analysis.

Kenya: Nominal CPUE of frigate tuna and kawakawa

90. The WPNT **NOTED** paper IOTC–2013–WPNT03–22, which provided an analyses of catch, effort and nominal CPUE data of frigate tuna (*Auxis thazard*) and kawakawa (*Euthynnus affinis*) caught by recreational fishers in Kenya, including the following abstract provided by the authors:

"*We analyzed catch, effort and nominal CPUE data of frigate tuna (Auxis thazard) and kawakawa (Euthynnus affinis) (1990-2009) caught by recreational fishers in Kenya. Fishing efforts and catch of both species after 2008 decreased sharply, most probably by piracy activities intensified from that year. Nominal CPUE of kawakawa has been decreasing in recent years, while frigate tuna has declined. Then, we discussed the relation between N_CPUE vs. catch. We also analyzed catchability (q) of boats to see how each boat perform fishing effectively using average nominal CPUE.* (see Fig. 3 and Fig. 4)"

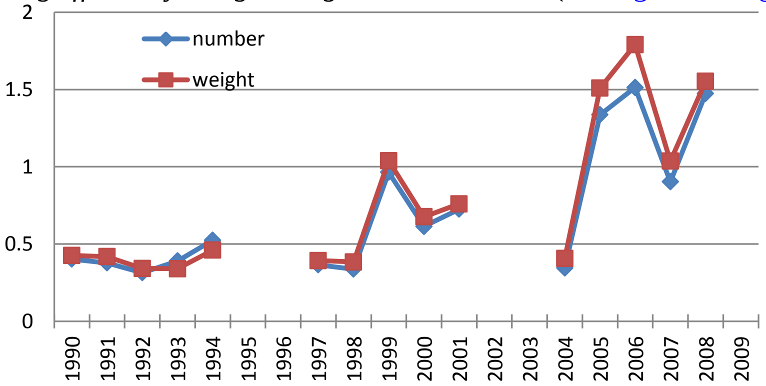

Fig. 3. Frigate tuna: Nominal CPUE (no. and kg/boat*fishing hours) of recreational fisheries in Kenya (1995–96 and 2002–03 data are incomplete and the 2009 data is an outlier, not shown in the graph).

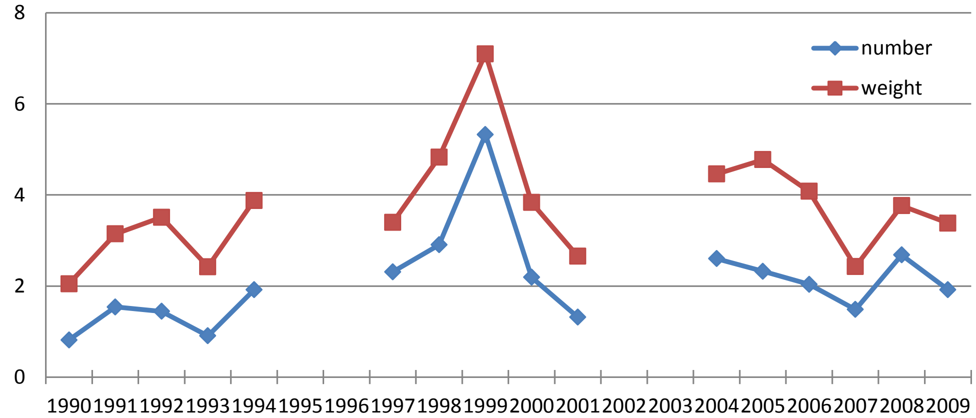

Fig. 4. Kawakawa: Nominal CPUE (no. and kg/boat*fishing hours) of recreational fisheries in Kenya (1995–96 and 2002–03 data are incomplete).

91. The WPNT **NOTED** that fine-scale resolution data is recommended to be analysed, and further work using vessel type and area interactions would be useful. Biological and fishery related data such as vessel size and power should be collected to permit the analysis, including standardising of CPUE over time.

92. The WPNT **NOTED** that the proportion of recreational catch to the total catch for kawakawa should be presented in subsequent WPNT meeting to determine how representative this indicator is for the regional trend, and whether it would be better to use the artisanal fleet as well.

Maldives: catches of kawakawa

93. The WPNT **NOTED** paper IOTC–2013–WPNT03–23, which provided a Maldives kawakawa pole-and-line fishery catch rate standardization (2004–11), 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 2004-2011. The raw data consists of around 124000 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 25,762 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 the 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 effects, length of the boat (as a vessel size class) and horse power was also used in the analysis.* – see paper for full abstract.”

94. The WPNT **NOTED** that the issue of zero catches needs to be resolved. Additionally using a zero-inflated model, or a proportion of skipjack tuna catch along with kawakawa as a covariate should be analysed. In addition, using zeros, through a simulation exercise, adding more and more percentage of zero’s with positive effort and its effects on the analysis should be examined with the generalized liner model (GLM).

95. The WPNT **NOTED** that the Maldives catch represents 5% of the reported Indian Ocean kawakawa catch and therefore Maldives CPUE (Fig. 5) may not be representative of the entire stock. CPCs are therefore encouraged to collect effort data to compute CPUE data for their respective fisheries..

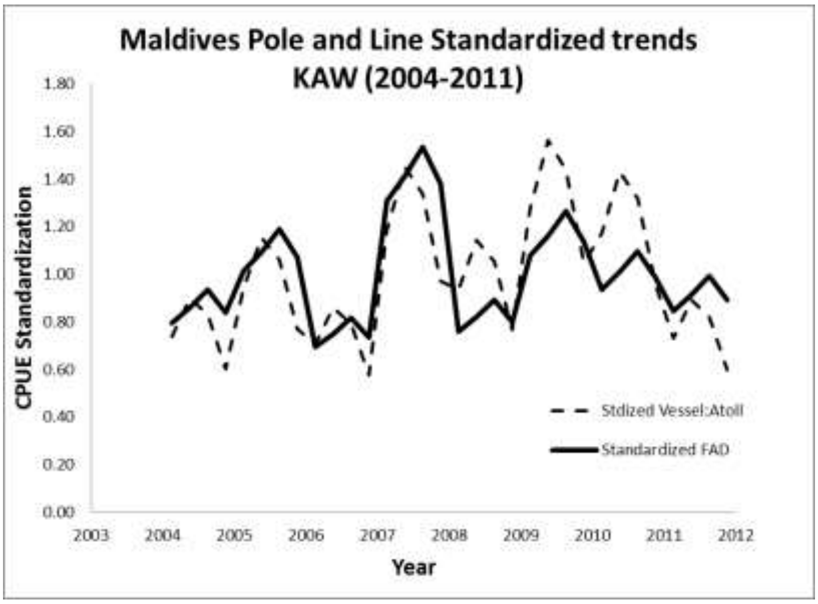

Fig. 5. Kawakawa: Maldives pole-and-line standardized index of abundance (CPUE) using two models (standardised by vessel and atoll; and standardised by FADs), from 2004–2011.

Oman: gillnet fishery standardised CPUE

96. The WPNT **NOTED** paper IOTC–2013–WPNT03–31 Rev_2, which provided a standardisation of kawakawa (*Euthynnus affinis*) catch rates from the drift gillnet fisheries in the Sultanate of Oman, including the following abstract provided by the authors:

“*Using available kawakawa nominal catch and effort data from gillnet fisheries in Oman (2002-2011), we standardized nominal CPUE (N_CPUE) by GLM. Standardized CPUE (STD_CPUE) suggested that it increased from 2002 to 2005 then decreased afterwards to 2011.* (see Fig. 6)”

97. The WPNT **NOTED** that the Kawakawa catch in Oman is less than 2.5%/yr on average for the Indian Ocean may not be representative of the entire Indian Ocean stock. CPCs are therefore encouraged to collect catch and effort data to compute CPUEs in their respective fisheries .

98. The WPNT **REQUESTED** that scientists from Oman pursue a similar analysis for their longtail tuna in 2014.

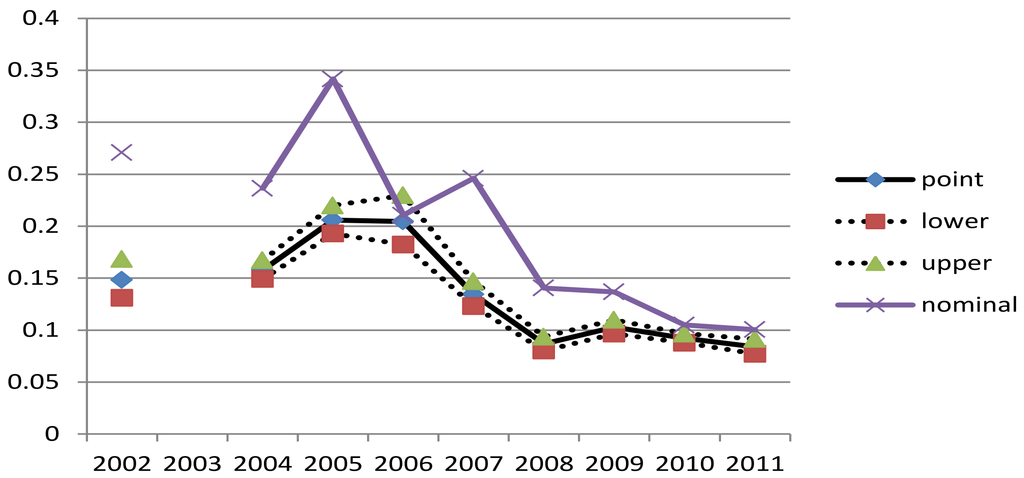

Fig. 6. Kawakawa: Sultanate of Oman gillnet standardized index of abundance (CPUE), its 95% confidence intervals and nominal CPUE, from 2002–2011.

7.3 Stock assessment

Indian Ocean kawakawa assessment using Maldives pole-and-line CPUE series

99. The WPNT **NOTED** paper IOTC–2013–WPNT03–24 which provided a stock assessment for kawakawa based on the Maldives pole-and-line CPUE Index, 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. Results obtained though similar to the posterior based stock reduction method only based on catch series presented by Zhou et. al. (IOTC 2013), differ in their interpretation towards the latter half of the time-series. 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, the model has difficulty estimating SMSY, though can still be useful for evaluating stock status and optimal yield targets. However, these should be used cautiously, and to a large extent the relative status of the stock is still highly uncertain.*”

100. The WPNT **AGREED** that the CPUE data is non-informative, and that using informative priors could be problematic. While the analysis was comprehensive and useful, using this analysis by itself is not useful for providing stock status advice.

Catch-based stock reduction methods

101. The WPNT **NOTED** paper IOTC–2013–WPNT03–25 which provided a stock assessment for kawakawa using catch-based stock reduction methods, including the following abstract provided by the authors:

“*We conduct stock assessments for two Indian Ocean neritic tuna species, Kawakawa and Longtail. We used a newly developed posterior-focused catch-based assessment method. 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 358-408 thousand tonnes depending on the upper depletion level assumed in 2011. The combination of such carrying capacity and growth rate can support a maximum sustainable yield (MSY) of 128-151 thousand tonnes. This means that catch levels in recent year may have exceeded MSY. The situations are similar for Longtail. The median virgin biomass was about 380 to 440 thousand tonnes, and the intrinsic population growth rate is about 1.14–1.26, somewhat less productive than Kawakawa. The entire stock can support a MSY of nearly 110–140 thousand tonnes. Catch levels in recent year may have been too high, and likely overfishing is occurring on the stock.*”

102. 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, kawakawa is near optimal rates, or exceeding optimal rates for fishing mortality (F_{MSY}) in recent years (2010 and 2011), though biomass is at about

B_{MSY} levels. However, given the uncertainty in stock structure in the Indian Ocean, the stock maybe experiencing localised overfishing in some parts of the Indian Ocean.

103. The WPNT **AGREED** that an examination of a four quadrant Indian Ocean stock structure (NE, SE, NW, SW) using the algorithms presented on stock-reduction analysis (SRA) techniques be undertaken for consideration at the next WPNT meeting in 2014.

104. 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.

ASPIC: kawakawa

105. The WPNT **NOTED** paper IOTC–2013–WPNT03–32 Rev_1 which provided a preliminary stock assessment for kawakawa using (*Euthynnus affinis*) using ASPIC, and the standardised CPUE of drift gillnet fisheries in Sultanate of Oman, including the following abstract provided by the authors:

> "*We attempted a preliminary stock assessment of kawakawa by ASPIC using the standardized CPUE of Omani drift gillnet fisheries (2001-2011) and the nominal catch (1950-2011). With an assumption of one stock structure in the Indian Ocean, we could not get the convergence in the first ASPIC run. With the alternate assumption of 4 stocks structure hypothesis (NW, NE, SW and SE), we re-attempted ASPIC run for the NW (Gulf and Oman Sea) hypothetical stock. Then we could get the conversion. The preliminary result suggested that the Gulf and Oman Sea hypothetical stock is at the orange zone in the Kobe plot with high Fratio (F2011/Fmsy) =1.57 and the safe level of the total biomass (TB) ratio (TB2011/TBmsy) =0.74. We also discussed about the piracy effect on the stock status and stock structure hypothesis.*"

106. The WPNT **AGREED** that the models presented here was a good approach to pursue for an analysis on hypothetical stock structure in the Indian Ocean. The model has fixed K and as such needs to look at uncertainty in trajectories accounting for both r and K, and account for this in the trajectories.

107. The WPNT **AGREED** that the results were preliminary, though catch trends in recent years for kawakawa indicate that the resources may be fully exploited or overexploited (i.e. at MSY levels) in the north-west Indian Ocean. Any additional increase in catch and/or effort is likely to be detrimental to the status of the stocks.

7.4 Selection of Stock Status indicators

108. The WPNT **RECALLED** that in the absence of reliable evidence on stock structure, the default hypothesis shall remain, whereby kawakawa is assumed to exist as a single stock throughout the entire Indian Ocean.

109. **NOTING** that the Commission adopted Resolution 12/01 *On the implementation of the precautionary approach*, which effectively means that in 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 at the next WPNT meeting.

110. The WPNT **AGREED** that stock status management advice should be based on the catch-based stock reduction methods. The approach presented is useful to assess stock status in the near term. All CPCs were encouraged to pursue more traditional stock assessment approaches of stock assessment in the region. In the interim, the catch-based methods are the only alternative that could be used for developing advice in the region.

7.5 Development of technical advice on the status of kawakawa

111. The WPNT **ADOPTED** the management advice developed for kawakawa (*Euthynnus affinis*) as provided in the draft resource stock status summary – Appendix VIII.

112. The WPNT **REQUESTED** that the IOTC Secretariat update the draft stock status summary for kawakawa with the latest 2012 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

113. The WPNT **NOTED** paper IOTC–2013–WPNT03–07 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 1950–2011. A summary is provided at Appendix IVd.

8.2 Data for input into stock assessments

114. The WPNT **NOTED** that limited new information was presented in 2013, despite longtail tuna being one of the agreed priority species for consideration in 2013.

8.3 Stock assessment updates

Catch-based stock reduction methods

115. The WPNT **NOTED** paper IOTC–2013–WPNT03–25 which provided a stock assessment for longtail tuna using catch-based stock reduction methods, including the following abstract provided by the authors:

   "*We conduct stock assessments for two Indian Ocean neritic tuna species, Kawakawa and Longtail. We used a newly developed posterior-focused catch-based assessment method. 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 358-408 thousand tonnes depending on the upper depletion level assumed in 2011. The combination of such carrying capacity and growth rate can support a maximum sustainable yield (MSY) of 128-151 thousand tonnes. This means that catch levels in recent year may have exceeded MSY. The situations are similar for Longtail. The median virgin biomass was about 380 to 440 thousand tonnes, and the intrinsic population growth rate is about 1.14–1.26, somewhat less productive than Kawakawa. The entire stock can support a MSY of nearly 110–140 thousand tonnes. Catch levels in recent year may have been too high, and likely overfishing is occurring on the stock*."

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 optimal rates for fishing mortality (F_{MSY}) though biomass is at about B_{MSY} levels. However, given the uncertainty in the stock structure in the Indian Ocean, it may be premature to use stock status indicators that state that the stock is being subjected to overfishing in the Indian Ocean.

117. The WPNT **AGREED** that an examination of a four quadrant Indian Ocean stock structure (NE, SE, NW, SW) using the algorithms presented on SRA techniques should be undertaken for consideration at the next WPNT meeting in 2014 for longtail tuna.

118. 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.

8.4 Selection of Stock Status indicators

119. The WPNT **RECALLED** that in the absence of reliable evidence on stock structure, the default hypothesis shall remain, whereby longtail is assumed to exist as a single stock throughout the entire Indian Ocean. However, exploratory analysis using data by regions should be encouraged.

120. The WPNT **AGREED** that there are limited stock status indicators available for longtail tuna (although preliminary work by the IOTC secretariat, IOTC–2013–WPNT03–25, on a catch-based stock reduction model in the Indian Ocean indicate that the stock is likely to be subject to overfishing, as the estimated MSY is between 110,000 and 140,000 t, while catches in 2011 were estimated at 164,537 t.

121. The WPNT **AGREED** that stock status advice should be based on the catch-based stock reduction methods. All CPCs were encouraged to pursue more traditional stock assessment approaches of stock assessment in the region. In the interim, the catch-based methods are the only alternative that could be used for developing advice in the region.

8.5 Development of technical advice on the status of longtail tuna

122. The WPNT **ADOPTED** the management advice developed for longtail tuna (*Thunnus tonggol*) as provided in the draft resource stock status summary – Appendix IX.

123. The WPNT **REQUESTED** that the IOTC Secretariat update the draft stock status summary for longtail tuna with the latest 2012 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

124. The WPNT **NOTED** paper IOTC–2013–WPNT03–07 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's)*, for the period 1950–2011. A summary is provided at Appendix IVf.

India: Narrow-barred Spanish mackerel

125. The WPNT **NOTED** paper IOTC–2013–WPNT03–26 which provided an overview of the fishery, biology and population characteristics of the narrow-barred Spanish mackerel exploited in India, including the following abstract provided by the authors:

"*The king seer also known as the narrow barred spanish mackerel, Scomberomorus commerson is an important and most sought after scombroid included under seerfishes. Exploitation is mainly by gillnets followed by hooks and lines and to a lesser extent by purse seines. The annual catch of S.commerson ranged between 26,625 t and 40,309 t forming 0.8% to 1.9% of the total fish catch and 57.8 to 66.3 % of the total seerfish catch of the country during 2007-2011. The fishery of S.commerson was sustained by fishes with a fork length ranging from 32 to 126 cm and mean at 74 cm. Lr was at 12 cm and Lmax at 155 cm. The length at first maturity was estimated at 70 cm. Fishes with empty stomachs were prevalent and the prey mostly consisted of smaller fishes like sardines, mackerel and scads. The asymptotic length L∞ was estimated at 162 cm, annual K at 0.78. Natural mortality M was estimated at 1.61 and total mortality Z at 6.43.*"

126. The WPNT **NOTED** that seerfishes form an important and valuable component of exploited marine fishery resource of India. The king seer also known as the narrow-barred Spanish mackerel, is an important and most sought after scombroid. Seerfish fishery from different regions of the Indian coast has been reported as early as 1987 and later on the biology and stock has been reported by several earlier workers in the field.

127. The WPNT **NOTED** the results of the study which suggest seerfish is under locally high fishing pressure and there may be a need to reduce effort in the near future.

128. The WPNT **AGREED** that the difference in the L∞ values identified from region to region may be the due to gear selectivity.

United Arab Emirates: Narrow-barred Spanish mackerel in the GCC countries.

129. The WPNT **NOTED** paper IOTC–2013–WPNT03–27 which provided an overview of the fisheries, biology, status and management of the narrow-barred Spanish mackerel (*Scomberomorus commerson*) in the Gulf Cooperation Council countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates), including the following abstract provided by the authors:

"*The Gulf Cooperation Council (GCC) is a political and economic union of six littoral states (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates) located at the northern extremity of the western Indian Ocean on the Arabian peninsula. The Narrow-barred Spanish mackerel, Scomberomorus commerson (Lacépède, 1800), forms a large component of catches in these countries and in some cases it is the most important commercially exploited species. It is mainly caught with gillnets set around schools from outboard powered fiberglass dories and traditional wooden dhows, hand lines and trolling lines are also used and it is targeted by the recreational fishery. Nets may also be set in a trap configuration and the extensive use of drifting gillnets has also been reported. Landings of S. commerson in the GCC countries increased to 35,000 mt in 1988. Subsequently, there was a precipitous decline associated with a collapse in the fishery and the total annual catch dropped to 10,662 mt by 1991.* – see paper for full abstract."

130. The WPNT **NOTED** that the fishery for *S. commerson* in the GCC region is based on the intensive differential harvest of immature fish that have not contributed to the reproductive capacity of the population or achieved their full growth potential.

131. The WPNT **NOTED** that the stock is characterised by both growth and recruitment overfishing, and the stock may be at approximately 13% of its unexploited size.

132. The WPNT **NOTED** that simulations suggest that stock rebuilding could be achieved if the selectivity characteristics of the fishery were modified so that the mean size at first capture was equivalent to the size at which YPR would be maximized Lc50 = Lmax or through the implementation of a 6 month fishery closure. However, local and national efforts to regulate the fishery are undermined by a lack of synergy in management planning between the GCC States. Regional collaboration in assessment and management are imperative in this context.

133. The WPNT **AGREED** that the stock structure component of the study should be expanded along the coast of I.R. Iran, Pakistan and also to Oman and Yemen.

9.2 Data for input into stock assessments

Kenya: catch trends for narrow-barred Spanish mackerel

134. The WPNT **NOTED** paper IOTC–2013–WPNT03–28 which provided a preliminary analysis of catch trends of narrow-barred Spanish mackerel *Scomberomorus commerson* caught from recreational trolling line fisheries in Kenya, including the following abstract provided by the authors:

    "*Recreational trolling line fisheries is becoming increasingly important in Kenya due to increased participation and fishing power, total catch is considered significant especially when compared to the artisanal commercial fisheries. The catch composition is varied with a total of fifteen pelagic species commonly landed. This paper provides a preliminary analysis of the nominal catch trend of narrow barred Spanish mackerel Scomberomorus commerson caught by recreational trolling lines boats over a twenty year period. Data was obtained from retained daily landings of narrow-barred Spanish mackerel from recreational boats reported at each sport fishing club. Nominal catches and effort are highly variable depending on vessels activity with the highest ever recorded annual catch reaching 8 tons and showing a general declining trend in the recent years. Great variability was observed in the nominal catch per unit effort with an observed distinct cycles of high and low nominal catch rates.*"

135. The WPNT **NOTED** that the decline in total effort identified in the recreational fishery data is a direct function of the increase in piracy activity from 2007.

I.R. Iran: narrow-barred Spanish mackerel population parameters

136. The WPNT **NOTED** paper IOTC–2013–WPNT03–29 which provided an overview of the growth, mortality and exploitation rate of narrow-barred Spanish mackerel, *Scomberomorus commerson* in the Persian Gulf and Oman Sea, Iran, Hormozgan's waters, including the following abstract provided by the authors:

    "*Growth, mortality and exploitation rate of kingfish, Scomberomorus commerson was studied. A total of 475 fish were collected monthly from fish-landing sites Jask, Bandar Abbas, Bandar Lengeh and Parsian in the North of Persian Gulf and Oman Sea coastal waters during October 2008 to September 2009. The FISAT II software was used to perform the estimate of growth, mortality and exploitation rate. The asymptotic length (L∞) was 151.2cm and growth coefficient (K) was 0.46/year. Estimations from the probability of capture routines gave the length-at-first capture, Lc as 66.47cm.The annual instantaneous rate of total mortality (Z) was 1.93/year and the natural mortality (M) was 0.54/year. Fishing mortality (1.39/year) was higher than the biological reference points (Fopt=0.27 and Flimit=0.36) and the exploitation rate (E) was 0.72..*"

137. The WPNT **NOTED** that the population parameters calculated in the study would be useful in updating the species executive summary for the consideration of the SC.

9.3 Stock assessment updates

138. The WPNT **AGREED** that although no stock assessment was undertaken for narrow-barred Spanish mackerel caught in IOTC fisheries in 2013, further exploratory analysis of the data available should be undertaken in preparation for the next WPNT meeting.

139. The WPNT **AGREED** that quantitative stock assessments of narrow-barred Spanish mackerel resources should be carried out prior to the next WPNT meeting, with CPCs collaborating to undertake the assessments based on biologically meaningful scales within the IOTC area of competence. Any assessment will greatly benefit by the provision of data sets to the IOTC Secretariat, as required by IOTC Resolution 10/02.

9.4 Selection of Stock Status indicators

140. The WPNT **RECALLED** that in the absence of reliable evidence on stock structure, the default hypothesis shall remain, whereby narrow-barred Spanish mackerel is assumed to exist as a single stock throughout the entire Indian Ocean.

141. The WPNT **RECALLED** the preliminary assessment presented at the WPNT01 meeting, on the biology and fishery for narrow-barred Spanish mackerel (*Scomberomorus commerson*), which suggested that there is a single stock of narrow-barred Spanish mackerel in the Gulf and neighbouring area, i.e. Oman and Arabian Seas.

142. The WPNT **AGREED** that an integrated stock assessment of the narrow-barred Spanish mackerel resource cannot be made at present due to the paucity of the information available from the entire range of the stock. Thus, the weight-of-evidence approach, including the use of data poor stock assessment approaches should be used in the coming years.

143. The WPNT **AGREED** that the management advice developed in 2012 shall be rolled over for 2013, with minor updates on species biology, fishery statistics and nominal CPUE, as no other indicators were presented at the WPNT03 meeting.

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

144. The WPNT **ADOPTED** the management advice developed for narrow-barred Spanish mackerel (*Scomberomorus commerson*) as provided in the draft resource stock status summary – Appendix XI.

145. The WPNT **REQUESTED** that the IOTC Secretariat update the draft stock status summary for narrow-barred Spanish mackerel with the latest 2012 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

146. The WPNT **NOTED** paper IOTC–2013–WPNT03–07 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 1950–2011. A summaries are is provided at Appendix IVa, b and e.

10.2 Stock status indicators for other neritic tuna species

Thailand: Nominal CPUE

147. The WPNT **NOTED** paper IOTC–2013–WPNT03–33 Rev_2 which provided a analyses of catch, fishing effort and nominal CPUE of neritic tuna and Indo-Pacific king mackerel exploited by Thai purse seine and king mackerel drift gillnet fisheries in the Andaman Sea, including the following abstract provided by the authors:
"*There are a number of the data which quality are unlikely good due to large outliers. We need to investigate this by checking the original data. Fishing efforts have been in stable. Thai purse seine fisheries in Area 7 (southern part of the Andaman Sea) are most active (70% of the total effort). King mackerel and longtail catch (1998-2010) have been decreasing consistently and the total catches in 2010 are less than 10% of the catches in 1998. It is difficult to suggest on the catch trends of bonito due to mixed species nature and also those for kawakawa because data are available only for a short period of time. In the king mackerel drift gillnet fisheries, target species is king mackerel nearly 60% of the total catch, while in Thai purse seine, they are bonito (earlier years) and kawakawa (later years) (54% and 62% respectively). Annual trends of nominal CPUE of kawakawa, longtail tuna and king mackerel suggest that all three species have been decreasing consistently to 2010. This further suggests that we need to conduct stock assessments in order to understand the status of stocks of these 3 species.* (see Fig. 7)"

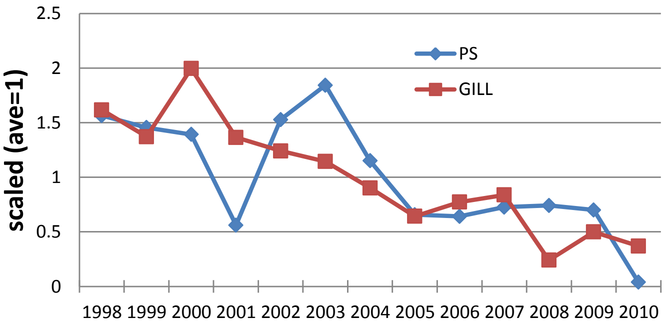

Fig. 7. Indo-Pacific king mackerel: Nominal CPUE (scaled with mean=1) of Thailand purse seine vessels and Indo=Pacific king mackerel gillnet fisheries in the Andaman Sea.

148. The WPNT **NOTED** that the nominal CPUE series for Indo-Pacific king mackerel has been in decline since 2010. Similar trends were observed for kawakawa and longtail tuna from Thailand's purse seine fishery.

149. The WPNT **AGREED** that Thailand should standardize the data for further analysis in future years for the purse seine fleet, using operational level data. Thailand requested assistance in the standardisation of the nominal CPUE series.

Stock structure

150. The WPNT **RECALLED** that in the absence of reliable evidence on stock structure, the default hypothesis shall remain, whereby bullet tuna, frigate tuna and Indo-Pacific king mackerel are assumed to exist as a single stock throughout the entire Indian Ocean.

Stock assessments

151. 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 2013, further exploratory analysis of the data available should be undertaken and presented at the next WPNT meeting.

152. The WPNT **AGREED** that an integrated stock assessment of the bullet tuna, frigate tuna and Indo-Pacific king mackerel resources cannot be made at present due to the scarcity and paucity of the information available from IOTC CPC's. Thus, the weight-of-evidence approach, including the use of data poor stock assessment approaches should be used where possible.

10.3 Development of management advice for other neritic tuna species

153. The WPNT **AGREED** that the management advice developed in 2012 shall be rolled over for 2013 with minor updates on species biology and fishery statistics, as no other indicators were presented at the WPNT03 meeting.

154. 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:
    - bullet tuna (*Auxis rochei*) – Appendix VI
    - frigate tuna (*Auxis thazard*) – Appendix VII
    - Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix X

155. The WPNT **REQUESTED** that the IOTC Secretariat update the draft stock status summary for bullet tuna, frigate tuna and Indo-Pacific king mackerel with the latest 2012 catch data, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration.

10.4 Update of other neritic tuna species Executive Summaries for the consideration of the Scientific Committee

156. The WPNT **REQUESTED** that the IOTC Secretariat update the draft stock status summary for bullet tuna, frigate tuna and Indo-Pacific king mackerel with the latest 2011 catch data, and for the summaries to be provided to the SC as part of the draft Executive Summaries, for its consideration.

11. Risk-Based Approaches to Determining Stock Status

157. The WPNT **RECALLED** its discussions from the previous WPNT meeting, whereby the Weight-of-Evidence approach was noted as being currently used in a number of countries to routinely determine stock status for data poor fisheries. The approach involves developing and applying a decision-making framework by assembling an evidentiary base to support status determination. Specifically, the framework aims to provide a structured, scientific process for the assembly and review of indicators of biomass status and levels of fishing mortality. Arguments for status determination are based upon layers of partial evidence. Ideally there would be

independence between these layers which will be developed with a mixture of quantitative and qualitative reasoning. The framework provides guidance with which to interpret those indicators, and aims to provide a transparent and repeatable process for status determination. The framework includes elements to describe attributes of the stock and fishery; documentation of lines of evidence; and documentation of status determination.

158. The WPNT **NOTED** that for neritic tuna and tuna-like stocks, particularly in smaller fisheries, only a subset of the types of evidence are likely to be available and/or useful. As a result, expert judgment has an important role in status determination, with an emphasis on documenting the key evidence and rationale for the decision.

159. The WPNT **AGREED** that the Weight-of-Evidence approach to determine species stock status should be used for neritic tunas under the IOTC mandate, including data poor assessment approaches, as an alternative to the current approach of relying solely on fully quantitative stock assessment techniques.

160. The WPNT **NOTED** that the data poor approaches to determining stock status explained during the WPNT03 meeting by the invited expert have a lot of potential in the region, as they could be applied to other species in the region.

161. The WPNT **NOTED** that there is a lot of potential to use empirical approaches and relate life history parameters to sustainable fishing mortality rates. While the catchability and gear based approach is useful, it is probably more applicable to the bycatch species.

162. The WPNT **AGREED** that stochastic stock reduction models using catch based methods to assess stock status on neritic tuna should be used in the future. These would be interim targets until CPUE and length based data for an integrated assessment are available, which is attainable for both kawakawa and longtail tuna over the intermediate term.

163. The WPNT **AGREED** that a simplified/introductory manual and associated training on how to develop stock status for data poor fisheries would be very useful in the Indian Ocean, and **REQUESTED** that the IOTC Secretariat incorporate these activities into its capacity building activities for 2014.

12. Research Recommendations and Priorities

Stock structure research

164. The WPNT **AGREED** that at present very little is known about the population structure and migratory range of most of the neritic tuna species, and that they are likely to be shared stocks among countries. As such, any stock assessment of these species should be carried out on a biologically relevant scale, once appropriate management units and associated data sets have been identified.

165. The WPNT **NOTED** that in order to be successful at stock structure analysis, conditions must exist in the species under study that allows the development of stock structure by limiting gene flow. This can be the result of specific spawning areas for different groups or populations of fish where there is little interchange between different sites over a period of time allowing for differentiation to occur. The sampling must successfully sample each of these groups independently. Finally, marker sets must provide sufficient information content to detect these genetic differences. Restricted gene flow between populations can occur for a number of reasons; “isolation by distance” just means that populations further apart are less likely to exchange with one another than populations that are closer together. Geographical barriers, oceanographic features, and temporal effect such as spawn timing can all play a role by inhibiting geneflow.

166. The WPNT **NOTED** that the sampling program can be done in a phased approach where widely spaced geographical locations are sampled first and then locations can be filled in if there is evidence of sufficient differentiation between the more distant sites. Spawning individuals should be targeted and multi-year sampling will provide a measure of annual sampling variability. If possible individuals should be sampled separately so corresponding biological data can be matched.

167. The WPNT **NOTED** that a number of marker types are possible for the analysis of genetic stock structure. Previously marker types like allozymes, RFLP’s have been used. Recently microsatellites and SNP’s have been found to provide the most power at differentiating populations. However finding a set of useful robust markers requires a lot of work. Fortunately, sequencing costs have become cheaper and new technologies are making marker discovery simpler.

168. The WPNT **NOTED** that we are generally looking for a set of 12 to 20 good highly polymorphic microsatellites or between 70 and 100 SNPs to provide sufficient power to detect genetic stock structure if it is present. One option to test the detection power of a set of markers may be to use simulated data where migration and mutation

rates can be fixed and different sets of markers projected forward through many generations using a program like EASYPOP.

169. The WPNT **NOTED** that the Indian mackerel sampling design developed for BOBLME identified a total of 3,100 samples from 38 locations. Marker development, standardisation across labs, and testing genetic stock structure using common genetic stock structure programs like Bayes, Genepop and Structure will be used for assessing stock structure. A similar structured design needs to be pursued by IOTC CPCs for stock structure studies on Neritic Tuna. Finally, RAD sequencing, a new approach for assessing stock structure maybe a long term cheaper solution if countries decide to go with newer technologies to assess stock structure in Neritic Tuna in the region.

170. The WPNT **RECOMMENDED** that 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.

171. The WPNT **AGREED** that morphometric and ecological (or tagging) data needs to be examined to assess whether any indicators for stock structure exist in kawakawa and longtail tuna Indian Ocean populations.

172. The WPNT **AGREED** to enhance data collection and reporting for these species so that it may conduct standard approaches for stock assessment using CPUE data.

173. The WPNT **AGREED** to refine the catch based methods and apply to additional species in the Indian Ocean.

12.1 Revision of the WPNT work plan

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 late November, 2013.

175. The WPNT **RECOMMENDED** that the SC consider and endorse the workplan for the WPNT for 2014, and tentatively for future years, as provided at Appendix XII.

13. OTHER BUSINESS

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

176. The WPNT **NOTED** with thanks, the outstanding contributions of the invited experts for the meeting, Dr. Shijie Zhou (CSIRO – Australia). The WPNT **ENCOURAGED** him to maintain links with IOTC scientists to aid in the development and use of data poor stock assessment approaches for neritic tuna stocks.

177. The WPNT **AGREED** that due to the contributions of Dr. Shijie Zhou (CSIRO – Australia) to the WPNT03 meeting, his continued participation would best be facilitated by considering his selection as the Invited Expert for the WPNT04 meeting.

178. **NOTING** the '*Rules of Procedure for the selection of Invited Experts to attend IOTC Working Party meetings'*, Dr. Shijie Zhou (CSIRO, Australia) was nominated and unanimously selected as the Invited Expert to attend the next WPNT meeting.

179. 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 2014, by an Invited Expert:
    - Expertise: stock structure/connectivity; including from regions other than the Indian Ocean; data poor assessment approaches.
    - Priority areas for contribution: kawakawa, longtail tuna or narrow-barred Spanish mackerel stock assessment.

13.2 Date and place of the Fourth WPNT

180. The WPNT participants were unanimous in thanking Indonesia for hosting the Third Session of the WPNT and **COMMENDED** Indonesia on the warm welcome, the excellent facilities and assistance provided to the IOTC Secretariat in the organisation and running of the Session. The hosts, Indonesia, covered the entire costs of the meeting within country, including the funding of 16 of its national scientists to attend the meeting.

181. The WPNT **RECOMMENDED** that the SC note that the participation of developing coastal state scientists has increased dramatically in recent years, through the implementation of the IOTC MPF, as well as though the hosting of the WPNT in developing coastal states (WPNT01: India, WPNT02: Malaysia and WPNT03: Indonesia). In 2011, 11 national scientists from India attended the first meeting, while in 2012, 13 attended from Malaysia and finally, in 2013, a total of 16 national scientists from Indonesia were able to attend the WPNT meeting.

182. Following an invitation from Thailand to host the Fourth Session of the WPNT, the WPNT **AGREED** to hold the next Session of the WPNT in either Phuket or Bangkok in June/July 2014. If the situation in Thailand changes, then two alternative venues were proposed, either Tanzania or India. The WPNT was **REMINDED** that hosts of all IOTC meetings are expected to bear the full costs associated with the meeting, in the host country.

183. The WPNT **REQUESTED** that the IOTC Secretariat liaise with Thailand to confirm the exact dates and meeting location and for these to be communicated to the SC for its consideration at its next session to be held in December 2013.

13.3 Review of the draft, and adoption of the Report of the Third WPNT

184. The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT03, 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:
    - bullet tuna (*Auxis rochei*) – Appendix VI
    - frigate tuna (*Auxis thazard*) – Appendix VII
    - kawakawa (*Euthynnus affinis*) – Appendix VIII
    - longtail tuna (*Thunnus tonggol*) – Appendix IX
    - Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix X
    - narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix XI

185. The report of the Third Session of the Working Party on Neritic Tunas (IOTC–2013–WPNT03–R) was **ADOPTED** on the 5 July 2013.

APPENDIX I
LIST OF PARTICIPANTS

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APPENDIX II
AGENDA FOR THE THIRD WORKING PARTY ON NERITIC TUNAS

Date: 2–5 July 2013
Location: Bali, Indonesia
Hotel Santika (Premiere Beach Resort Bali); Jalan Kartika Plaza; Tuban, Kuta
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 FIFTEENTH SESSION OF THE SCIENTIFIC COMMITTEE** (Secretariat)

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

5. **PROGRESS ON THE RECOMMENDATIONS OF WPNT02** (Chair and Secretariat)

6. **NEW INFORMATION ON FISHERIES AND ASSOCIATED ENVIRONMENTAL DATA FOR NERITIC TUNAS**
   6.1 Review of the statistical data available for neritic tunas (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:
      - Catch and effort
      - Catch at size
      - Growth curves and age-length key
      - Catch at age
      - CPUE indices and standardised CPUE indices
      - 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:
      - Catch and effort
      - Catch at size
      - Growth curves and age-length key
      - Catch at age
      - CPUE indices and standardised CPUE indices
      - 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 Stock status indicators for other neritic tuna species (all)

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

10.4 Update of other neritic tuna species Executive Summaries for the consideration of the Scientific Committee (all)

11. RISK-BASED APPROACHES TO DETEMINING STOCK STATUS (Secretariat)

12. RESEARCH RECOMMENDATIONS AND PRIORITIES

12.1 Revision of the WPNT work plan (Chair)

13. OTHER BUSINESS

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

13.2 Date and place of the Fourth Working Party on Neritic Tunas (Chair and Secretariat)

13.3 Review of the draft, and adoption of the Report of the Third Working Party on Neritic Tunas (Chair)

APPENDIX III
LIST OF DOCUMENTS

Document	Title	Availability
IOTC–2013–WPNT03–01a	Agenda of the Third Working Party on Neritic Tunas	✓(15 March 2013) ✓(16 June 2013)
IOTC–2013–WPNT03–01b	Annotated agenda of the Third Working Party on Neritic Tunas	✓(25 June 2013) ✓(10 July 2013)
IOTC–2013–WPNT03–02	List of documents	✓(17 June 2013) ✓(10 July 2013)
IOTC–2013–WPNT03–03	Outcomes of the Fifteenth Session of the Scientific Committee (Secretariat)	✓(16 June 2013)
IOTC–2013–WPNT03–04	Outcomes of the Seventeenth Session of the Commission (Secretariat)	✓(03 July 2013)
IOTC–2013–WPNT03–05	Review of current Conservation and Management Measures relating to neritic tuna species (Secretariat)	✓(16 June 2013)
IOTC–2013–WPNT03–06	Progress made on the recommendations of WPNT02 (Secretariat and Chair)	✓(17 June 2013)
IOTC–2013–WPNT03–07 Rev_1	Review of the statistical data available for the neritic tuna species (Secretariat)	✓(17 June 2013) ✓(28 June 2013)
IOTC–2013–WPNT03–08	Data collection challenges in the Maldives neritic tuna fishery (A.R. Jauharee & M. Ahusan)	✓(21 June 2013)
IOTC–2013–WPNT03–09	Status of neritic tuna fisheries in India (C. Babu & A. Anrose)	✓(12 June 2013)
IOTC–2013–WPNT03–10	The role and importance of neritic tuna catches in I.R. Iran fishing activities (R.A. Naderi)	✓(17 June 2013)
IOTC–2013–WPNT03–11 Rev_1	Small tuna fisheries in the Malacca Strait; west coast of peninsular Malaysia (S. Jamon, S. Basir & E.M. Faizal)	✓(20 June 2013) ✓(23 June 2013)
IOTC–2013–WPNT03–12	Baseline study on socio-economic benefits of artisanal tuna and tuna-like fishery in the United Republic of Tanzania (M. Igulu, M. Kishe, J. Luomba, B. Kuguru, R. Kayanda, J. Kangwe & B. Ngatunga)	✓(18 June 2013)
IOTC–2013–WPNT03–13	Neritic tunas catch situation from the trip reports of Malagasy observers in 2012 (R. Fanazava)	✓(17 June 2013)
IOTC–2013–WPNT03–14	Impact of climate anomaly on catch composition of neritic tuna in Sunda Strait (eastern part of Indian Ocean) (K. Amri & F. Satria)	✓(17 June 2013)
IOTC–2013–WPNT03–15	Catch and size distribution of neritic tunas from purse seine in Andaman sea coast of Thailand, 2012 (C. Sa-nga-ngam, P. Nootmorn, T. Jaiyen, S. Boonsuk & K. Loychuen)	✓(14 June 2013)
IOTC–2013–WPNT03–16	Catch performance of fishing gears for neritic tuna in Indian Ocean based on Palabuhanratu fishing port (T. Hidayat, T. Noegroho, K. Amri & D. Nugroho)	✓(17 June 2013)
IOTC–2013–WPNT03–17	Status of tuna fishery in Sudan (A.N. Elawad)	✓(31 May 2013)
IOTC–2013–WPNT03–18 Rev_2	Neritic tuna fishery along the Indian coast and biology and population characteristics of longtail and frigate tuna (E.M. Abdussamad, K.P. Said Koya, P. Rohith & S. Kuriakaose)	✓(17 June 2013) ✓(03 July 2013) ✓(04 July 2013)
IOTC–2013–WPNT03–19	Some biological aspects of frigate tuna (*Auxis thazard*), bullet tuna (*Auxis rochei*), and kawakawa (*Euthynnus affinis*) in west coasts Sumatera, Indian Ocean (T. Noegroho, T. Hidayat & K. Amri)	✓(17 June 2013)
IOTC–2013–WPNT03–20	Study on population parameters of kawakawa, *Euthynnus affinis* (Cantor 1849), in Indian Ocean (a case study in Northwest Sumatra IFMA 572) (I. Jatmiko, R. Kartika Sulistyaningsih & B. Setyadji)	✓(17 June 2013)
IOTC–2013–WPNT03–21	Fishery and biological habits of kawakawa (*Euthynnus affinis* - Cantor 1849) and narrow-barred Spanish mackerel (*Scomberomorus commerson* - Lacepède 1800) in the coastal waters of Dar es Salaam Tanzania (M.G. Johnson & A.R. Tamatamah)	✓(19 June 2013)

Document	**Title**	**Availability**
IOTC–2013–WPNT03–22 Rev_1	Analyses of catch, effort and nominal CPUE data of frigate tuna (*Auxis thazard*) and kawakawa (*Euthynnus affinis*) caught by recreational fishers in Kenya (S. Ndegwa, P.N. Wekesa, C. Ndoro & T. Nishida)	✓(20 June 2013) ✓(29 June 2013)
IOTC–2013–WPNT03–23	Maldives kawakawa pole and line fishery catch rate standardization: 2004–2011 (R. Sharma, J. Geehan, M.S. Adam & R. Jauhary)	✓(14 June 2013)
IOTC–2013–WPNT03–24	Indian Ocean kawakawa assessment based on the Maldives pole and line CPUE index (R. Sharma & S. Zhou)	✓(14 June 2013)
IOTC–2013–WPNT03–25	Stock assessment of two neritic tuna species in Indian Ocean, kawakawa and longtail tuna using catch-based stock reduction methods (S. Zhou & R. Sharma)	✓(14 June 2013)
IOTC–2013–WPNT03–26	Fishery, biology and population characteristics of the narrow-barred Spanish mackerel *Scomberomorus commerson* exploited in India (P. Rohit & E.M. Abdussamad)	✓(01 June 2013)
IOTC–2013–WPNT03–27	A review of the fisheries, biology, status and management of the narrow-barred Spanish mackerel (*Scomberomorus commerson*) in the Gulf Cooperation Council countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates) (E. Grandcourt)	✓(17 June 2013)
IOTC–2013–WPNT03–28 Rev_1	Preliminary analysis of catch trends of narrow-barred Spanish mackerel *Scomberomorus commerson* caught from recreational trolling line fisheries in Kenya (P.N. Wekesa & S.W. Ndegwa)	✓(17 June 2013) ✓(27 June 2013)
IOTC–2013–WPNT03–29 Rev_1	Growth, mortality and exploitation rate of narrow-barred Spanish mackerel, *Scomberomorus commerson* in the Persian Gulf and Oman Sea, Iran, Hormozgan's waters (F. Kaymaram, S. Ghasemi, A. Vahabnezhad & M. Darvishi)	✓(08 June 2013) ✓(18 June 2013)
IOTC–2013–WPNT03–30	Size structure of bullet tuna (*Auxis rochei*, Risso, 1810) caught by small scale and industrial purse seine fisheries in Indian Ocean – south of Java based on trial scientific observer data (B. Setyadji, D. Novianto & A. Bahtiar)	✓(17 June 2013)
IOTC–2013–WPNT03–31 Rev_2	Standardization of kawakawa (*Euthynnus affinis*) catch rates of drift gillnet fisheries in Sultanate of Oman (F. Rashid Al-Kiyumi, L. Al-kharusi, T. Nishida & B. Al-Siyabi)	✓(19 June 2013) ✓(28 June 2013) ✓(10 July 2013)
IOTC–2013–WPNT03–32 Rev_1	Preliminary kawakawa (*Euthynnus affinis*) stock assessment by ASPIC using standardized CPUE of drift gillnet fisheries in Sultanate of Oman (F. Rashid Al-Kiyumi, B. Al-Siyabi, L. Al-Kharusi & T. Nishida)	✓(19 June 2013) ✓(28 June 2013)
IOTC–2013–WPNT03–33 Rev_2	Analyses of catch, fishing efforts and nominal CPUE of neritic tuna and king mackerel exploited by Thai purse seine and king mackerel drift gillnet fisheries in the Andaman Sea (C. Sa nga ngam, P. Nootmorn & T. Nishida)	✓(19 June 2013) ✓(30 June 2013) ✓(08 July 2013)
IOTC–2013–WPNT03–34 Rev_1	Analysis of kawakawa (*Euthynnis affinis*) landings in Sri Lanka and estimation of the length-weight and length-length relationships (S.S.K. Haputhantri & K.H.K. Bandaranake)	✓(24 June 2013) ✓(29 June 2013)
Information papers		
IOTC–2013–WPNT03–INF01	A simple method for estimating MSY from catch and resilience (S. Martell & R. Froese)	✓(17 June 2013)
IOTC–2013–WPNT03–INF02	Towards sustainability of data-limited multi-sector fisheries (eds. S.J. Newman, D.J. Gaughan, G. Jackson, M.C. Mackie, B. Molony, J. St John & P. Kailola)	✓(17 June 2013)
IOTC–2013–WPNT03–INF03	Rapid quantitative risk assessment for fish species in selected Commonwealth fisheries (S. Zhou, T. Smith & M. Fuller)	✓(17 June 2013)
IOTC–2013–WPNT03–INF04	Rapid quantitative risk assessment for fish species in seven Commonwealth fisheries (S. Zhou, M. Fuller & T. Smith)	✓(17 June 2013)
IOTC–2013–WPNT03–INF05	Guidelines for the presentation of stock assessment models (IOTC Scientific Committee)	✓(24 June 2013)
IOTC–2013–WPNT03–INF06	An update on the neritic tuna fisheries of Pakistan (M. Moazzam)	✓(30 June 2013)

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

Extract from IOTC–2013–WPNT03–07 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 1950–2011 (in metric tonnes) (Data as of June 2013)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Purse seine	0	3	23	223	467	555	430	543	519	490	547	442	804	918	1,239	493
Gillnet	41	153	289	469	1,091	1,529	1,323	1,377	1,525	1,347	1,655	1,406	2,012	2,290	3,046	2,412
Line	113	193	317	322	687	1,178	837	1,031	1,000	996	1,148	1,108	1,875	2,172	2,897	1,167
Other	5	13	53	314	890	1,600	1,498	1,021	1,531	1,137	1,698	2,109	2,236	2,476	3,237	4,475
Total	**159**	**362**	**683**	**1,329**	**3,135**	**4,862**	**4,089**	**3,973**	**4,575**	**3,969**	**5,048**	**5,065**	**6,926**	**7,856**	**10,419**	**8,547**

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 1998 at around 4,600 t. The catches decreased slightly in the following years and remained around 3,000 t until the mid-2000's. The highest reported catches of bullet tuna were taken in 2010 with 10,419 t estimated as being landed (Table 1; Fig. 1).

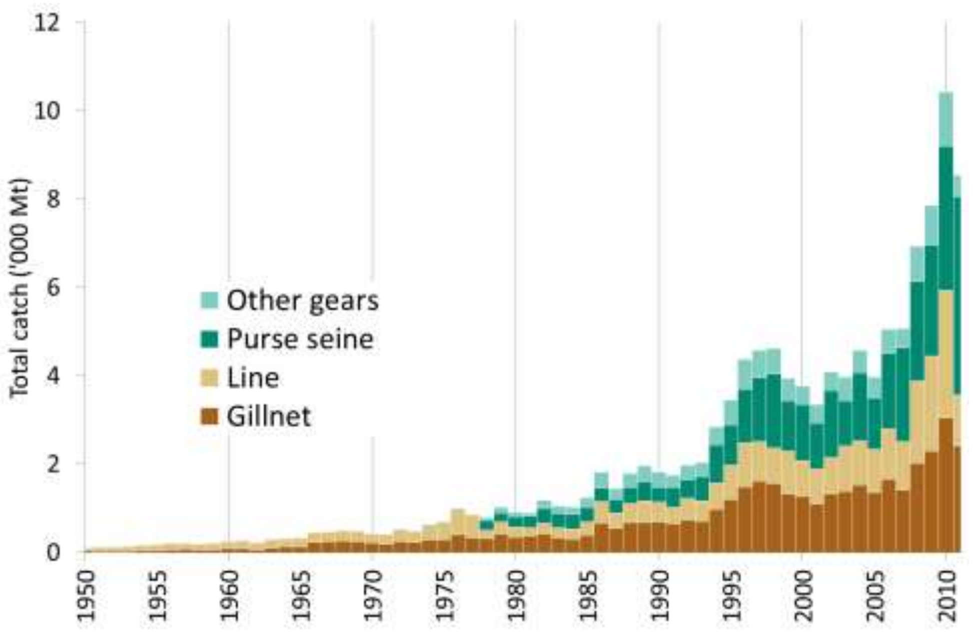


Fig. 1. Bullet tuna: Annual catches of bullet tuna by gear recorded in the IOTC Database (1950–2011)

[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 unreporting fisheries for which catches had to be estimated.

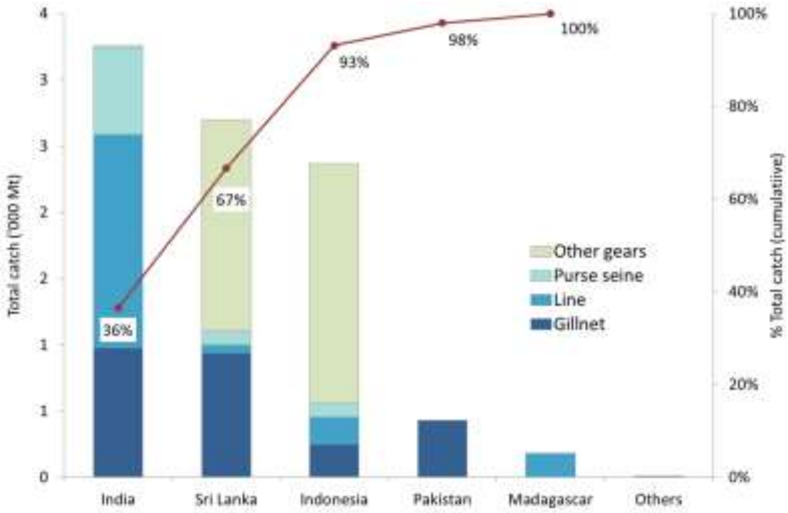


Fig. 2. Bullet tuna: average catches in the Indian Ocean over the period 2009-2011, by country. Countries are ordered from left to right, according to the importance of catches of bullet tuna reported. The red line indicates the (cumulative) proportion of catches of bullet tuna for the countries concerned, over the total combined catches of bullet tuna reported from all countries and fisheries.

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

Bullet tuna – Uncertainty of catches

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

- Aggregation: Bullet tuna are usually not reported by species being aggregated with frigate tunas or, less frequently, other small tuna species.
- Mislabelling: Bullet tuna are usually mislabelled as frigate tuna, 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 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 changed substantially since the WPNT meeting in 2012, with catches more than doubling over the entire time series, following major reviews of catch time series for Indonesia, India, and Sri Lanka.

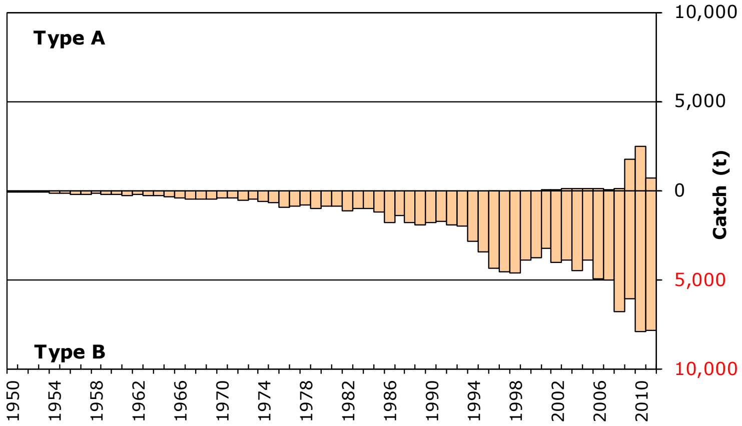


Fig. 3. Bullet tuna: Uncertainty of annual catch estimates for bullet tuna (1950–2011). Catches below the zero-line (Type B) refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat), do not report catch data by gear and/or species (broken by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document. Catches over the zero-line (Type A) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets. (Data as of June 2013)

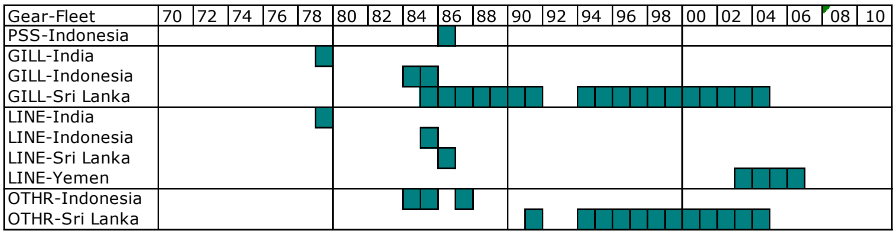
Bullet tuna – Effort trends

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 it 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 (1970–2011) . Note that no catches and effort are available at all for 1950–78



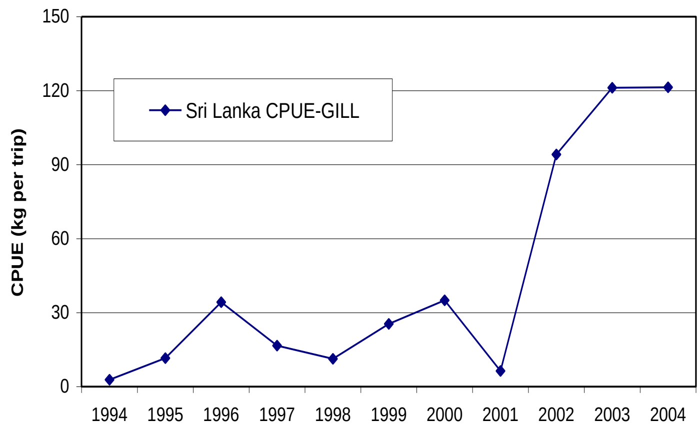
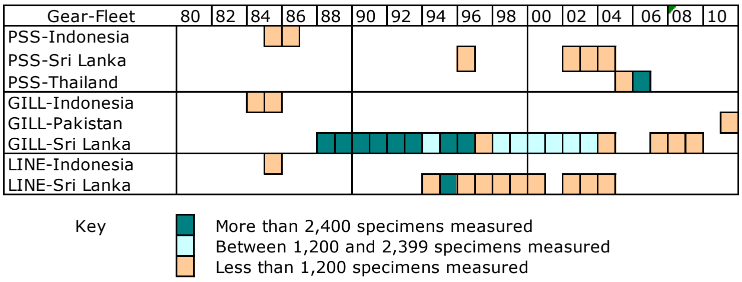


Fig. 4. Bullet tuna: Nominal CPUE series for the gillnet fishery of Sri Lanka derived from the available catches and effort data (1994–2004)

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 (1980–2011)[2]. Note that no length frequency data are available for the period 1950–83



[2] 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–2013–WPNT03–07 Rev_1

Frigate tuna – 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 (byproduct) for industrial purse seiners 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[3]. (Fig. 3)

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 early 1980's and over 60,000 t by the mid-1990's, and remaining at the same level over the following ten years. Catches increased substantially 2005, with current catches at around 100,000 t (Table 1; Fig. 2). 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, the countries attributed with the highest catches are Indonesia (64%), India (10%), Sri Lanka (10%) and Iran (6%) (Table 1; Fig. 2).

TABLE 1. Frigate tuna: Best scientific estimates of the catches of frigate tuna by type of fishery for the period 1950–2011 (in metric tonnes) (Data as of June 2013)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Purse seine	13	32	904	4,136	6,190	8,014	7,704	8,836	8,698	8,695	9,281	7,783	7,371	6,666	9,387	8,585
Gillnet	479	1,234	2,696	5,685	11,847	15,907	12,872	15,729	15,795	15,288	17,863	17,661	19,669	17,768	25,006	24,081
Line	1,270	2,413	4,952	11,806	21,651	29,858	23,906	25,684	29,149	25,618	29,648	32,148	39,204	39,725	43,735	44,985
Other	1,429	1,989	2,444	4,653	10,763	16,767	14,806	14,856	15,380	14,933	15,307	17,714	21,825	23,329	24,065	25,069
Total	**3,190**	**5,668**	**10,997**	**26,280**	**50,451**	**70,546**	**59,289**	**65,105**	**69,023**	**64,534**	**72,098**	**75,306**	**88,069**	**87,488**	**102,194**	**102,720**

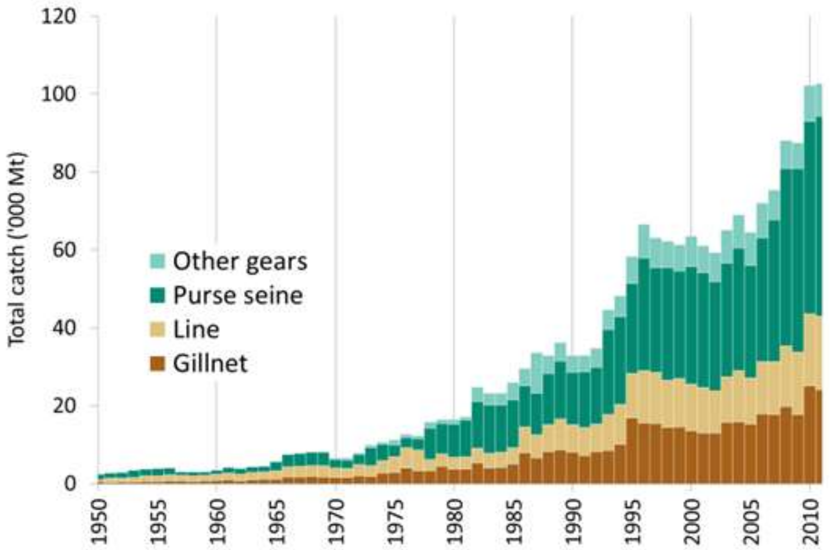


Fig. 1. Frigate tuna: Annual catches of frigate tuna by gear recorded in the IOTC Database (1950–2011)

[3] 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 fleets for which catches had to be estimated.

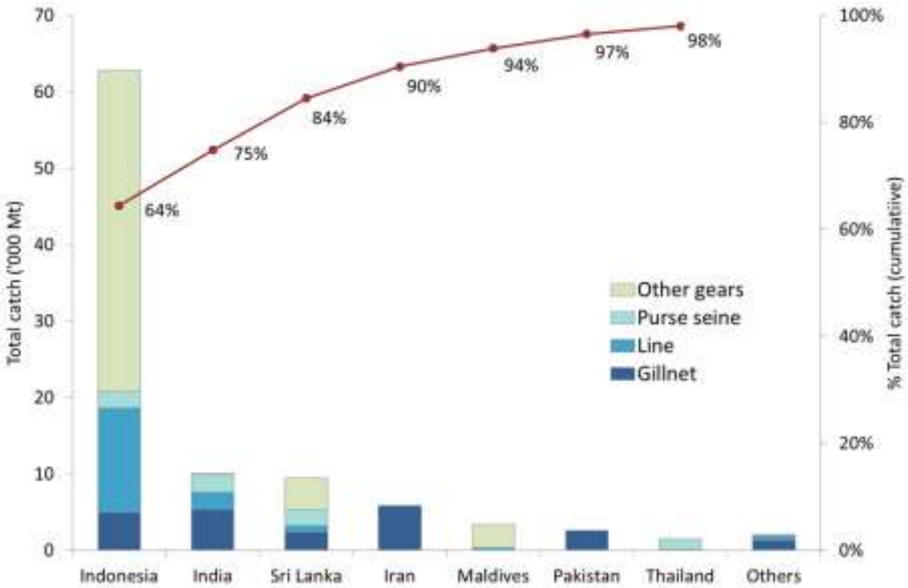


Fig. 2. Frigate tuna: average catches in the Indian Ocean over the period 2009–11, by country. Countries are ordered from left to right, according to the importance of catches of frigate tuna reported. The red line indicates the (cumulative) proportion of catches of frigate for the countries concerned, 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 it was indicated that the catches of frigate tuna had been underestimated by Indonesia. While the new catches estimated for frigate tuna in Indonesia remain uncertain, representing around 65% of the total catches of this species in the Indian Ocean in recent years (2009–11), the new estimates are considered more reliable.
- 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 and assigned by gear on the basis of official reports and information from various other alternative sources. 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 20% of the total catches of this species in the Indian Ocean.
- Artisanal fisheries of Myanmar (and Somalia): None of these countries have 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 reported by species, they usually refer to both species (due to mislabeling, with all catches assigned as frigate tuna).
- Industrial fisheries: The catches of frigate tuna recorded for industrial purse seiners are thought to be a fraction of those retained on board. Due to this species being a bycatch, 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 catch series of frigate tuna has changed substantially since the WPNT meeting in 2012, following major reviews of catch time series for Indonesia, India, and Sri Lanka.

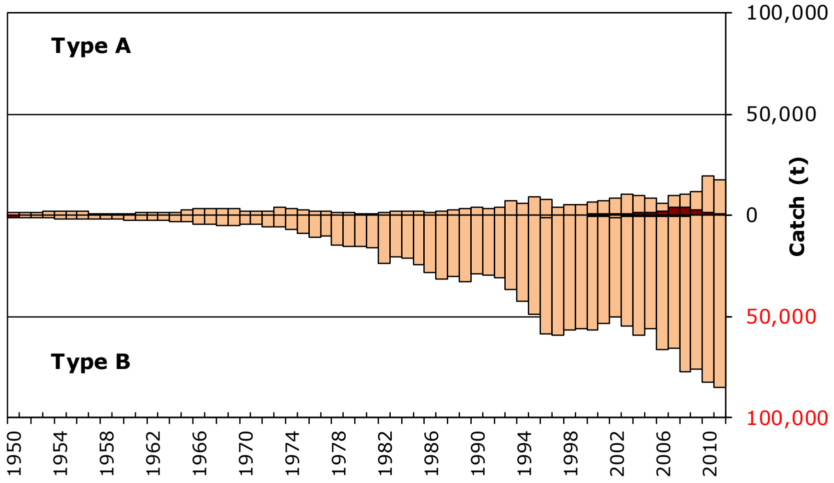


Fig. 3. Frigate tuna: Uncertainty of annual catch estimates for frigate tuna (1950–2011). Catches below the zero-line (Type B) refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat), do not report catch data by gear and/or species (broken by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document. Catches over the zero-line (Type A) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets (Data as of June 2013).

Frigate tuna – Effort trends

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

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

Standardised CPUE series have not yet been developed. Catch-and-effort series are available from some fisheries but they are considered highly incomplete (Fig. 4). 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 (Table. 2) 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.

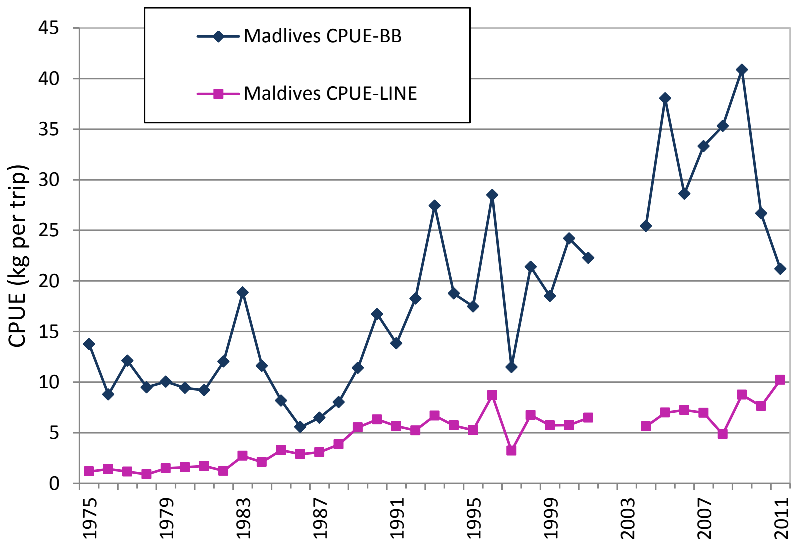
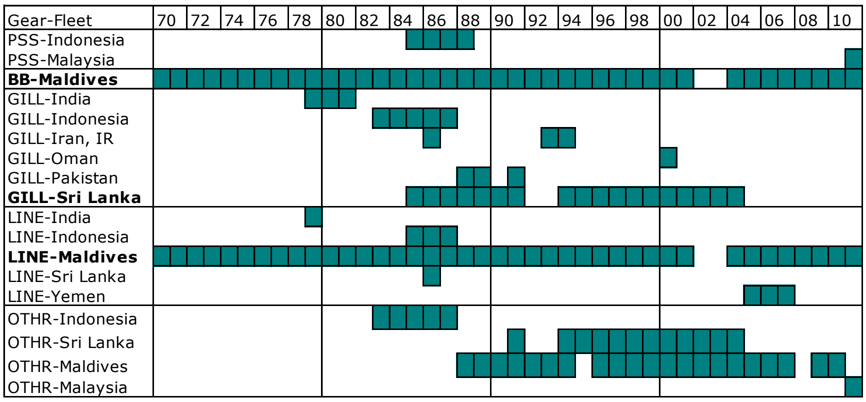


Fig. 4. Frigate tuna: Nominal CPUE series for the baitboat (BB using mechanied boats) and line (LINE, including handlines and trolling using mechanized boats) fisheries of Maldives derived from the available catches and effort data (1975–2011)

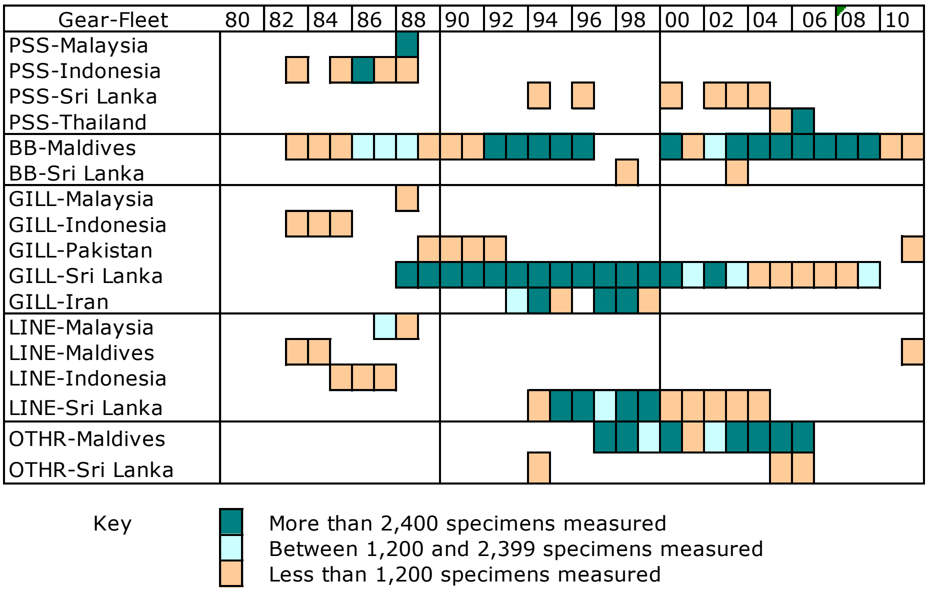
TABLE 2. Frigate tuna: Availability of catches and effort series, by fishery and year (1970–2011)[4]. Note that no catches and effort are available for the period 1950–69 in the IOTC Secretariat databases



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, 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 (1980–2011)[5]. Note that no length frequency data are available for the period 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) 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 some selected fisheries are shown in Fig. 5.
- Sex ratio data have not been provided to the Secretariat by CPCs.

[4] 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

[5] 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

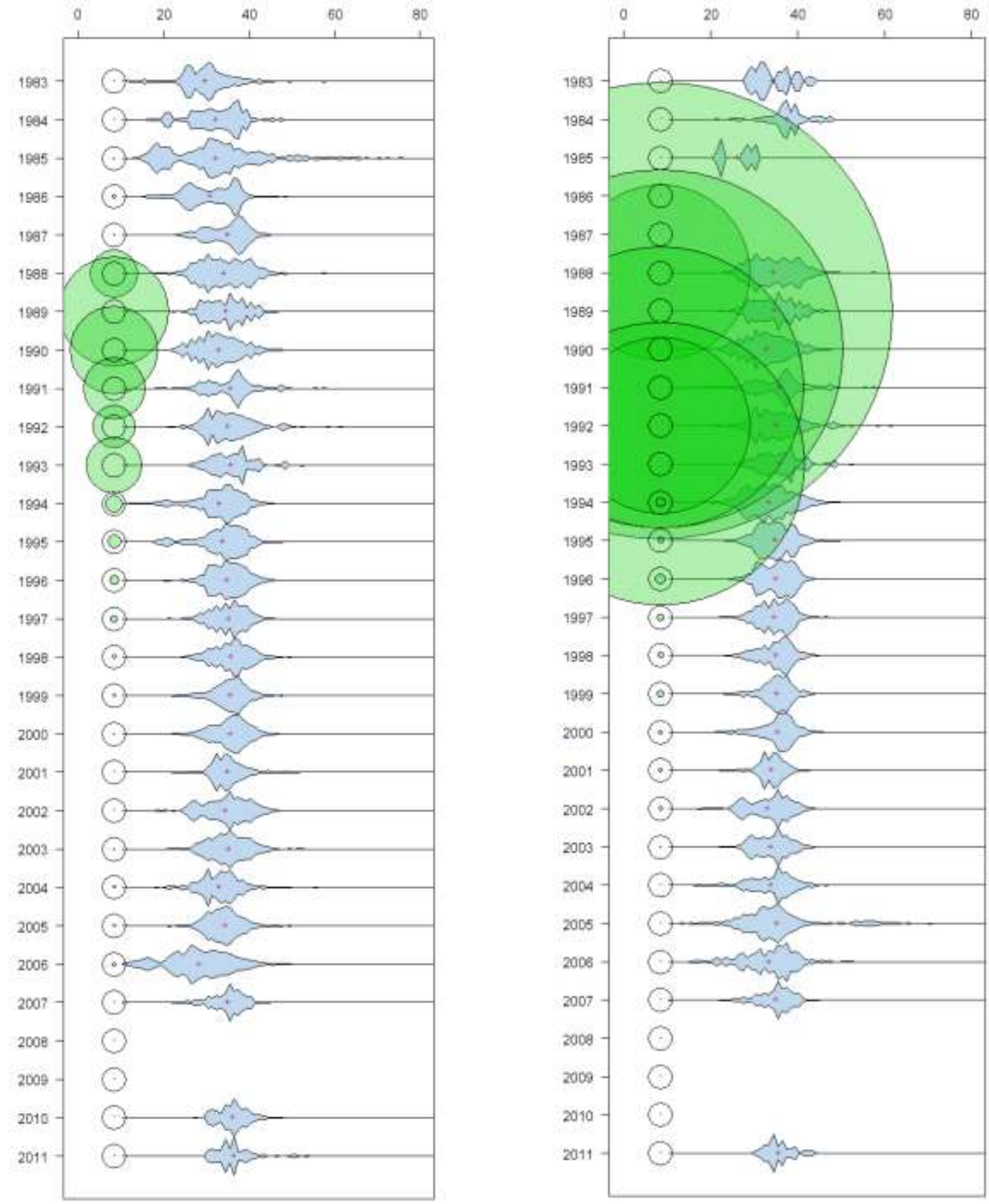


Fig. 5. Frigate tuna: Length frequency distributions (total amount of fish measured by 1cm length class) derived from the data available at the IOTC Secretariat for selected fisheries, by gear and year. The black outline circles (to the left of each chart) indicate the minimum sampling standard set by 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).

APPENDIX IVC
MAIN STATISTICS FOR KAWAKAWA (*EUTHYNNUS AFFINIS*)

Extract from IOTC–2013–WPNT03–07 Rev_1

Kawakawa – Fisheries and catch trends

Kawakawa is caught mainly by coastal purse seines, gillnets, handlines and trolling (Table 1; 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[6] (Fig. 2).

TABLE 1. Best scientific estimates of the catches of kawakawa by type of fishery for the period 1950–2011 (in metric tonnes) (Data as of June 2013)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Purse seine	307	807	2,880	10,235	20,544	30,338	26,881	27,283	29,042	30,239	35,195	34,123	34,729	36,774	36,180	35,639
Gillnet	2,179	4,098	9,085	15,708	27,800	47,526	41,791	41,918	43,240	43,788	49,929	52,280	62,071	59,390	53,920	65,379
Line	2,102	3,642	7,145	11,732	18,742	24,036	20,206	20,539	24,224	22,061	23,635	25,196	31,429	31,659	31,981	33,867
Other	88	297	612	1,411	3,515	6,250	4,785	4,815	5,635	5,880	6,109	8,120	8,257	9,065	9,475	8,767
Total	**4,676**	**8,844**	**19,722**	**39,085**	**70,601**	**108,149**	**93,663**	**94,554**	**102,140**	**101,968**	**114,868**	**119,719**	**136,486**	**136,888**	**131,557**	**143,652**

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 40,000 t mark in the mid-1980's and 143,000 t in 2011, the highest catches ever recorded for this species. In recent years the majority of the catches of kawakawa have been taken in the East Indian Ocean.

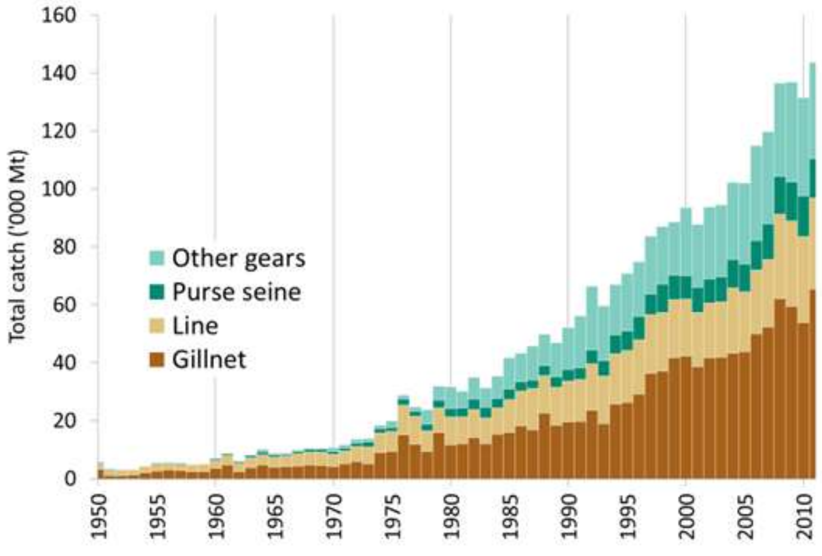


Fig. 1. Kawakawa: Annual catches of kawakawa by gear recorded in the IOTC database (1950–2011)

[6] 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 unreporting fisheries for which catches had to be estimated.

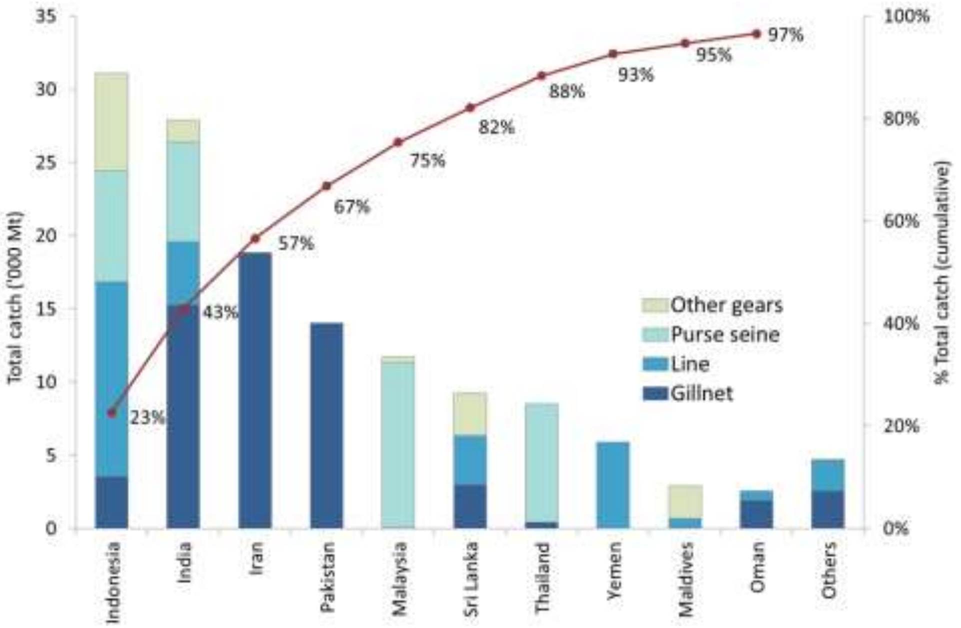


Fig. 2. Kawakawa: Average catches in the Indian Ocean over the period 2009–11, by country. Countries are ordered from left to right, according to the importance of catches of kawakawa reported. The red line indicates the (cumulative) proportion of catches of kawakawa for the countries concerned, over 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 (23%), India (20%), Iran (14%), Pakistan (10%) and Malaysia (9%) (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, in a recent review it was indicated that the catches of kawakawa had been overestimated by Indonesia. While the new catches estimated for the kawakawa in Indonesia remain uncertain, representing around 23% (38% 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 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 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 20% (17% in the past) of the total catches of this species in the Indian Ocean in recent years.
- 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 Malaysia and Thailand).
- 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 European Union 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 European Union recently reported discard levels of kawakawa for its purse seine fleet, for 2003–07, estimated using observer data.
- Changes to the catch series: Overall, the catch series of kawakawa has not changed substantially since the WPNT meeting in 2012. While the reviews in India, Indonesia, and other countries led to changes in the total catch of kawakawa and breakdown by gear in each country, as a whole, the total catches of kawakawa remain at similar levels when compared to previous estimates.

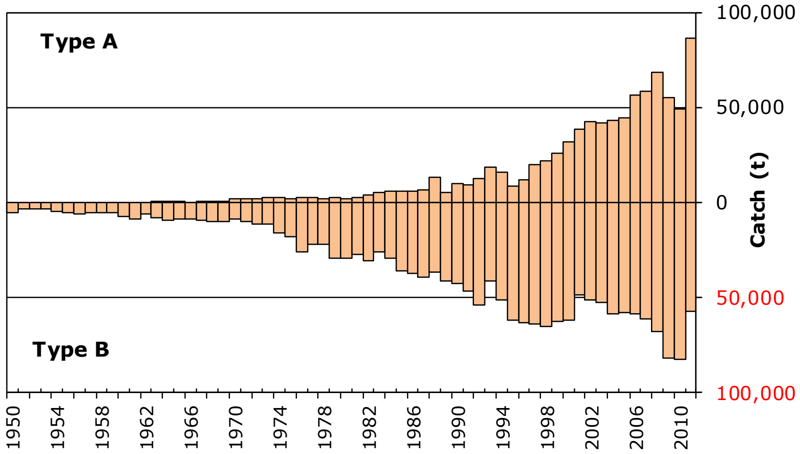


Fig. 3. Kawakawa: Uncertainty of annual catch estimates for kawakawa (1950–2011). Catches below the zero-line (Type B) refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat), do not report catch data by gear and/or species (broken by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document. Catches over the zero-line (Type A) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets (Data as of June 2013).

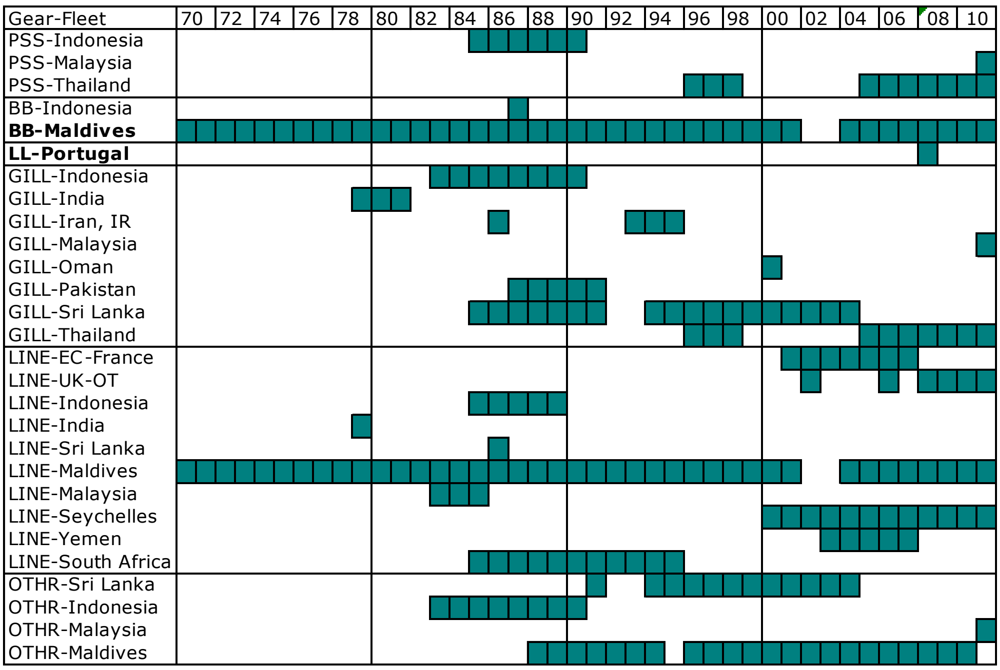
Kawakawa – Effort trends

Effort trends are unknown for kawakawa in the Indian Ocean.

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

Standardised CPUE series were developed for some fisheries in 2013 (see IOTC–2013–WPNT03–R). Catch-and-effort series are available from some fisheries but they are considered highly incomplete. In most cases catch-and-effort data are only available for short periods (Table 2). 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 (1970–2011)[7]. Note that no catch and effort data are available for the period 1950–69 in the IOTC Secretariat databases



[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, when available catches and effort may not be available throughout the year existing only for short periods

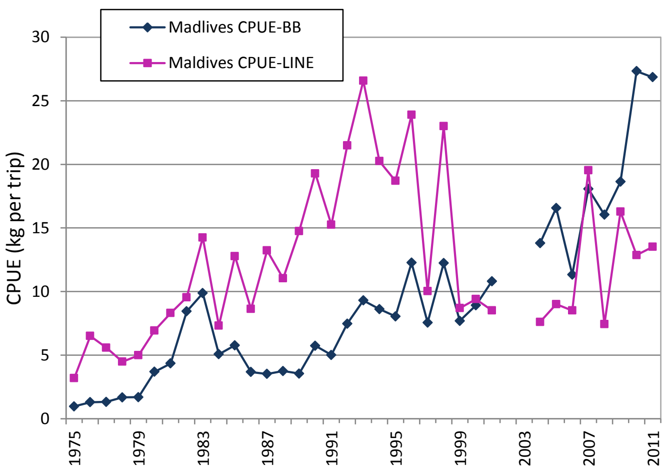
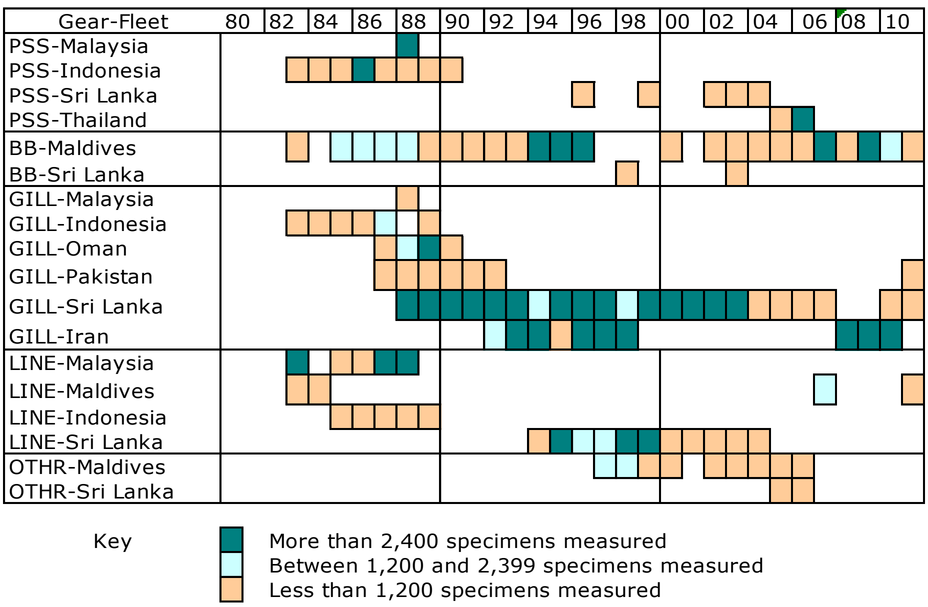


Fig. 4. Kawakawa: Nominal CPUE series for the baitboat (BB) and troll line (TROL) fisheries of Maldives (1975–2011) derived from the available catches and effort data

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 only 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, data collection did not continue after the end of the IPTP activities.
- 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. Length distributions derived from the data available for some selected fisheries are shown in Fig. 5.
- 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 (1980–2011)[8]. Note that no length frequency data are available for the period 1950–82



[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

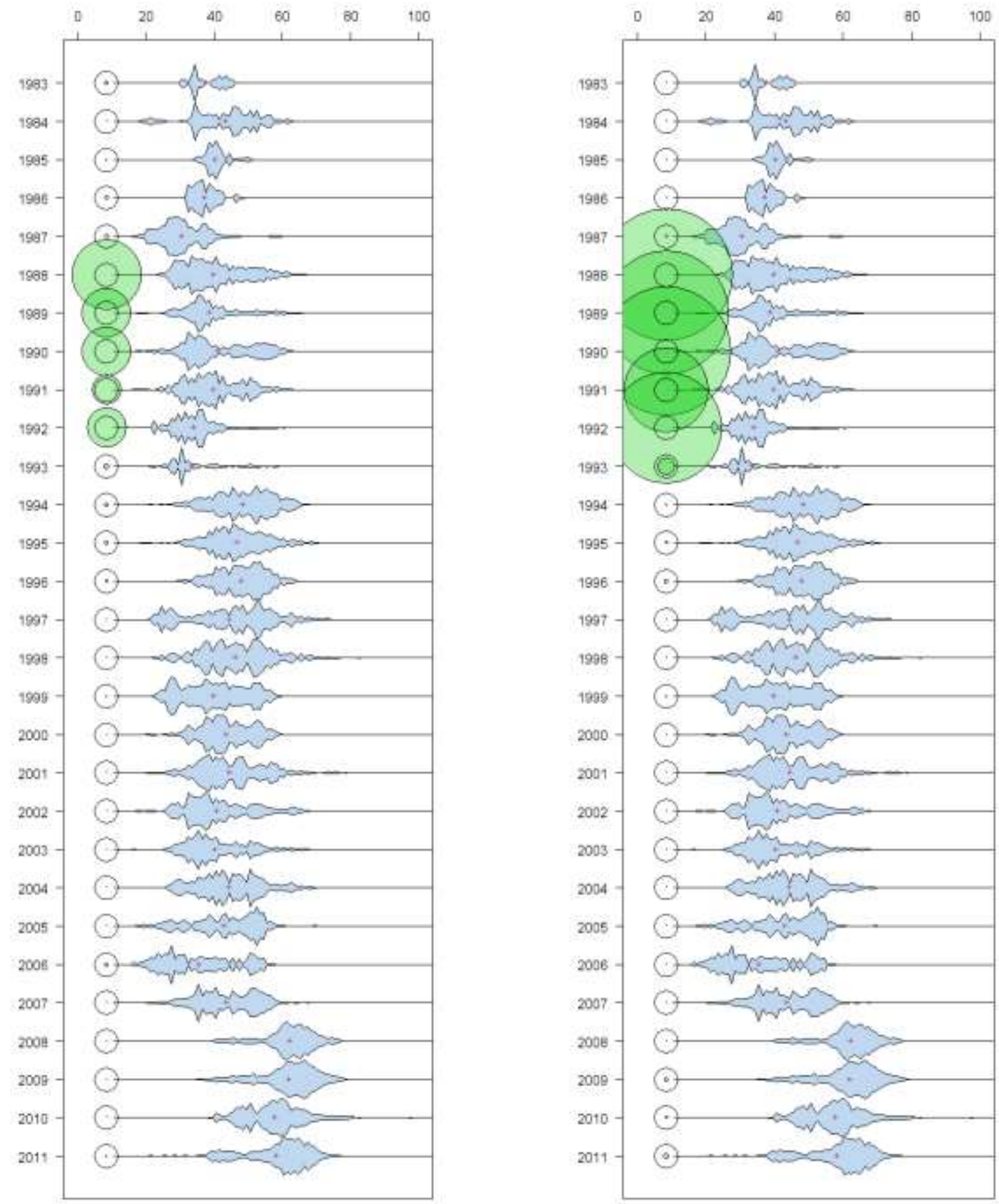


Fig. 5. Kawakawa: Length frequency distributions (total amount of fish measured by 1cm length class) derived from the data available at the IOTC Secretariat for selected fisheries and periods, by gear and year. The black outline circles (to the left of each chart) indicate the minimum sampling standard 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).

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

Extract from IOTC–2013–WPNT03–07 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[9]. The catches provided in Table 1 are based on the information available at the IOTC Secretariat and the following observations on catches cannot currently be verified. Estimated catches of longtail tuna increased steadily from the mid 1950's to the year 2000 when over 85,000 t were landed. Catches then declined until 2005 (66,482 t). Since 2005, catch have increased continually with the highest catches ever recorded at around 165,000 t, landed in 2011.

In recent years (2009–11), the countries attributed with the highest catches of longtail tuna are Iran (47%) and Indonesia (16%) and Pakistan (10%), and to a lesser extent, Oman, Malaysia, India and Thailand (25%) (Table 1; Fig. 2). In particular, Iran has reported large increases in the catch of longtail tuna since 2009. The increase in catches of longtail tuna coincides with a decrease in the catches of skipjack tuna and is thought to be the consequence of increased gillnet effort in coastal waters 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 1950–2011 (in metric tonnes) (Data as of June 2013)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Purse seine	44	204	1,036	4,398	8,106	11,513	14,233	11,591	9,326	7,720	11,145	15,464	11,339	13,390	12,475	21,989
Gillnet	2,593	5,849	8,826	23,613	36,563	54,140	47,085	51,660	42,622	40,188	47,899	55,538	61,937	77,616	95,445	114,524
Line	909	1,160	2,676	6,443	9,799	15,672	13,239	12,724	15,524	15,474	18,034	19,440	17,629	18,032	19,084	20,571
Other	0	0	236	1,899	3,135	3,977	2,884	2,951	3,490	3,100	3,838	4,883	6,004	5,877	6,613	7,453
Total	**3,547**	**7,213**	**12,773**	**36,352**	**57,603**	**85,302**	**77,442**	**78,924**	**70,962**	**66,482**	**80,916**	**95,325**	**96,909**	**114,915**	**133,617**	**164,537**

The size of longtail tuna taken by IOTC fisheries typically ranges between 20 and 100 cm depending on the type of gear used, season and location (Fig. 9). The fisheries operating in the Andaman Sea (coastal purse seines and troll lines) tend to catch longtail tuna of small size (20–45cm) while the main gillnet fisheries operating in the Arabian Sea (Iran and Pakistan) catch larger specimens (50–100cm).

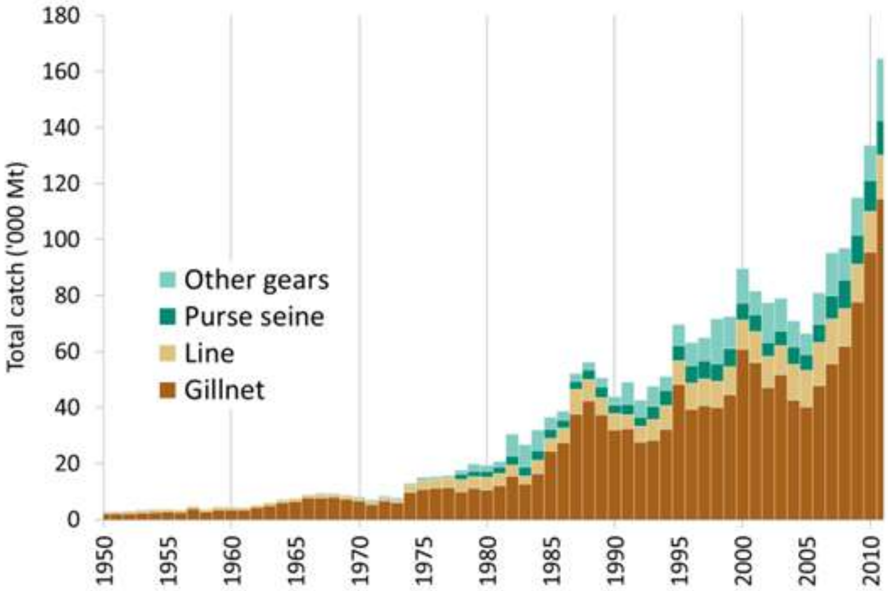


Fig. 1. Longtail tuna: Annual catches of longtail tuna by gear recorded in the IOTC Database (1950–2011)

9 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.

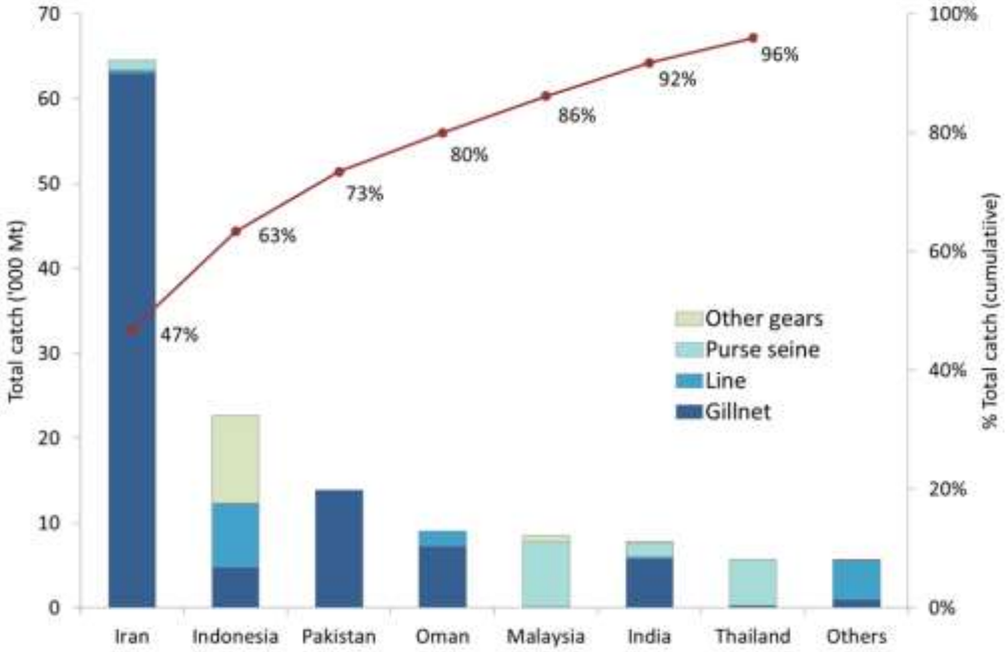


Fig. 2. Longtail tuna: Average catches in the Indian Ocean over the period 2009–11, by country. Countries are ordered from left to right, according to the importance of catches of longtail reported. The red line indicates the (cumulative) proportion of catches of longtail tuna for the countries concerned, 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, in a recent review of the data (2012) it was identified that the catches of longtail tuna had been overestimated by Indonesia. While the new catches estimated for 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 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 represented 12% of the total catches of this species in recent years (2009–11).
- Artisanal fisheries of Mozambique, Myanmar (and Somalia): None of these countries have ever reported catches of longtail tuna to the IOTC Secretariat. Catch levels are unknown but are not considered 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 Malaysia (catches not reported by species). The catches estimated for the longtail tuna represent 9% of the total catches of this species in recent years.
- Discard levels are believed to be very low although they are unknown for most fisheries.
- Changes to the catch series: There have been significant changes to the catches of longtail tuna since the WPNT meeting in 2012, following major reviews of catch time series for Indonesia, India, and Sri Lanka.

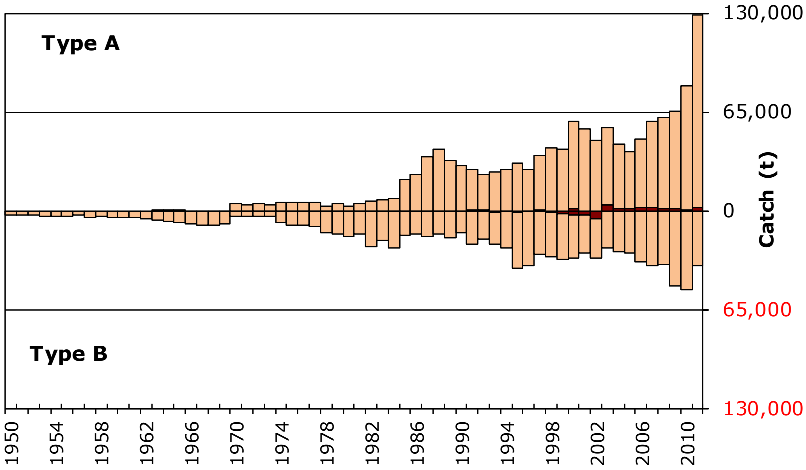


Fig. 3. Uncertainty of annual catch estimates for longtail tuna (1950–2011). Catches below the zero-line (Type B) refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat), do not report catch data by gear and/or species (broken by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document. Catches over the zero-line (Type A) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets (Data as of June 2013)

Longtail tuna – Effort trends

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

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

Nominal CPUE 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 catch and effort series (extending for more than 10 years) are only available for Thailand small purse seines and gillnets (Fig. 4). No catch and effort data are available from sports fisheries, other than for partial data from the sports fisheries of Kenya.

TABLE 2. Longtail tuna: Availability of catches and effort series, by fishery and year (1970–2011)[10]. Note that no catch and effort data are available for the period 1950–1971 in the IOTC Secretariat databases

Gear-Fleet	70		72		74		76		78		80		82		84		86		88		90		92		94		96		98		00		02		04		06		08		10	
PSS-Malaysia																														■												■
PSS-Thailand																											■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PS-Iran, IR																														■	■		■		■							
PS-Seychelles																															■			■								
PS-NEI																															■											
GILL-India											■	■																														
GILL-Indonesia																■	■																									
GILL-Iran, IR																	■							■	■	■																
GILL-Malaysia																														■												■
GILL-Oman																															■											
GILL-Pakistan																		■	■	■	■	■																				
GILL-Thailand			■								■	■	■	■	■	■	■	■	■		■						■	■	■	■	■	■	■	■	■		■	■	■	■	■	■
LINE-Australia																									■	■	■	■	■	■	■	■	■	■	■	■	■					
LINE-Indonesia																■																										
LINE-Malaysia														■	■	■														■												■
LINE-Yemen																																		■	■	■		■				
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OTHR-Indonesia																■	■																									
OTHR-Malaysia																														■												■

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

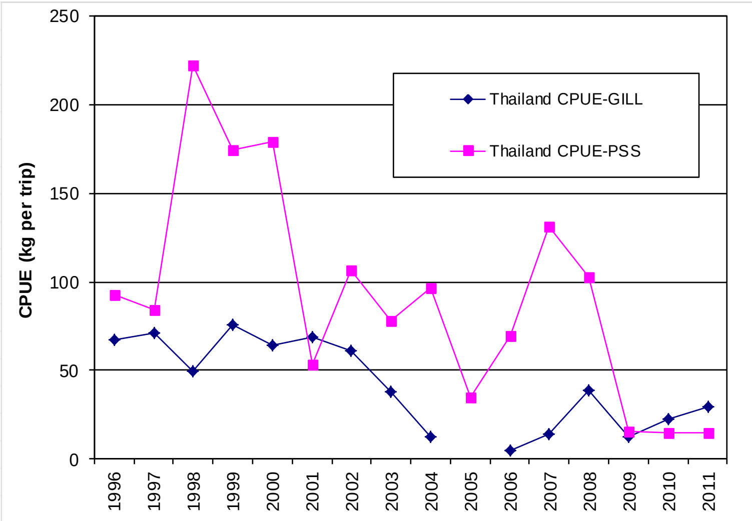
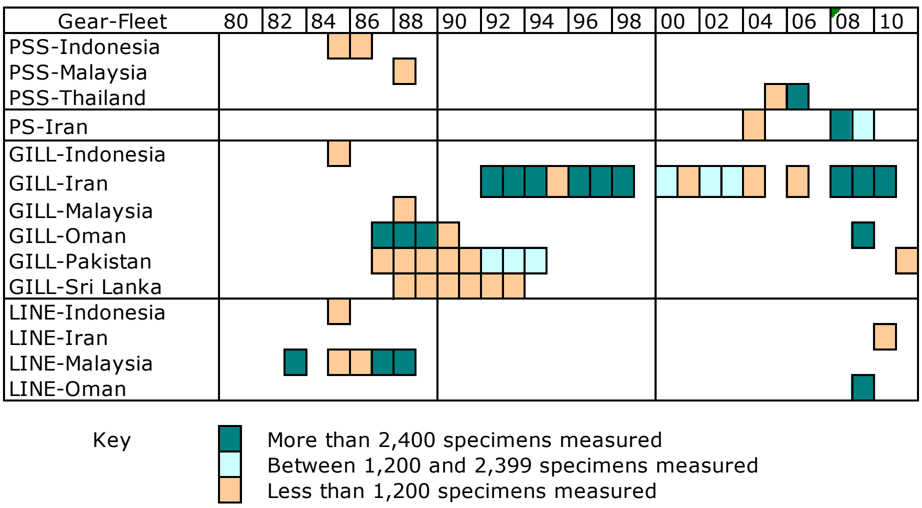


Fig. 4. Longtail tuna: Nominal CPUE series for the gillnet (GILL) and coastal purse seine (PSS) fisheries of Thailand derived from the available catches and effort data (1996–2011)

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

- The size of longtail tuna taken by the Indian Ocean fisheries typically ranges between 15–120 cm depending on the type of gear used, season and location. The fisheries operating in the Andaman Sea (coastal purse seines and troll lines) tend to catch longtail tuna of small size (20–45cm) while the drifting gillnet fisheries operating in the Arabian Sea catch larger specimens (50–100cm).
- Trends in average weight can only be assessed for I.R. Iran drifting 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, data collection did not continue after the end of the IPTP activities.
- Catch-at-Size(Age) tables are not available for the longtail tuna due to the paucity of size data available from most fleets and the uncertain status of the catches for this species (Table 3). Length distributions derived from the data available for some selected fisheries are shown in Fig. 5.
- 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 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, 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 (1980–2011)[11]. Note that no catch and effort data are available for the period 1950–1982 in the IOTC Secretariat databases



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

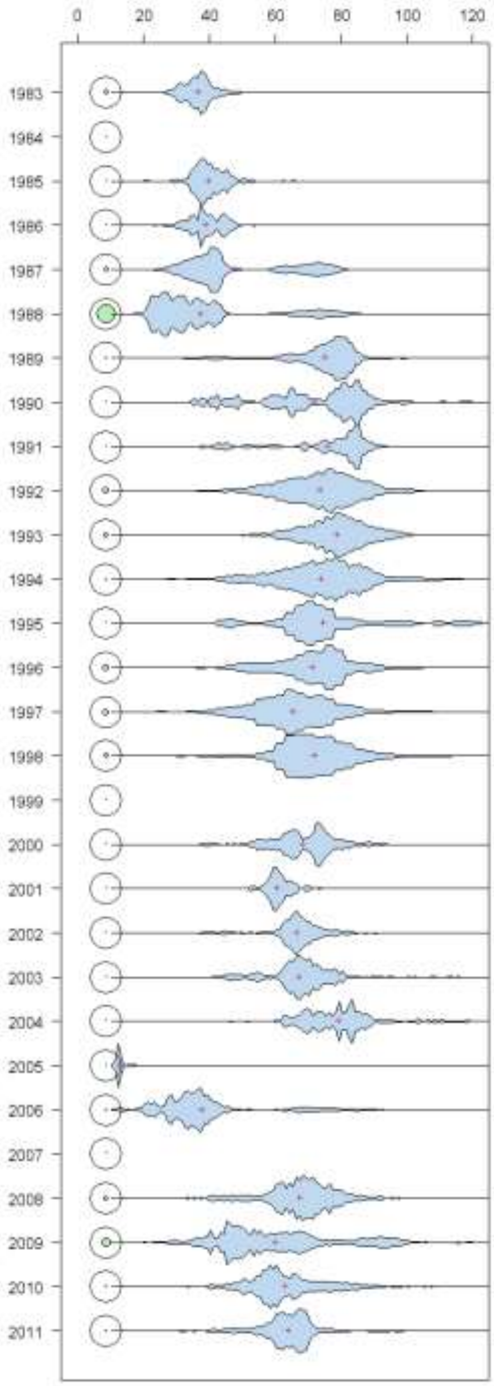
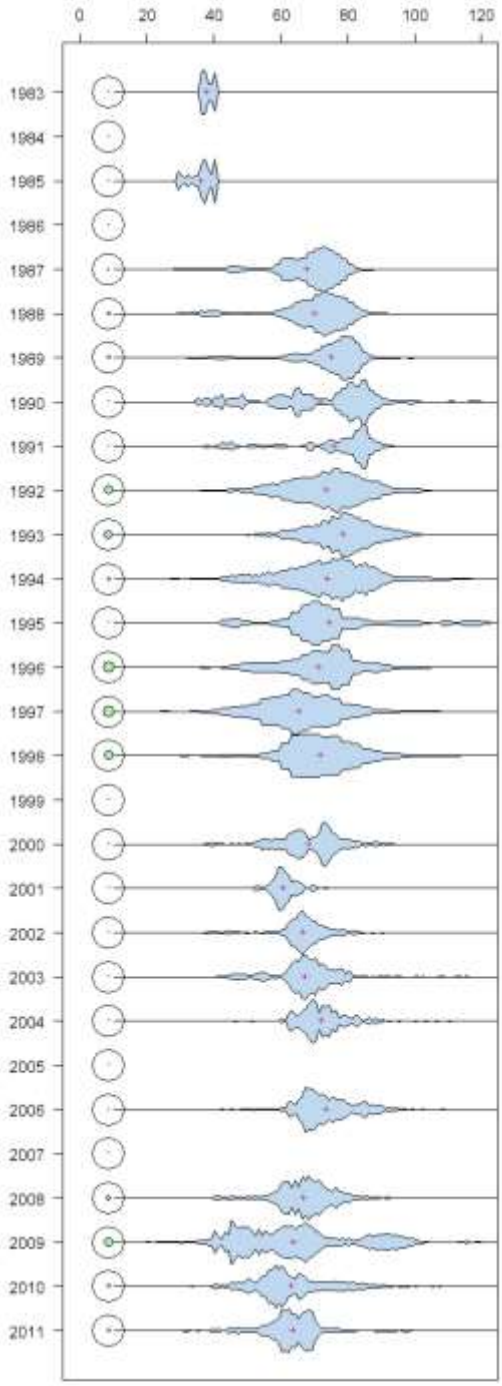
LOT (All samples): size (in cm)	LOT (Gillnet samples): size (in cm)
	

Fig. 12: Longtail tuna: Length frequency distributions (total amount of fish measured by 1cm length class) derived from the data available at the IOTC Secretariat for selected fisheries, by gear and year. The black outline circles (to the left of each chart) 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).

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

Extract from IOTC–2013–WPNT03–07 Rev_1

Indo-Pacific king mackerel – Fisheries and catch trends

The Indo-Pacific king mackerel[12] is mostly caught by artisanal 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[13] (Fig. 1).

TABLE 1. Indo-Pacific king mackerel: Best scientific estimates of the catches of Indo-Pacific king mackerel by type of fishery for the period 1950–2011 (in metric tonnes) (Data as of June 2013)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Purse seine	5	9	53	623	850	1,067	933	956	910	804	844	1,233	1,487	1,832	1,416	1,528
Gillnet	4,213	6,747	13,532	16,556	21,251	23,065	21,525	21,008	21,848	18,055	20,252	26,176	31,968	31,744	26,126	28,513
Line	404	500	1,184	1,881	2,286	2,610	2,280	2,220	2,347	2,117	2,085	3,032	3,639	3,950	3,201	3,468
Other	7	12	30	3,845	5,042	9,189	8,024	7,648	8,079	7,768	7,993	10,467	12,001	15,557	11,670	12,765
Total	**4,630**	**7,268**	**14,799**	**22,904**	**29,430**	**35,931**	**32,762**	**31,831**	**33,183**	**28,743**	**31,174**	**40,907**	**49,094**	**53,083**	**42,413**	**46,274**

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 early 1970's and over 30,000 t since the mid-1990's. Catches increased steadily since then until 1995, in which catches around 40,000 t were recorded. The catches of Indo-Pacific king mackerel between 1997 and 2005 were more or less stable, estimated at around 30,000 t. Current catches have been higher, close to 50,000 t. The highest catches were recorded in 2011, at around 53,000 t.

In recent years, the countries attributed with the highest catches are India (42%) and Indonesia (28%) and, to a lesser extent, Myanmar and Iran (16%) (Fig. 2). Catches of king mackerel in the eastern Indian Ocean have been higher in recent years.

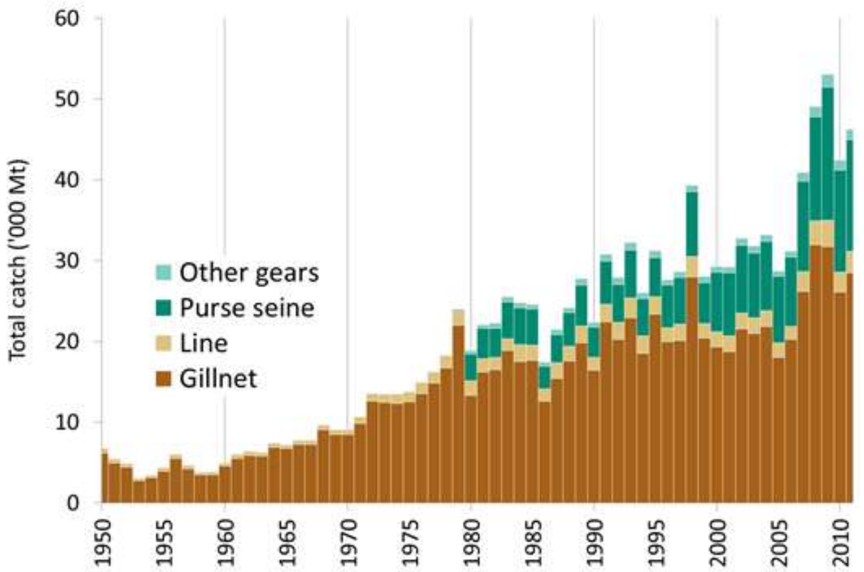


Fig. 1. Indo-Pacific king mackerel: Annual catches of Indo-Pacific king mackerel by gear recorded in the IOTC database (1950–2011)

[12] Hereinafter referred to as King mackerel

[13] 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 unreporting fisheries for which catches had to be estimated.

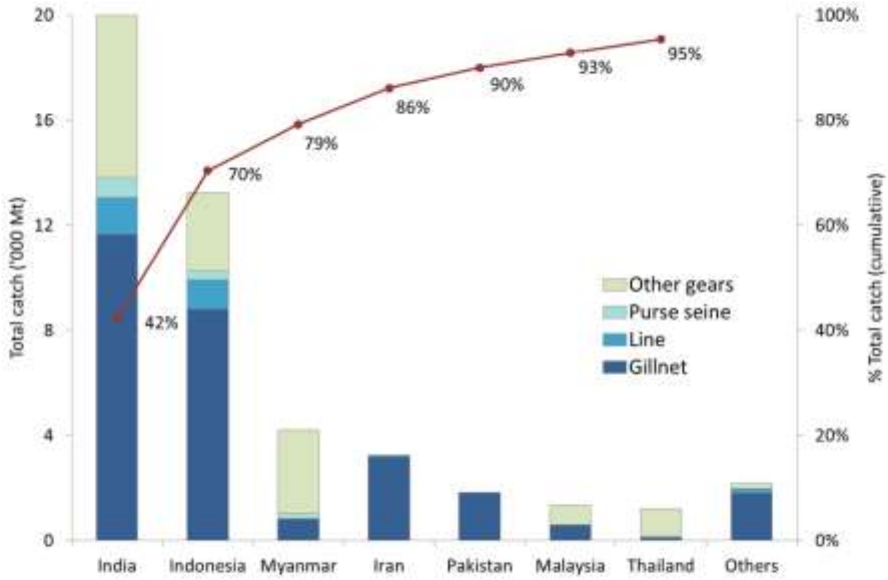


Fig. 2. Indo-Pacific king mackerel: average catches in the Indian Ocean over the period 2009–11, by country. Countries are ordered from left to right, according to the importance of catches of Indo-Pacific king mackerel reported. The red line indicates the (cumulative) proportion of catches of Indo-Pacific 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 2012.

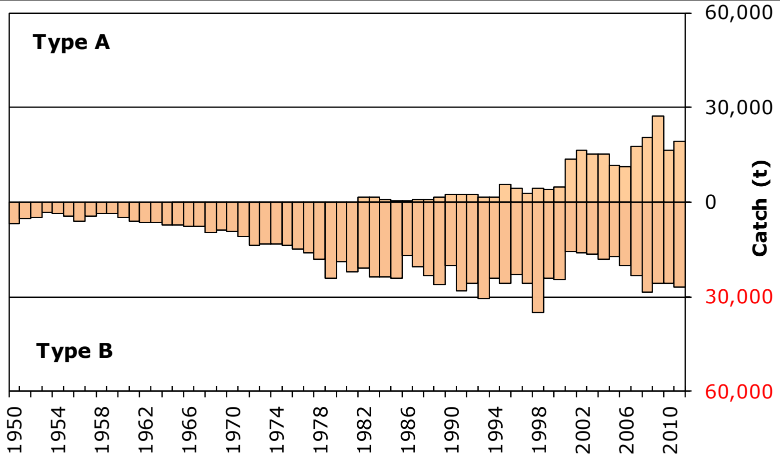


Fig. 3. Indo-Pacific king mackerel: Uncertainty of annual catch estimates for Indo-Pacific king mackerel (1950–2011). Catches below the zero-line (Type B) refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat), do not report catch data by gear and/or species (broken by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document. Catches over the zero-line (Type A) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets (Data as of June 2013)

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

Standardised CPUE series have not yet been developed. Nominal CPUE series are however available from some fisheries but 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 (1970–2011)[14]. Note that no catches and effort are available for the period 1950–85 at the IOTC Secretariat

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									■												
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(age) data are not available for the Indo-Pacific king mackerel 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. Indo-Pacific king mackerel: Availability of length frequency data, by fishery and year (1980–2011)[15]. 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
PSS-Thailand													■	■		
GILL-Sri Lanka					■■	■	■■									

Key
- ■ (dark) More than 2,400 specimens measured
- ■ (light blue) Between 1,200 and 2,399 specimens measured
- ■ (orange) Less than 1,200 specimens measured

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

[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

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

Extract from IOTC–2013–WPNT03–07 Rev_1

Narrow-barred Spanish mackerel – Fisheries and catch trends

Narrow-barred Spanish mackerel 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 1. Narrow-barred Spanish mackerel: Best scientific estimates of the catches of narrow-barred Spanish mackerel by type of fishery for the period 1950–2011 (in metric tonnes) (Data as of June 2013)

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Purse seine	41	69	425	2,613	4,668	6,487	4,925	5,456	5,500	5,550	8,404	7,189	8,279	10,063	11,121	11,083
Gillnet	8,681	16,863	29,734	51,768	60,018	64,082	60,964	63,080	61,989	53,776	65,159	69,222	73,119	69,189	75,133	81,663
Line	2,581	3,300	7,106	14,463	14,741	18,767	15,976	17,366	17,397	16,950	19,272	20,048	22,537	23,580	23,870	25,662
Other	16	27	326	5,352	9,205	19,935	18,715	17,516	18,585	17,466	22,223	22,993	22,008	26,215	24,220	26,593
Total	**11,318**	**20,259**	**37,592**	**74,196**	**88,632**	**109,271**	**100,580**	**103,417**	**103,472**	**93,741**	**115,059**	**119,453**	**125,943**	**129,047**	**134,344**	**145,001**

The catch estimates for narrow-barred Spanish mackerel were derived from very small amounts of information and are therefore highly uncertain[16]. 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 mid-1970's to over 100,000 t by the mid-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 higher catches recorded in the west.

In recent years, the countries attributed with the highest catches of narrow-barred Spanish mackerel are Indonesia (31%) and India (22%) and, to a lesser extent, Iran, Myanmar, Pakistan, and the UAE (24%) (Fig. 2).

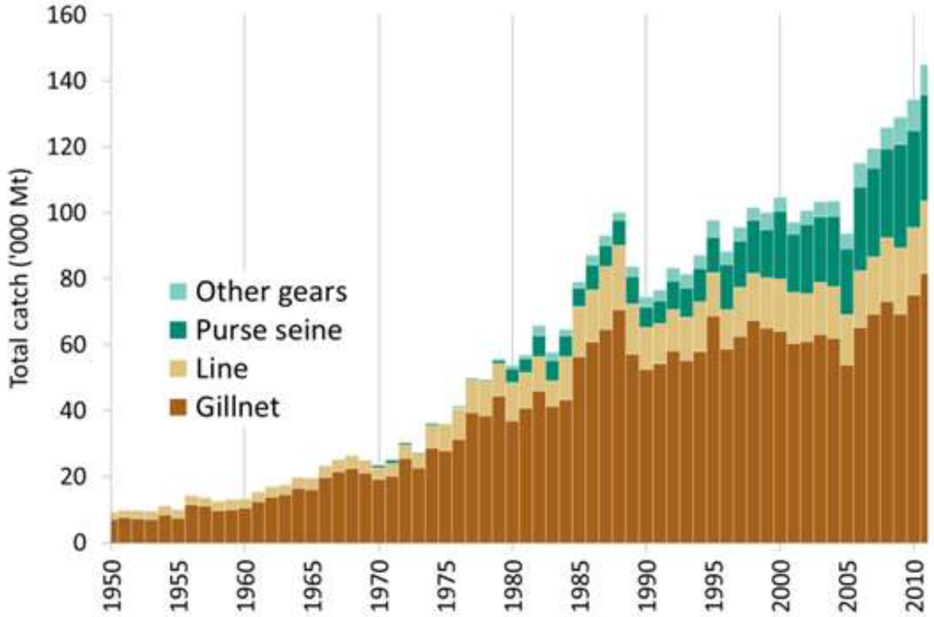


Fig. 1. Narrow-barred Spanish mackerel: Annual catches of narrow-barred Spanish mackerel by gear recorded in the IOTC database (1950–2011)

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

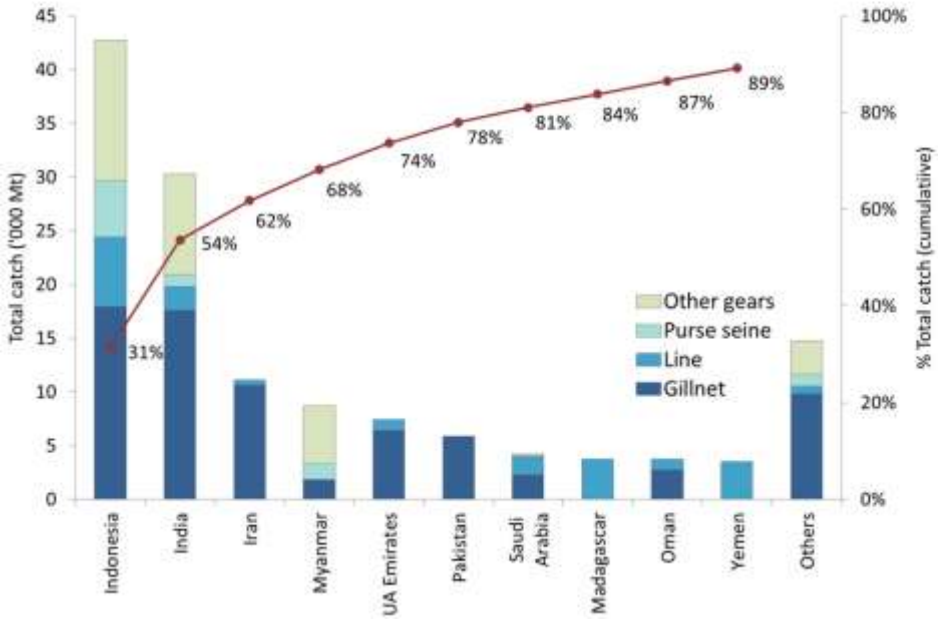


Fig. 2. Narrow-barred Spanish mackerel: Average catches in the Indian Ocean over the period 2009–11, by country. Countries are ordered from left to right, according to the importance of catches of narrow-barred Spanish mackerel reported. The red line indicates the (cumulative) proportion of catches narrow-barred 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 India and Indonesia: India and Indonesia 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 recent review the catches of narrow-barred Spanish mackerel were reassigned by gear. The catches of narrow-barred Spanish mackerel estimated for this component represent around 55% 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 Spanish mackerel. Similarly, the catches of wahoo in some longline fisheries are thought to be mislabelled as Spanish mackerel. This mislabelling is thought to have little impact in the case of the 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: The catch series of narrow-barred Spanish mackerel has not changed substantially since the WPNT meeting in 2012. The catch series estimated for the WPNT in 2013 show lower catches of narrow-barred Spanish mackerel between the mid-1990's and early 2000's, following a review of the catch series in India.

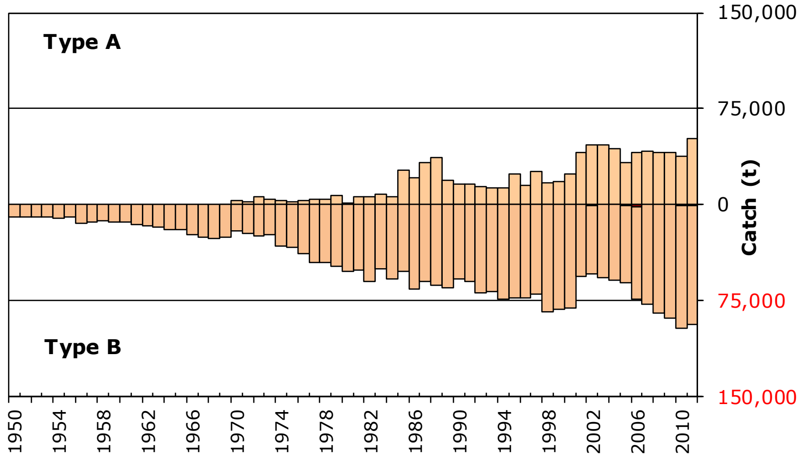


Fig. 3. Narrow-barred Spanish mackerel: Uncertainty of annual catch estimates for narrow-barred Spanish mackerel (1950–2011). Catches below the zero-line (Type B) refer to fleets that do not report catch data to the IOTC (estimated by the IOTC Secretariat), do not report catch data by gear and/or species (broken by gear and species by the IOTC Secretariat) or any of the other reasons provided in the document. Catches over the zero-line (Type A) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets (Data as of June 2013)

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

Standardised CPUE series have not yet been developed. Nominal CPUE 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 (1970–2011)[17]. Note that no catches and effort are available for the period 1950–84 and 2008–11

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																														■												

[17] 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

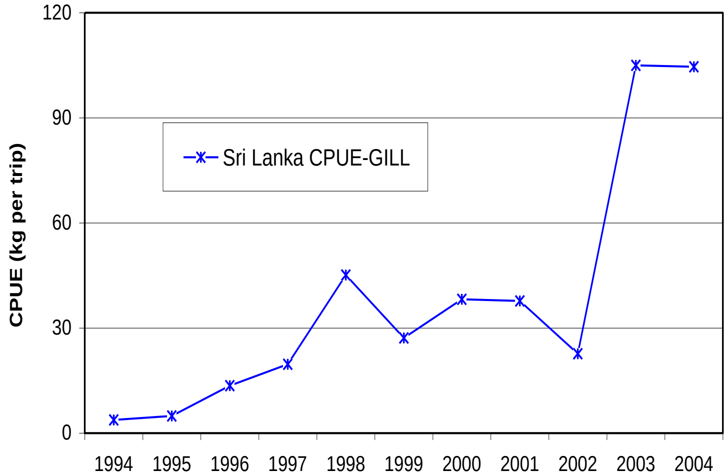
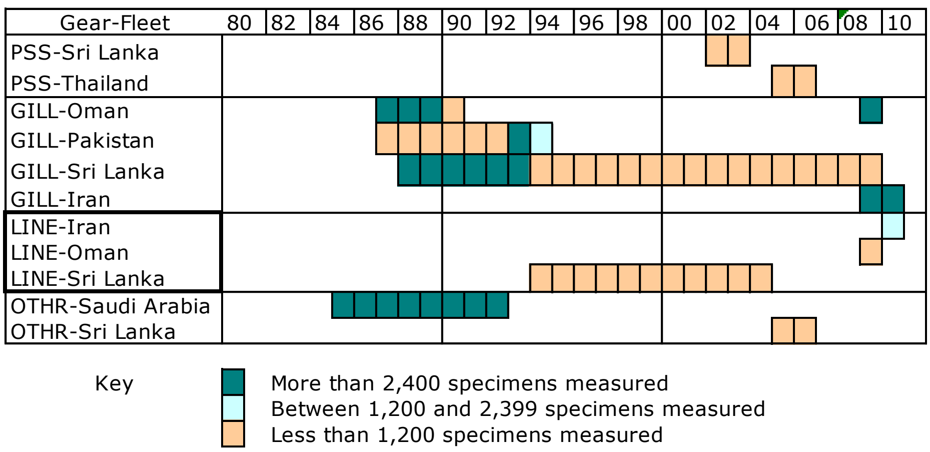


Fig. 4. Narrow-barred Spanish mackerel: Nominal CPUE series for the gillnet fishery of Sri Lanka derived from the available catches and effort data (1994–2004)

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 (Fig. 5) but the amount of specimens measured has been very low in recent years. 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(age) 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. Length distributions derived from the data available for some selected fisheries are shown in Fig. 5.
- Sex ratio data have not been provided to the Secretariat by CPCs.

TABLE 3. Narrow-barred Spanish mackerel: Availability of length frequency data, by fishery and year (1980–2011). Note that no length frequency data are available for the period 1950–84



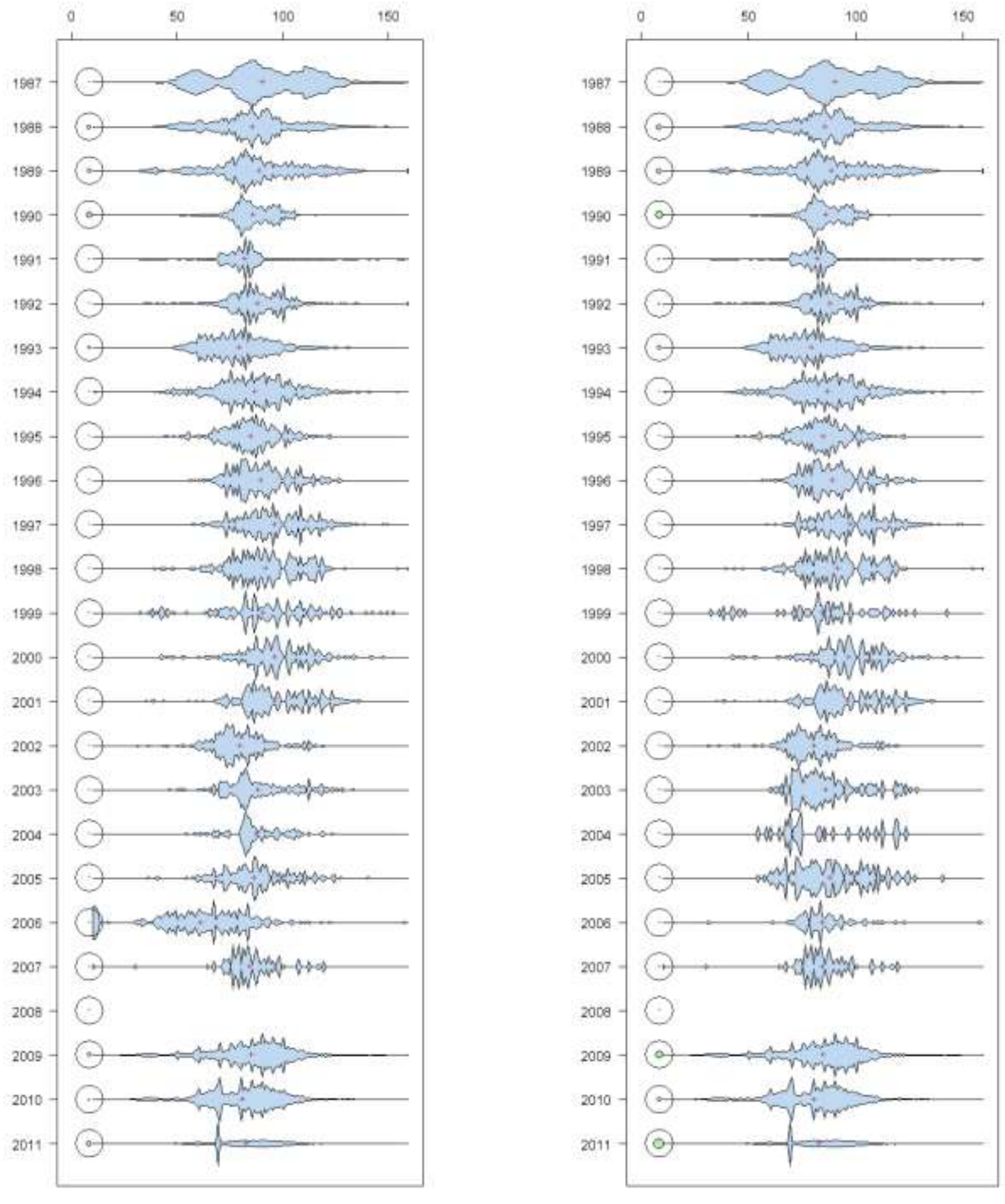


Fig. 5. Narrow-barred Spanish mackerel: Length frequency distributions (total amount of fish measured by 1cm length class) derived from the data available at the IOTC Secretariat for selected fisheries and periods, by gear and year. The black outline circles (to the left of each chart) indicate the minimum 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).

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

Extract from IOTC–2013–WPNT03–07 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.

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

- **Drifting gillnet** fisheries of **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[18]. 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 **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 seiners, in particular frigate tuna, bullet tuna, and kawakawa (all purse seine fleets).

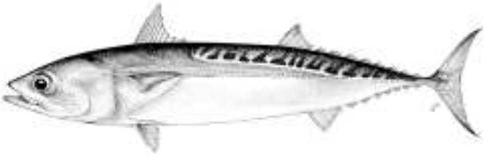
4. Biological data for all tropical tuna species:

- All fisheries: There is a generalised lack of biological data for most neritic tuna species, in 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.

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

APPENDIX VI
BULLET TUNA – DRAFT RESOURCE STOCK STATUS SUMMARY

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



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		2013 stock status determination
Indian Ocean	Catch[2] 2011: Average catch[2] 2007–2011:	8,547 t 7,763 t	
	MSY: F_{2011}/F_{MSY}: SB_{2011}/SB_{MSY}: SB_{2011}/SB_0:	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

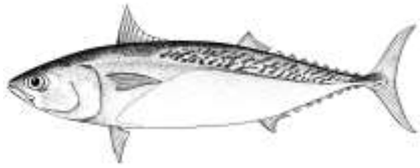
Stock status. There remains considerable uncertainty about stock structure and total catches. No quantitative stock assessment is currently available for bullet tuna in the Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Therefore stock status remains **uncertain** (Table 1). However, 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.

Outlook. The continued increase of annual catches for bullet tuna is likely to have further increased the pressure on the Indian Ocean stock as a whole, however there is not sufficient information to evaluate the effect that this increase may have had on the resource. 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 for the whole Indian Ocean is unknown.
- annual catches urgently need to be reviewed.
- improvement in data collection and reporting is required to assess the stock.

APPENDIX VII
FRIGATE TUNA – DRAFT RESOURCE STOCK STATUS SUMMARY

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



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**		**2013 stock status determination**
Indian Ocean	Catch[2] 2011: Average catch[2] 2007–2011:	102,720 t 91,155 t	
	MSY: F_{2011}/F_{MSY}: SB_{2011}/SB_{MSY}: SB_{2011}/SB_0:	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. There remains considerable uncertainty about stock structure and the total catches. 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. Therefore stock status remains **uncertain** (Table 1). However, 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.

Outlook. The continued increase of annual catches for frigate tuna is likely to have further increased the pressure on the Indian Ocean stock as a whole, however there is not sufficient information to evaluate the effect that this increase may have had on the resource. 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 for the whole Indian Ocean is unknown.
- annual catches urgently need to be reviewed.
- improvement in data collection and reporting is required to assess the stock.

APPENDIX VIII
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		2013 stock status determination
Indian Ocean	Catch[2] 2011: Average catch[2] 2007–2011:	143,652 t 133,660 t	
	MSY: F_{2011}/F_{MSY}: B_{2011}/B_{MSY}: SB_{2011}/SB_0:	126,000–132,000 t 0.9–1.06 1.09–1.17 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. There remains considerable uncertainty about stock structure and about the total catches. Preliminary analysis using a stock-reduction analysis (SRA) approach indicates that the stock in near optimal levels of F_{MSY}, or exceeding these targets, although stock biomass remains above the level that would produce MSY (B_{MSY}). Due to the quality of the data being used, the simplistic approach used here, and the rapid increase in kawakawa catch in recent years, some measures need to be taken to slow the increase in catches in the IO Region, despite the stock status remaining classified as **uncertain** (Table 1). A separate analysis done on a sub-population (north-west Indian Ocean region) 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. 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.

Outlook. 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, and the stock is likely to currently be fully exploited. 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 for the whole Indian Ocean is estimated to be between 120,000 and 132,000 t.
- annual catches urgently need to be reviewed.
- 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.

APPENDIX IX
LONGTAIL TUNA – DRAFT RESOURCE STOCK STATUS SUMMARY

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

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**		**2013 stock status determination**
Indian Ocean	Catch[2] 2011: Average catch[2] 2007–2011:	164,537 t 121,061 t	(orange)
	MSY: F_{2011}/F_{MSY}: B_{2011}/B_{MSY}: SB_{2011}/SB_0:	110,000–123,000 t 1.11–1.77 1.11–1.25 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)	(red)	(orange)
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	(yellow)	(green)
Not assessed/Uncertain	(grey)	

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

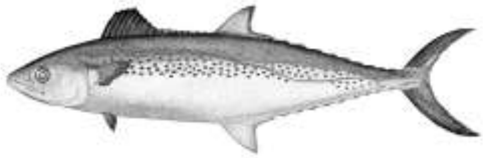
Stock status. There remains considerable uncertainty about stock structure and about the total catches in the Indian Ocean. Stock Reduction Analysis techniques indicate that the stock is being exploited at rates that exceed F_{MSY} in recent years. Whether a four quadrant stock structure of catches in the Indian Ocean or a one stock assumption is used in the analysis, the conclusions remain the same. However, further exploratory analysis of the data available should be undertaken in preparation for the next WPNT meeting before the assessment results are used for stock status determination. 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. Given estimated values of current biomass are above the estimated abundance to produce B_{MSY} in 2011, 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).

Outlook. 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 is likely being exceeded in recent years.
- annual catches urgently need to be reviewed.
- improvement in data collection and reporting is required to assess the stock status, primarily abundance index series from I.R. Iran, Oman and Indonesia.

APPENDIX X
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**		**2013 stock status determination**
Indian Ocean	Catch[2] 2011: Average catch[2] 2007–2011:	46,274 t 46,354 t	
	MSY: F_{2011}/F_{MSY}: SB_{2011}/SB_{MSY}: SB_{2011}/SB_0:	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. There remains considerable uncertainty about stock structure and the total catches. 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. Therefore stock status remains **uncertain** (Table 1). However, 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.

Outlook. The continued increase of annual catches for Indo-Pacific king mackerel is likely to have further increased the pressure on the Indian Ocean stock as a whole, however there is not sufficient information to evaluate the effect that this increase may have had on the resource. 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 for the whole Indian Ocean is unknown.
- annual catches urgently need to be reviewed.
- improvement in data collection and reporting is required to assess the stock.

APPENDIX XI
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		2013 stock status determination
Indian Ocean	Catch[2] 2011: Average catch[2] 2007–2011:	145,001 t 130,758 t	
	MSY: F_{2011}/F_{MSY}: SB_{2011}/SB_{MSY}: SB_{2011}/SB_0:	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. There remains considerable uncertainty about stock structure and the total catches. No quantitative stock assessment is currently available for narrow-barred Spanish mackerel for the entire Indian Ocean, and due to a lack of fishery data for several gears, only preliminary stock indicators can be used. Therefore stock status remains **uncertain** (Table 1). However, 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. Although indicators from the Gulf and Oman Sea suggest that overfishing is occurring in this area, the degree of connectivity with other regions remains unknown.

Outlook. 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, however there is not sufficient information to evaluate the effect that this increase may have had on the resource. 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:

- the Maximum Sustainable Yield estimate for the whole Indian Ocean is unknown.
- annual catches urgently need to be reviewed.
- improvement in data collection and reporting is required to assess the stock.

APPENDIX XII
WORKPLAN: WORKING PARTY ON NERITIC TUNAS

Priority species for research in 2014

The WPNT **AGREED** to the list of priority research topics for neritic tunas (priority species) as provided in Table 1.

The WPNT **AGREED** that as regionally appropriate, kawakawa, longtail tuna and narrow-barred Spanish mackerel, are the priority species for research in 2014, although research may also continue on other neritic tuna species on an opportunistic basis.

The WPNT **AGREED** that once the new Fishery Officer (Science) is recruited to the Secretariat, that he/she shall undertake a literature review of all available population parameters for either kawakawa or longtail tuna, to support further stock assessment of these species in 2014.

Capacity building

Capacity building activities (regional or sub-regional) by the IOTC Secretariat should focus on using a single neritic tuna species as an example, for the following core areas. Focus species should be kawakawa and longtail tuna for the eastern Indian Ocean and kawakawa and narrow-barred Spanish mackerel for the western Indian Ocean.

- Data collection, compilation and reporting
- Stock structure determination (population genetics)
- Data poor stock assessment approaches.

Priority projects for 2013 and 2014

Stock structure – High priority

The WPNT **AGREED** that there was a clear need to 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.

The WPNT **AGREED** that Table 2 should be used as a starting point for research project development to delineate potential stock structure for neritic tunas in the Indian Ocean, and that in the absence of reliable evidence relating to stock structure, a precautionary approach should be undertaken whereby 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 WPNT **AGREED** that research on stock structure should take two separate approaches:

- genetic research to determine the connectivity of neritic tunas throughout their distributions: such studies should be developed at the sub-regional level (Table 2), with the assistance and support from the IOTC Secretariat for the development of project proposals.
- tagging research to better understand and estimate exploitation rates, the movement dynamics, possible spawning locations, natural mortality, fishing mortality and post-release mortality of neritic tunas from various fisheries in the Indian Ocean.

The WPNT **NOTED** that tagging projects could potentially be more expensive for neritic tunas than for oceanic tunas, due to their lower abundance and that catches are mainly by artisanal vessels for which an extensive recovery network would need to be developed through the different coastal states of the Indian Ocean.

The WPNT **AGREED** that genetic studies be given a higher priority for immediate research over tagging studies until appropriate funding has been identified. Any study should be designed in a such a way as to simultaneously collect biological material (e.g. tissue/fin clippings, ototliths, gonads, length/weight, and possibly morphometrics) in order to estimate biological parameters for future stock assessments. Both genetic, tagging and biological studies would need to be rigorously planned and preferably combined, to ensure data is collected across all temporal and spatial strata for each gear type to ensure biological parameters are representative of the population(s) being fished.

Biological information

The WPNT **AGREED** that 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.

CPUE standardisation

The WPNT **AGREED** that there was an urgent need to develop standardised CPUE series for each neritic tuna species for the Indian Ocean as a whole or by sub-region as appropriate, once stock structure and management units have been determined.

Stock assessment

NOTING that there is an urgent need to carry out stock status determinations for neritic tunas and tuna-like species under the IOTC mandate, and that at present the data held at the IOTC Secretariat would be insufficient to undertake integrated stock assessments for any stock, the SC **AGREED** that alternative approaches 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. In 2014, kawakawa, longtail tuna and narrow-barred Spanish mackerel should be the focus species.

Table 1. Priority research projects for obtaining the information necessary to develop stock status indicators for neritic tuna species in the Indian Ocean

Research project	Sub-projects	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
	Gen-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	At present the data held at the IOTC Secretariat would be insufficient to undertake stock assessments for any neritic tuna species under the IOTC mandate/simplified approaches could be pursued	High
	Develop alternative approaches to determining stock status via and indicator based assessment	High

Table 2. 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.

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

Note: Appendix references refer to the Report of the Third Session of the Working Party on Neritic Tunas (IOTC–2013–WPNT03–R)

Meeting participation fund

WPNT03.01 (para. 3) **NOTING** that the IOTC Meeting Participation Fund (MPF), 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*), was used to fund the participation of 11 national scientists, including the Chair and Vice-Chair, to the WPNT03 meeting (10 in 2012), the WPNT **RECOMMENDED** that this fund be maintained into the future, as neritic tunas are very important resources for many of the coastal countries of the Indian Ocean.

WPNT03.02 (para 4) **NOTING** that the MPF was established for the purposes of supporting scientists and representatives from IOTC Members and Cooperating non-Contracting Parties (CPCs) who are developing States to attend and/or contribute to the work of the Commission, the Scientific Committee and its Working Parties, and that the Commission had directed the Secretariat to ensure that the MPF would be utilized, as a first priority, to support the participation of scientists from developing CPCs in scientific meetings of the IOTC, including Working Parties, rather than non-science meetings, the WPNT **RECOMMENDED** that the SC consider making a request to the Commission to provide additional direction to the Secretariat regarding the use of the funds. The direction should clarify what proportion of the MPF should be used for scientific versus non-scientific meetings each budget cycle.

Review of Conservation and Management Measures relating to neritic tunas

WPNT03.03 (para 16) The WPNT **RECOMMENDED** that the SC consider proposing the following amendments to Resolution 10/02, for the Commission's consideration in 2014:

1) The Resolution would be easier to interpret if a set of 'Definitions' was added, including those for coastal fisheries, longline fisheries and purse seine fisheries.

2) Change paragraph 3 a) from:

"For coastal fisheries: available catch by species, fishing gear and fishing effort shall be submitted frequently and may be provided using an alternative geographical area if it better represents the fishery concerned."

to the following:

"Coastal fisheries:

Available catch by species, fishing gear and fishing effort, by month shall be submitted and may be provided using an alternative geographical area if it better represents the fishery concerned. The data shall be extrapolated to the total monthly catches, for each gear and for the geographical area of concern. A description of the extrapolation procedures (including raising factors corresponding to the sampling coverage) shall also be submitted."

3) Change paragraph 5, under a new heading "**Fish aggregating devices (FADs) and support vessels data**", and then split the paragraph into two sections "Purse seine fisheries" and "Other fisheries", so that coastal fisheries report the following:

Other fisheries

Given that Anchored Fish Aggregating Devices (AFADs) are an integral part of the fishing effort exerted by the coastal fisheries using them, the following data shall be provided:

a) Type of AFADs used in the country, including specification (i.e. dimensions, materials used).
b) Total number of active AFADs by 1° grid area and month.

New Information on Fisheries and Associated Environmental Data Relating to Neritic Tunas

IOTC database

WPNT03.04 (para 20) 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 **RECOMMENDED** that the CPCs listed in the Appendix, make efforts to remedy the data issues identified and to report back to the WPNT at its next meeting.

General discussion on data

WPNT03.05 (para 24) The WPNT **RECOMMENDED** that the SC request the Commission increase the IOTC Capacity Building budget line so that capacity building workshops/training can be carried out in 2014 and 2015 on the collection, reporting and analyses of catch and effort data for neritic tuna and tuna-like species. Where appropriate this training session shall include information that explains the entire IOTC process from data collection to analysis and how the information collected is used by the Commission to develop Conservation and Management Measures.

WPNT03.06 (para 26) **NOTING** that some CPCs, in particular from India, Indonesia and Thailand, have collected large data sets on neritic tuna species over long time periods, the WPNT reiterated its previous **RECOMMENDATION** 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 stock status indicators or comprehensive stock assessments of neritic tuna species in the future.

WPNT03.07 (para 29) **NOTING** that monofilament gillnets are recognised to have highly detrimental impacts on fishery ecosystems, as they are non-selective, and that the use of monofilament gillnets have already been banned in a large number of IOTC CPCs, the WPNT **RECOMMENDED** that each CPC using monofilament gillnets to estimate total catch and bycatch, etc., taken by monofilament gillnets in comparison to other net material, and to report the findings at the next WPNT meeting.

Research Recommendations and Priorities

Stock structure research

WPNT03.08 (para 170) The WPNT **RECOMMENDED** that 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.

Revision of the WPNT work plan

WPNT03.09 (para 175) The WPNT **RECOMMENDED** that the SC consider and endorse the workplan for the WPNT for 2014, and tentatively for future years, as provided at Appendix XII.

Other Business

Date and place of the Fourth WPNT

WPNT03.10 (para 181) The WPNT **RECOMMENDED** that the SC note that the participation of developing coastal state scientists has increased dramatically in recent years, through the implementation of the IOTC MPF, as well as though the hosting of the WPNT in developing coastal states (WPNT01: India, WPNT02: Malaysia and WPNT03: Indonesia). In 2011, 11 national scientists from India attended the first meeting, while in 2012, 13 attended from

Malaysia and finally, in 2013, a total of 16 national scientists from Indonesia were able to attend the WPNT meeting.

Review of the draft, and adoption of the Report of the Third WPNT

WPNT03.11 (para 184) The WPNT **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPNT03, 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:

- bullet tuna (*Auxis rochei*) – Appendix VI
- frigate tuna (*Auxis thazard*) – Appendix VII
- kawakawa (*Euthynnus affinis*) – Appendix VIII
- longtail tuna (*Thunnus tonggol*) – Appendix IX
- Indo-Pacific king mackerel (*Scomberomorus guttatus*) – Appendix X
- narrow-barred Spanish mackerel (*Scomberomorus commerson*) – Appendix XI