DRAFT: IOTC SCIENCE WORK PLAN 2014–18

PREPARED BY: IOTC SECRETARIAT, 16 NOVEMBER 2013

BACKGROUND

To provide the Scientific Committee (SC) with the proposed research priorities for each of the Working Party meetings held in 2013, with the aim of developing an IOTC Science Work Plan for 2014, and future years.

BACKGROUND

The research priorities and overall work plan for each the IOTC working parties has largely been left to the participants at each meeting, with limited input from the SC and Commission each year. In some cases this has led to the over extension of national scientists from some CPCs who have called for a clearer focus and direction from the SC on key topics for research.

The information contained in this paper aims to provide the SC with the assessment priorities and research recommendations from each of the IOTC working party meetings held in 2013 so that the SC may better be able to develop a coordinated approach for national scientists to deliver upon all requests from the Commission.

DISCUSSION

Appendix I is a collation of the proposed stock assessments, ecological risk assessments, and other core projects for 2014–18 for the consideration and potential endorsement by the SC.

Appendix II provides a collation of the draft work plans developed by each of the working parties in 2013, as well as the previous work plans for working parties not held in 2013, for the consideration and potential endorsement by the SC.

RECOMMENDATION

That the Scientific Committee:

1) **AGREE** to a schedule of stock assessments, ERAs, and research priorities for IOTC Working Party meetings in 2014, and tentatively for 2015–2018;
2) **DEVELOP** a work plan for 2014–18 for the consideration of the Commission.

APPENDIX

Appendix I: Draft: Schedule of stock assessments for IOTC species and species of interest from 2014–2018, and for other WP priorities

Appendix II: Research recommendations and priorities from IOTC Working Party meetings held in 2013

APPENDIX I
DRAFT: SCHEDULE OF STOCK ASSESSMENTS FOR IOTC SPECIES AND SPECIES OF INTEREST FROM 2014–2018, AND FOR OTHER WP PRIORITIES

Species	2014	2015	2016	2017	2018
Working Party on Neritic Tunas					
Bullet tuna	Indicators				
Frigate tuna	Indicators				
Kawakawa	**Full assessment**				
Longtail tuna	**Full assessment**				
Indo-Pacific king mackerel	Indicators				
Narrow-barred Spanish mackerel	**Full assessment**				
Working Party on Billfish					
Black marlin	Indicators	**Full assessment**	**Full assessment**	Indicators	**Full assessment**
Blue marlin	Indicators	**Full assessment**	**Full assessment**	Indicators	**Full assessment**
Striped marlin	Indicators	**Full assessment**	**Full assessment**	Indicators	**Full assessment**
Swordfish	**Full assessment**	Indicators	Indicators	**Full assessment**	Indicators
Indo-Pacific sailfish	**Full assessment**	Indicators	Indicators	**Full assessment**	Indicators
Working Party on Tropical Tunas					
Bigeye tuna	Indicators	Indicators	**Full assessment**	Indicators	Indicators
Skipjack tuna	**Full assessment**	Indicators	Indicators	**Full assessment**	Indicators
Yellowfin tuna	Indicators	**Full assessment**	Indicators	Indicators	**Full assessment**
Working Party on Temperate Tunas					
Albacore	**Full assessment**	Indicators	**Full assessment**	Indicators	**Full assessment**
Working Party on Ecosystems and Bycatch					
Blue sharks	Indicators & data poor approaches			Indicators & data poor approaches	Revisit ERA
Oceanic whitetip sharks	Indicators & data poor approaches				Revisit ERA
Scalloped hammerhead sharks		Indicators & data poor approaches			Revisit ERA
Shortfin mako sharks			Indicators & data poor approaches		Revisit ERA
Silky sharks		Indicators (data poor approaches)			Revisit ERA
Bigeye thresher sharks				Indicators & data poor approaches	Revisit ERA
Pelagic thresher sharks			Indicators & data poor approaches		Revisit ERA
Marine turtles		Review of mitigation measures in 12/04		Revisit ERA	
Seabirds		Review of mitigation measures in 12/06		Review of mitigation measures in 12/06	
Marine Mammals					
Working Party on Methods					
Management Strategy Evaluation	Extension of the MSE process to tropical tunas				

Note: the assessment schedule may be changed dependant on the annual review of fishery indicators, or SC and Commission requests.

APPENDIX II
RESEARCH RECOMMENDATIONS AND PRIORITIES FROM IOTC WORKING PARTY MEETINGS HELD IN 2013

Working Party on Ecosystems and Bycatch (WPEB)

(Extracts from IOTC–2013–WPEB09–R)

Requests from the Commission

At Sessions of the Commission, Conservation and Management Measures adopted contained elements which call on the Scientific Committee, via the WPEB, to undertake specific tasks.

Resolution 13/04 ***On the conservation of cetaceans***

(para. 6) The Commission requests that the IOTC Scientific Committee develop best practice guidelines for the safe release and handling of encircled cetaceans, taking into account those developed in other Regional Fisheries Management Organisations, including the Western and Central Pacific Fisheries Commission, and that these guidelines be submitted to the 2014 Commission meeting for endorsement.

Resolution 13/05 ***On the conservation of whale sharks (<u>Rhincodon typus</u>)***

(para. 6) The Commission requests that the IOTC Scientific Committee develop best practice guidelines for the safe release and handling of encircled whale sharks, taking into account those developed in other regional fisheries management organisations including the Western and Central Pacific Fisheries Commission, and that these guidelines be submitted to the 2014 Commission meeting for endorsement.

Resolution 13/06 ***On a scientific and management framework on the Conservation of sharks species caught in association with IOTC managed fisheries***

(para. 2) The SC recommendation or advice shall be conducted taking account of:

a) full stock assessments on sharks, stock assessment and Ecological Risk Assessments (ERAs) by fishing gears, using available best scientific data/information;
b) trend of fishing effort by fishing gear on each shark species;
c) effective IOTC Conservation and Management Measures for certain fishing gears with high risk by shark species;
d) priority in shark species with high risk;
e) review of practical implementation of prohibition to retain on board of shark species;
f) feasibility of implementation of prohibition to retain on board including identification of shark species;
g) impact and bias of IOTC Conservation and Management Measures of sharks on fishing operations and sharks data/information collected and reported by CPCs;
h) further improvement of level for sharks data/information submitted by CPCs, particularly developing CPCs.

(para. 7) Scientific observers shall be allowed to collect biological samples (vertebrae, tissues, reproductive tracts, stomachs, skin samples, spiral valves, jaws, whole and skeletonised specimens for taxonomic works and museum collections) from oceanic whitetip sharks taken in the IOTC area of competence that are dead at haulback, provided that the samples are a part of a research project approved by the IOTC Scientific Committee (SC)/the IOTC Working Party on Ecosystems and Bycatch (WPEB). In order to obtain the approval, a detailed document outlining the purpose of the work, number of samples intended to be collected and the spatio-temporal distribution of the sampling effect must be included in the proposal. Annual progress of the work and a final report on completion shall be presented to the SC/WPEB.

(para. 9) The provisional measures stipulated in this Resolution shall be evaluated in 2016 by the IOTC Scientific Committee to deliver more appropriate advice on the conservation and management of the stocks for the consideration of the Commission.

Resolution 13/08 ***Procedures on a fish aggregating devices (FADs) management plan, including more detailed specification of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species***

(para. 7) The IOTC Scientific Committee will analyse the information, when available, and provide scientific advice on additional FAD management options for consideration by the Commission in 2016, including recommendations on the use of biodegradable materials in new and improved FADs and the phasing out of FAD designs that do not prevent the entanglement of sharks, marine turtles and other species. When

assessing the impact of FADs on the dynamic and distribution of targeted fish stocks and associated species and on the ecosystem, the IOTC Scientific Committee will, where relevant, use all available data on abandoned FADs (i.e. FADs without a beacon).

Resolution 12/04 ***On the conservation of marine turtles***

(para. 11) The IOTC Scientific Committee shall request the IOTC Working Party on Ecosystems and Bycatch to:
a) Develop recommendations on appropriate mitigation measures for gillnet, longline and purse seine fisheries in the IOTC area;
b) Develop regional standards covering data collection, data exchange and training;
c) Develop improved FAD designs to reduce the incidence of entanglement of marine turtles, including the use of biodegradable materials.

The recommendations of the IOTC Working Party on Ecosystems and Bycatch shall be provided to the IOTC Scientific Committee for consideration at its annual session in 2012. In developing its recommendations, the IOTC Working Party on Ecosystems and Bycatch shall examine and take into account the information provided by CPCs in accordance with paragraph 10 of this measure, other research available on the effectiveness of various mitigation methods in the IOTC area, mitigation measures and guidelines adopted by other relevant organizations and, in particular, those of the Western and Central Pacific Fisheries Commission. The IOTC Working Party on Ecosystems and Bycatch will specifically consider the effects of circle hooks on target species catch rates, marine turtle mortalities and other bycatch species.

(para. 17) The IOTC Scientific Committee shall annually review the information reported by CPCs pursuant to this measure and, as necessary, provide recommendations to the Commission on ways to strengthen efforts to reduce marine turtle interactions with IOTC fisheries.

Resolution 12/06 ***On reducing the incidental bycatch of seabirds in longline fisheries***

(para. 8) The IOTC Scientific Committee, based notably on the work of the WPEB and information from CPCs, will analyse the impact of this Resolution on seabird bycatch no later than for the 2016 meeting of the Commission. It shall advise the Commission on any modifications that are required, based on experience to date of the operation of the Resolution and/or further international studies, research or advice on best practice on the issue, in order to make the Resolution more effective.

Resolution 12/09 ***On the conservation of thresher sharks (Family Alopiidae) caught in association with fisheries in the IOTC area of competence***

(para. 7) Scientific observers shall be allowed to collect biological samples (vertebrae, tissues, reproductive tracts, stomachs, skin samples, spiral valves, jaws, whole and skeletonised specimens for taxonomic works and museum collections) from thresher sharks that are dead at haulback, provided that the samples are part of the research project approved by the IOTC Scientific Committee (or IOTC Working Party on Ecosystems and Bycatch (WPEB)). In order to obtain the approval, a detailed document outlining the purpose of the work, number and type of samples intended to be collected and the spatio-temporal distribution of the sampling work must be included in the proposal. Annual progress of the work and a final report on completion of the project shall be presented to the IOTC WPEB and the IOTC Scientific Committee.

Resolution 11/04 ***On a regional observer scheme***

(para. 15) The elements of the Observer Scheme, notably those regarding its coverage, are subject to review and revision, as appropriate, for application in 2012 and subsequent years. Basing on the experience of other Tuna RFMOs, the IOTC Scientific Committee will elaborate an observer working manual, a template to be used for reporting (including minimum data fields) and a training program.

Resolution 05/05 ***Concerning the conservation of sharks caught in association with fisheries managed by IOTC***

(para. 2) In 2006 the IOTC Scientific Committee (in collaboration with the IOTC Working Party on Ecosystems and Bycatch) provide preliminary advice on the stock status of key shark species and propose a research plan and timeline for a comprehensive assessment of these stocks.

(para. 5) The ratio of fin-to-body weight of sharks described in paragraph 4 shall be reviewed by the IOTC Scientific Committee and reported back to the Commission in 2006 for revision, if necessary.

Core topics for research

The WPEB **RECOMMENDED** that the following core topic areas as priorities for research over the coming years, taking into account data gaps, capacity among CPCs, and areas for implementation:

High Priority:

- ***Shark stock status analyses (development of abundance indices)***
    i. Develop/improve accurate standardised CPUE indices for each shark species for the Indian Ocean as a whole or by sub-region as appropriate, once stock structure and management units have been determined.
    ii. Develop methods to estimate historical catch series by gear.
    iii. Develop life history and biological patterns for the species (namely migration patterns and distribution patterns).
- ***Capacity building***
    i. Scientific assistance to CPCs and specific fleets considered to have the highest risk to bycatch species (e.g. gillnet fleets and longline fleets).
- ***Stock assessment***
    i. There is a clear request from the Commission to carry out stock status determinations for sharks in the Indian Ocean, and that at present the data held at the IOTC Secretariat would be insufficient to undertake integrated stock assessments for any stock.
    ii. Alternative approaches should be explored as options 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.
- ***Bycatch mitigation***
    i. Sharks
    ii. Seabirds – line weighting
    iii. Marine turtles
    iv. Marine mammals

Medium Priority

- ***Depredation***
    i. Longline fishery depredation
- ***Stock structure***
    i. genetic research to determine the connectivity of species throughout their distributions: such studies should be developed at the sub-regional level.
    ii. tagging research to better understand and estimate exploitation rates, the movement dynamics, possible spawning locations, natural mortality, fishing mortality and post-release mortality of stocks from various fisheries in the Indian Ocean.
- ***Biological information***
    i. Quantitative biological studies are necessary for all species 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.

Working Party on Billfish (WPB)

(Extracts from IOTC–2013–WPB11–R)

Requests from the Commission

At Sessions of the Commission, Conservation and Management Measures adopted contained elements which call on the Scientific Committee, via the WPB, to undertake specific tasks.

(S17 para. 28) The Commission **NOTED** that most of the evidence provided to date has indicated that the resource in the southwest Indian Ocean has been overfished in the past decade and that biomass remains below the level that would produce the maximum sustainable yield (B_{MSY}), however recent declines in catch and effort have brought fishing mortality rates to levels below the level that would produce the maximum sustainable yield (F_{MSY}). A risk of reversing the rebuilding trend remains if there is any increase in catch in this region. Thus, catches of swordfish in the southwest Indian Ocean should be maintained at levels at or below those observed in 2009 (6,600 t), until there is clear evidence of recovery and biomass exceeds B_{MSY}.

(S17 para. 29) The Commission **REQUESTED** that the southwest region continue to be analysed as a special resource, as it appears to be highly depleted compared to the Indian Ocean as a whole.

Core topics for research agreed at WPB11

The following are the core topic areas considered as priorities for research over the coming years, taking into account data gaps, capacity among CPCs, and areas for implementation (taken from the Report of the 11th Session of the WPB).

Data

The WPB **NOTED** the main billfish data issues that are considered to negatively affect the quality of the statistics available at the IOTC Secretariat, by type of dataset and fishery, which are provided in Appendix V, and **REQUESTED** that the CPCs listed in the Appendix, make efforts to remedy the data issues identified and to report back to the WPB at its next meeting.

Alternative management measures for swordfish

The WPB **NOTED** that at its 17th Session, the Commission **REQUESTED** that the southwest region continue to be analysed as a special resource [*for swordfish*], as it appears to be highly depleted compared to the Indian Ocean as a whole.

Historical data series

The WPB **REQUESTED** that both Japan and Taiwan,China undertake an historical review of their longline fleets and to document the changes in fleet dynamics for presentation at the next WPB meeting. The historical review should include as much explanatory information as possible regarding changes in fishing areas, species targeting, gear changes and other fleet characteristics to assist the WPB understand the current fluctuations observed in the data.

Length-age keys

The WPB **RECOMMENDED** that as a matter of priority, CPCs that have important fisheries catching billfish (EU, Taiwan,China, Japan, Indonesia and Sri Lanka) to collect and provide basic or analysed data that would be used to establish length-age keys and non-standard measurements to standard measurements keys for billfish species, by sex and area.

Catch, Catch-and-effort, Size data

The WPB **RECOMMENDED** that all CPCs assess and improve the status of catch-and-effort data for marlins and sailfish, noting that improvements to the data for the EU fleets and its provision to the IOTC Secretariat, would be most beneficial to the work of the WPB.

The WPB **REQUESTED** that all CPCs provide the IOTC Secretariat with longline catch-and-effort and size data of marlins and sailfish by time and area strata, noting that this is already a mandatory reporting requirement.

The WPB **REQUESTED** that Japan resume size sampling on its commercial longline fleet, and that Taiwan,China provide size data for its fresh longline fleet to attain the minimum recommended by the Commission (1 fish by metric ton of catch by type of gear and species).

The WPB **REQUESTED** that Indonesia and India continue to improve their data collection programs and provide catch-and-effort and size frequency data for their longline fleets, to the IOTC Secretariat.

The WPB **REQUESTED** that all CPCs having artisanal and semi-industrial fleets, in particular I.R. Iran, Pakistan and Sri Lanka, provide catch and effort as well as size data as per IOTC requirements for billfish caught by their fleets. Some developing coastal states indicted that they have difficulties meeting these requirements.

Data inconsistencies

Noting the progress made to date, the WPB **REQUESTED** that the IOTC Secretariat finalise the study aimed at assessing the consistency of average weights derived from the available catch and effort data, as derived from logbooks, and size data provided by Japan, Taiwan,China, Seychelles and EU,Spain and to report final results at the next WPB meeting.

The WPB **REQUESTED** from 2011 that as a matter of priority, India, I.R. Iran (provided by I.R. in August 2013) and Pakistan provide catch-and-effort data and size data for billfish, in particular gillnet fisheries, by the reporting deadline of 30th June each year, noting that this is already a mandatory reporting requirement. As part of this process, these CPCs shall use the billfish identification cards to improve the identification of marlin species caught by their fisheries.

Review of data available at the Secretariat for marlins

The WPB **NOTED** that the quality of the data available at the IOTC Secretariat on marlins (by species) is likely to be compromised by species miss-identification and **REQUESTED** that CPCs review their historical data in order to identify and correct potential identification problems that are detrimental to any analysis of the status of the stocks.

I.R. Iran billfish fishery

The WPB **REQUESTED** that I.R. Iran revisit individual logbook archives to try and obtain more details of historical species composition for its industrial fisheries.

Thailand billfish fishery

NOTING that data from the research vessels of Thailand are not presented by species, the WPB **REQUESTED** that the species level data be presented at the next WPB meeting. The translation of the IOTC species identification guides into Thai would assist in ensuring higher resolution for species identification.

The WPB **REQUESTED** the authors undertake a more detailed analysis of trends in billfish landings between the 2008 and 2012, a period identified in the current study of high variability in total landings.

Indonesia billfish fishery

The WPB **REQUESTED** that Indonesia develop and present a detailed paper on its fleets fishing effort and CPUE, by species, at the next WPB meeting.

The WPB **NOTED** that the current observer coverage for the Indonesian longline fleet is approximately 2% of total fishing effort. In 2013 Indonesia plans to deploy additional scientific observers on its longline, purse seine and gillnet vessels in order to reach the minimum required coverage level of 5%, as specified in Resolution 11/04 *on a regional observer scheme*. At present observers are only being deployed on its longline fleet. The WPB **REQUESTED** that the result of these additional scientific observer deployments be reported at the next WPB meeting.

Sri Lanka billfish fishery

The WPB **REQUESTED** that as a matter of priority, Sri Lanka increase sampling coverage to attain at least the coverage levels recommended by the Commission (1 fish by metric ton of catch by type of gear and species), including:

- catches sampled or observed for at least 5% of the vessel activities for coastal fisheries, including collection of catch, effort and size data for IOTC species and main bycatch species;
- implementation of logbook systems for offshore fisheries that incorporate species level information requirements for billfish, as per IOTC Resolution 12/03.

The information collected through the above activities should allow Sri Lanka to estimate species level catches by gear for billfish and other important IOTC or bycatch species.

Recreational and sports fisheries for billfish

The WPB **REQUESTED** that the African Billfish Foundation continue its important work, particularly in the areas of collaborative research aimed at obtaining more information on movements of billfishes, via both conventional and archival tagging programs that will allow the collection of information on both horizontal and vertical movements as well as on population dynamics.

Indian billfish research: Environment influences on abundance

NOTING that all billfish species were combined for analysis, which may produce a biased result due to differences in species biology, the WPB **REQUESTED** that the authors undertake a similar analysis by species, for the consideration at the next WPB meeting.

Maldives billfish landings

The WPB **RECALLED** that the level of capture of marlins from the Maldivian artisanal fishery appears to be very high compared to the total catches reported for the Indian Ocean and **REQUESTED** that the Maldives provide a review of its landings of each marlin species at the next WPB meeting.

The WPB **REQUESTED** that the Maldives implement data collection systems, through logbooks and sampling for its fisheries that incorporate species level information requirements for billfish, as per IOTC standards. The information collected should allow the Maldives to estimate species level catches by gear for billfish and other important IOTC or bycatch species.

CPUE discussion summary – Marlins

The WPB **REQUESTED** that both Japan and Taiwan,China undertake a historical review of their longline data and to document the changes in fleet dynamics for presentation and the next WPB meeting. The historical review should include as much explanatory information as possible regarding changes in fishing areas, species targeting, gear changes and other fleet characteristics to assist the WPB understand the current fluctuations observed in the data.

Parameters for future analyses: stock assessments

The WPB **REQUESTED** that a sensitivity analysis be performed using Stock Reduction Analysis methodology, using different series of catch data to assess how robust the estimation of reference points for management are, and how the stock status determination performs.

Review of data available at the secretariat for Indo-Pacific sailfish

The WPB **NOTED** the main sailfish data issues that are considered to negatively affect the quality of the statistics available at the IOTC Secretariat, by type of dataset and fishery, which are provided in Appendix V, and **REQUESTED** that the CPCs listed in the Appendix, make efforts to remedy the data issues identified and to report back to the WPB at its next meeting.

Kenyan sailfish sports fishery

The WPB **NOTED** that catch and effort data for the sports fishery in Kenya from 1987–2010 should be submitted to the IOTC Secretariat to assist in future assessments for these species. The WPB **REQUESTED** that Kenya undertake a comprehensive analysis based on their long-term sport fisheries for consideration at the next WPB meeting.

Indo-Pacific sailfish - other

NOTING that limited new information on I.P. sailfish were presented at the WPB11, the WPB **REQUESTED** that the IOTC Secretariat contact scientists from the U.A.E. to obtain the latest information from the sailfish fishery in the Gulf, as the most recent information submitted to the WPB some time ago suggested that the fishery may be collapsing. Any new information received should be submitted to the next WPB meeting as part of a general review of sailfish fisheries in the Indian Ocean.

The WPB **REQUESTED** that all CPCs improve data collection and reporting for sailfish given the importance of this species to many sports fisheries operating in the Indian Ocean. In particular for Kenya who indicated that they have a long catch history series available for potential analysis.

Review of data available at the secretariat for swordfish

NOTING the potential underreporting of swordfish catches from Indonesian fresh-tuna longline fisheries and the way in which the IOTC Secretariat had estimated swordfish catches, the WPB **REQUESTED** that catch extrapolation must be undertaken, taking into consideration species-specific targeting (day-deep vs. night-shallow sets) for fleets taking SWO as a bycatch. The WPB was informed that major research and commercial operations targeting tuna in day deep sets produce very low levels of swordfish bycatch even in the areas where swordfish is a dominant species in shallow-night sets.

Priority species for 2014: *Swordfish and Indo-Pacific sailfish*

High priority projects

- ***Stock status analyses (development of abundance indices)***
    i. Develop/improve accurate standardised CPUE indices for Indo-Pacific sailfish for the Indian Ocean as a whole or by sub-region as appropriate.
    ii. Develop methods to estimate historical catch series by gear.
    iii. Develop life history and biological patterns for the species (namely migration patterns and distribution patterns).
- ***Capacity building***
    i. Scientific assistance to CPCs and specific fleets considered to have the highest risk to billfish species (e.g. gillnet fleets and longline fleets).
- ***Stock assessment***
    i. Swordfish: There is a clear request from the Commission to carry out stock status determinations for swordfish in the southwest Indian Ocean, in addition to the Indian Ocean as a whole.
    ii. Indo-Pacific sailfish: Alternative approaches should be explored as options 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.

Medium priority project:

- ***Stock structure***
    i. genetic research to determine the connectivity of species throughout their distributions: such studies should be developed at the sub-regional level.

ii. tagging research to better understand and estimate exploitation rates, the movement dynamics, possible spawning locations, natural mortality, fishing mortality and post-release mortality of stocks from various fisheries in the Indian Ocean.

- ***Biological information***
  i. Quantitative biological studies are necessary throughout the species 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.

Working Party on Tropical Tunas (WPTT)

(Extracts from IOTC–2013–WPTT15–R)

Requests from the Commission

At Sessions of the Commission, Conservation and Management Measures adopted contained elements which call on the Scientific Committee, via the WPTT, to undertake specific tasks.

Resolution 13/08 Procedures on a fish aggregating devices (FADs) management plan, including more detailed specification of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species

(para. 7) The IOTC Scientific Committee will analyse the information, when available, and provide scientific advice on additional FAD management options for consideration by the Commission in 2016, including recommendations on the use of biodegradable materials in new and improved FADs and the phasing out of FAD designs that do not prevent the entanglement of sharks, marine turtles and other species. When assessing the impact of FADs on the dynamic and distribution of targeted fish stocks and associated species and on the ecosystem, the IOTC Scientific Committee will, where relevant, use all available data on abandoned FADs (i.e. FADs without a beacon).

Resolution 13/11 On a ban on discards of bigeye tuna, skipjack tuna, yellowfin tuna, and a recommendation for non-targeted species caught by purse seine vessels in the IOTC area of competence

(para. 4) The IOTC Scientific Committee, the IOTC Working Party on Tropical Tunas, and the IOTC Working Party on Ecosystems and Bycatch shall annually:

a) review the information available on bycatch (retained and discarded) by purse seine vessels; and
b) provide advice to the Commission on options to sustainably manage discards in purse seine fisheries.

Resolution 12/13 For the conservation and management of tropical tunas stocks in the IOTC area of competence

(para. 10) The IOTC Scientific Committee will provide at its 2011, 2012 and 2013 Plenary sessions:

a) an evaluation of the closure area, specifying in its advice if a modification is necessary, its basic scientific rationale with an assessment of the impact of such a closure on the tropical tuna stocks, notably yellowfin tuna and bigeye tuna;
b) an evaluation of the closure time periods, specifying in its advice if a modification is necessary, its basic scientific rationale with an assessment of the impact of such a closure on the tropical tuna stocks, notably yellowfin tuna and bigeye tuna;
c) an evaluation of the impact on yellowfin tuna and bigeye tuna stocks by catching juveniles and spawners taken by all fisheries. The IOTC Scientific Committee shall also recommend measures to mitigate the impacts on juvenile and spawners;
d) any other advice on possible different management measures based on the Kobe II matrix, on the main targeted species under the IOTC competence.

Resolution 05/01 ***On Conservation and Management Measures for bigeye tuna***

(para. 7) The IOTC Scientific Committee be tasked to provide advice, including advice on;

- the effects of different levels of catch on the SSB (in relation to MSY or other appropriate reference point);
- the impact of misreported and illegal catch of bigeye tuna on the stock assessment and required levels of catch reduction; and
- evaluation of the impact of different levels of catch reduction by main gear types.

Priority species for 2014: *Skipjack tuna*

High priority projects 2014–2015

- ***Stock status analyses (development of abundance indices)***
    i. Develop/improve accurate standardised CPUE indices for all three tropical tuna species, for the Indian Ocean as a whole or by sub-region as appropriate.
    ii. Investigate the source of inconsistencies in the longline length frequency data, as identified by the WPTT.
    iii. Develop methods to estimate historical catch series by gear.
    iv. Develop life history and biological patterns for the species (namely migration patterns and distribution patterns).
- ***Tagging data analysis***
    i. Information and results arising from the RTTP-IO tagging program should be fully utilised and summarised for the 2014 WPTT skipjack tuna stock assessment. Additional analyses are recommended, including, inter alia:
        1. Analysis of the existing tagging data sets.
            - Skipjack tuna movements (taking into account the reporting rates of tags now estimated) using ad hoc models
            - Skipjack tuna growth: VB or others
            - Skipjack tuna total mortality rates based on temporal trends of recoveries
            - Skipjack natural mortality and longevity
            - Analysis of potential interactions between purse seine and pole-and-line fisheries
            - Review of FAD catches and their association to FADs: movements, growth, etc.

    This work should be conducted as soon as possible as all the data needed for this study (on fisheries and tags/recoveries) are now fully available and this work should also make use of the results from the tagging symposium research.

Stock assessment

- ***Skipjack tuna***

Medium priority project:

- ***Tagging data***
    i. Improved approaches for integrating tagging data into stock assessments.

    The recent RTTP-IO (and similar large-scale tagging programmes in the Pacific Ocean) have provided a wealth of data on tropical tuna population dynamics. However, recent analyses have demonstrated that movement dynamics are not compatible with standard tag-based population estimators for movement and natural/fishing mortality. In attempting to integrate the tagging data within stock assessments, the following problems are encountered:
        1. Tag reporting rates are thought to be low for all fleets except for the purse seine fleet landing in the Seychelles. If reporting rates by longline and artisanal fisheries are low, then this may introduce greater uncertainties in the recovery results.
        2. Tag displacements are relatively low on average (for instance in the Indian Ocean showing a full mixing only within 500 nautical mile radius) and full mixing of the tagged and untagged population is demonstrably limited at the basin scale.
        3. Tag release designs are unbalanced in the west and negligible in the east.
        4. Tagging results show various other complexities that are still difficult to incorporate in current assessments (for instance differential growth and mortality by sex).
        5. Assessments are often sensitive to the inclusion of tagging data, and it is currently not clear that recent Indian Ocean assessments are improved by including tag dynamics, or whether large biases for movement and mortality are being introduced.

    There is not a simple solution for these problems, but there are directions to explore:
        1. Increasing the spatial resolution of the tagging model (for instance with full mixing boxes of ~500 mile radius) will reduce the impact of the tag mixing problem (but this comes at a cost of increased model complexity and over-parameterisation).
        2. There is potential value in attempting to use environmental and physical oceanographic information to make inferences about population dynamics in data-poor regions.
        3. Simulation studies can help to understand the biases, potentially develop bias correction methods, and improve the quantification of uncertainty introduced by constraining assumptions.

Estimated budget for IOTC consultants to be engaged on skipjack tuna analysis

Description	Unit price	Units required	Total
Improved approaches for integrating tagging data into stock assessments (fees)	US$400	75	30,000
Data preparation for skipjack tuna stock assessment	US$400	50	20,000
Total estimate (US$)			**50,000**

- ***Stock structure***
    i. genetic research to determine the connectivity of species throughout their distributions: such studies should be developed at the sub-regional level.
    ii. Additional tagging research to better understand and estimate exploitation rates, the movement dynamics, possible spawning locations, natural mortality, fishing mortality and post-release mortality of stocks from various fisheries in the Indian Ocean.
- ***Biological information***
    i. Quantitative biological studies are necessary throughout the species 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.

Working Party on Neritic Tunas (WPNT)

(Extracts from IOTC–2013–WPNT03–R)

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.

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

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.

WORKING PARTIES NOT HELD IN 2013

Working Party on Temperate Tunas (WPTmT)

(Extracts from IOTC–2012–WPTmT04–R)

Revision of the WPTmT work plan

CPUE standardisation

(para. 110) The WPTmT **AGREED** that there was an urgent need to investigate the CPUE issues as outlined in paragraph 72 and for this to be a high priority research activity for the albacore resource in the Indian Ocean in 2013.

(para. 111) The WPTmT also **ENCOURAGED** data to be used in stock assessments, including CPUE standardisations, be made available not less than three months before each meeting by CPCs and where possible, data summaries no later than two months prior to each meeting, from the IOTC Secretariat; and **RECOMMENDED** that data to be used in stock assessments, including CPUE standardisations be made available not less than 30 days before each meeting by CPCs.

Stock assessment

(para. 112) The WPTmT **AGREED** that there was an urgent need to carry out revised stock assessments for the albacore resource in the Indian Ocean in 2013.

(para. 113) **NOTING** that with the exception of the SS3 stock assessment paper, all others stock assessment papers for albacore were made available by the authors immediately prior to the WPTmT04 meeting, which did not allow the other participants of the meeting to adequately review the methodology, the WPTmT **REMINDED** working party participants of the 2010 Scientific Committee recommendation that stock assessment papers need to be provided to the Secretariat for posting to the IOTC website **no later than 15 days before** the commencement of the relevant meeting.

(para. 114) The WPTmT **AGREED** that future projections for stock assessments should firstly examine scenarios under constant catch projections of +/-20% and +/-40%, and then refine the catch projects to finer l scale levels depending on the initial outcomes, noting that the aim to develop useful projections for the development of management advice.

Stock structure

(para. 115) Noting that at present very little is known about the population structure and migratory range of albacore in the Indian Ocean, other than the possible connectivity with the southern Atlantic, the WPTmT **RECOMMENDED** that research aimed at determining albacore stock structure, migratory range and movement rates in the Indian Ocean be considered a high priority research project by the Scientific Committee in 2013.

Spawning

(para. 116) Noting that there are difficulties faced by some CPCs in collecting gonad samples from albacore, as a result of fish generally being frozen whole after being gutted, the WPTmT **RECOMMENDED** that CPCs collect gonad samples from albacore to confirm the spawning time and location of the spawning area that are presently hypothesized for albacore, over the coming year and to report findings at the next WPTmT in 2013.

Additional core topics for research

(para. 117) The WPTmT **ENCOURAGED** China and other CPCs to provide further research reports on albacore biology, including using through the use of fish otolith studies, either from data collected through observer programs or other research programs, at the next WPTmT meeting in 2013.

(para. 118) The WPTmT **RECOMMENDED** that the Scientific Committee add the following core topic areas as priorities for research over the coming year:

- Size data analyses
- Growth rates and ageing studies
- Stock status indicators – exploration of indicators from available data
- Collaborate with SPC-OFP to examine their current simulation approach to determine priority research areas.

Working Party on Methods (WPM)

(Extracts from IOTC–2012–WPM04–R)

(para. 43) The WPM **RECOMMENDED** that the SC consider the draft workplan for the development of the IOTC MSE process, provided at Appendix IV. [*of the WPM04 Report*]

(para. 44) The WPM **RECOMMENDED** that the SC consider requesting that the Commission allocate funds in the 2013 and 2014 IOTC budgets, for an external expert on MSE to be hired for 30 days per year, to supplement the skill set available within IOTC CPCs.