OUTCOMES OF THE 21st SESSION OF THE SCIENTIFIC COMMITTEE

PREPARED BY: IOTC SECRETARIAT[1], 31 JULY 2019

PURPOSE

To inform participants at the 15th Working Party on Ecosystems and Bycatch (WPEB15) of the recommendations arising from the 21st Session of the IOTC Scientific Committee (SC) held from 3 7 December 2018, specifically relating to the work of the WPEB.

BACKGROUND

At the 21st Session of the SC, the SC noted and considered the recommendations made by the WPEB in 2018 that included requests to address the deficiencies in data collection, monitoring and reporting by CPCs, as well as to carry out targeted research and analysis on the most commonly caught elasmobranch species.

List of the most commonly caught elasmobranch species

Common name	Species	Code
Manta and devil rays	Mobulidae	MAN
Whale shark	*Rhincodon typus*	RHN
Thresher sharks	*Alopias spp.*	THR
Mako sharks	*Isurus spp.*	MAK
Silky shark	*Carcharhinus falciformis*	FAL
Oceanic whitetip shark	*Carcharhinus longimanus*	OCS
Blue shark	*Prionace glauca*	BSH
Hammerhead shark	Sphyrnidae	SPY
Other Sharks and rays	–	SKH

The recommendations on the deficiencies in data collection, monitoring and reporting by CPCs in relation to bycatch species will be discussed in paper IOTC–2019–WPEB15–07 and are therefore not presented in this paper.

Based on the recommendations arising from the WPEB14, the SC21 adopted a set of recommendations, provide in Appendix A of this paper.

The recommendations contained in Appendix A were provided to the Commission for consideration at its 23rd Session held in June 2019. A separate paper, IOTC–2019–WPEB15–04 addresses the responses and actions of the Commission.

In addition, the SC21 reviewed and endorsed a Program of Work for the WPEB, including a revised assessment schedule, as detailed in Appendix B and Appendix C respectively. A separate paper (IOTC–2019–WPEB15–10) will outline the review and development process for a *Program of Work* for the WPEB for the next five years (2020–2024).

DISCUSSION

In addition to the recommendations outlined in Appendix A, Appendix B and Appendix C, the following extracts from the SC21 Report (IOTC–2018–SC21–R) are provided here for the consideration and action of the WPEB15:

The SC **RECOMMENDED** that data collection for mobulid rays (if possible to species level) should be improved, that by-catch mitigation methods should be investigated and that safe release techniques and best practices should be implemented.

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The SC noted the status and declines of Mobula spp. in the Indian Ocean (which under current taxonomic revisions include the manta rays as well). Given the significant declines of these species across their range in the Indian Ocean along with evidence of these species' interaction with pelagic fisheries, in particular tuna gillnet, purse seine, and occasionally longline fisheries, the SC **RECOMMENDED** that management actions, such as non-retention measures in the IOTC Area of Competence (as a first step considering the Precautionary Approach) among others, are required to enable these species to recover and must immediately be adopted instead of waiting until 2020.

The SC noted concern in British Indian Ocean Territory around the impacts of drifting and beached FADs on habitats and species, and noted that monitoring has recorded 60 events in 10 months to October 2018 and SC requested about the possibility to expand the successful FADWATCH project, which has been focused on the Seychelles, for mitigating FAD beaching in other areas. The SC noted the request of the WPEB to expand the FADWATCH project to other areas and the Secretariat comment that funding is being secured for this initiative.

Bycatch species identification and data issues

The SC noted the encouraging results of research by WWF-Pakistan on the use of subsurface gillnet gears (i.e. net below 2m depth) as a tool to reduce bycatch of cetaceans, sharks and sea turtles, which were presented during the 2018 WPTT and WPEB meetings.

The SC noted issues with the species identification in Pakistan bycatch data. Pakistan noted that more precise data should be available in coming years.

Despite identification cards being available, the SC noted ongoing issues around species identification data for sea turtles, sharks, cetaceans and other bycatch species and **AGREED** that improvements to the collection of data for all bycatch species is required. The Secretariat noted that these data are currently collected through national reports and observer data submissions, but were often limited. Consequently, the SC **RECOMMENDED** to the Commission that the species reporting of turtles (as a first step) is improved through an amendment to Annexes II and III in Resolution 15/01.

BIOFAD project

The SC noted paper IOTC–2018–SC21–13 which provided an update on progress in the BIOFAD project, including testing designs and identifying options to mitigate impacts of drifting FADs on the ecosystem

The SC noted that the BIOFAD trial project was more developed in the Indian Ocean than the project in the Atlantic Ocean and that comparison of results between the two regions would be useful. The SC noted that both projects had co-finance available through the FAO's ABNJ project (funded through GEF) and they are actively encouraging fleets from other countries to become involved. The SC noted the intention to deploy a similar program in the Atlantic in 2019.

The SC noted the intention to compare the efficacy of BIOFADs versus conventional FADs using acoustic and catch data. This phase has not commenced but data will be presented to future WPs.

Resolution 17/05 and the conservation of sharks in IOTC fisheries

The SC noted paper IOTC–2018–WPDCS14–37 which provided an update on Resolution 17/05 and the conservation of sharks in IOTC fisheries, including an assessment of shark finning in the IOTC area,

The SC noted that this study was conducted in response to a request from the Commission in 2018 (IOTC–2018–S22–R):

(Para. 39) The Commission AGREED to the requests made to the Compliance Committee and Scientific Committee in working paper IOTC-2018-S22-06Rev1:

- *to analyse and document, wherever possible, whether the practice of shark finning still takes place in IOTC and to what extent, despite the adoption of Resolution 17/05, and to review the compliance with the requirements contained in Res 17/05, including the shark finning prohibition and the fins naturally attached requirement adopted by IOTC (Compliance Committee);*
- *to identify possible means to improve the submission of complete, accurate and timely catch records for sharks, as well as the collection of species-specific data on catch, biology, discards and trade. (Scientific Committee).*

The SC acknowledged that this document covers both points requested by the Commission, however, the SC only has the mandate to address the second point as the first point is expressly aimed at the Compliance Committee.

In response to a number of concerns around some of the recommendations from the paper, the SC noted that the objective was to identify possible means to improve the submission of complete, accurate and timely catch records for sharks, as well as the collection of species specific data on catch, biology, discards and trade. The SC noted that these were not specific recommendations for its consideration at SC21 but would be explored further during the 2019 WPEB meeting.

Status of development and implementation of national plans of action for seabirds and sharks, and implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations

The SC noted paper IOTC–2018–SC21–06 which provided the SC with the opportunity to update and comment on the current status of development and implementation of national plans of action for seabirds and sharks, and implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations, by each IOTC CPC.

The SC **RECOMMENDED** that the Commission note the current status of development and implementation of National Plans of Action (NPOAs) for sharks and seabirds, and the implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations, by each CPC as provided in Appendix 5, recalling that the IPOA-Seabirds and IPOA-Sharks were adopted by the FAO in 1999 and 2000, respectively, and recommended the development of NPOAs.

Outcomes from the updated ecological risk assessments for sharks

The SC noted paper IOTC–2018–SC21–14 which provided an updated ecological risk assessment for shark species caught in fisheries managed by the IOTC,

The SC noted that despite the encouraging progress, results were still highly uncertain and that stock status (e.g. B or F estimates) cannot be inferred from such studies. The SC acknowledged that where information on stock status was needed, simple production models or other data poor assessment methods may be more appropriate. The SC suggested that for future assessments, uncertainty in the data could be better captured in the presentation of results.

The SC noted that these methods are intended to give an estimate of relative risk and may be useful for prioritising species for additional data collection, more comprehensive assessments and possible management actions.

The SC noted that the timeframe for updating ecological risk assessments should be considered carefully in the context of the time and effort to run the assessments and the benefits derived from such assessments, including how they can be used to provide management advice. Following extensive discussion on the pros and cons of ecological risk assessment, the SC **AGREED** that such methods cannot be used to provide advice on status. The SC further suggested that ecological risk assessments should only be updated when there are significant changes in the fishery or biological characteristics or large changes in catch and/or effort (e.g. each 5-6 years).

The SC noted a lack of information on shark catches, as evidenced by only 55% of total shark catches across the IOTC area of competence being identified to a species level. The SC suggested that current regulations allowing the landing of headed and skinned carcasses may prohibit better identification at landing. The SC suggested that a possible solution is to use genetic testing, but that there are currently difficulties with this approach relating to the ability of observers or other sampling methods to collect reliable samples.

The SC noted the ecological risk assessment work for sharks, turtles and seabirds and that ERA approaches are a useful way to prioritise relative risk between species, but do not provide information that is analogous to quantitative stock assessment. It was suggested that future work could explore the overlap between ERA and stock assessment methods in the context of how they can be used to provide management advice.

The SC **AGREED** that the results of the marine turtles and sharks ERAs would be used to update the executive summaries for relevant species.

Progress towards Ecosystem Based Fisheries Management (EBFM) in IOTC – Preliminary Ecosystem Report Cards

The SC noted the agreement to work intersessionally to develop ecosystem indicators for different components and for this to be presented to the next WPEB meeting. This is included in Appendix XIX workplan of the WPEB report.

The SC noted that while IOTC may develop its own unique approaches to EBFM, collaboration with ICCAT on its recent work on the implementation of EBFM would be beneficial. The SC further noted that IOTC documents relevant to the collection of socio-economic information were available.

The SC noted paper IOTC–2018–WPDCS14–36 which described a proposal for the development of an ocean-climate web page for the IOTC,

The SC agreed that this work should be incorporated into the ecosystem report card project and encouraged the authors to collaborate with that initiative.

Acknowledging that current models used in IOTC do not explicitly consider the influence of climate change and variability on ecosystems and fisheries resources, the SC noted variety of ecosystem models in use globally (e.g. Atlantis, ECOSIM, APECOSM) that could be used to better explore these influences. The SC suggested that assessments of the use of these systems could be undertaken by small working groups within the WPEB, noting that funding and appropriate research frameworks would be needed to underpin this work.

Acknowledging that the IOTC Secretariat has limited human resources, the SC noted that algorithms for automatically transferring the large amount of information from external portals to be included on the website should ensure that there is minimal strain on IOTC resources for the implementation of this initiative.

The SC noted that the currency of information could be maintained in near real-time, with a lag of 1-2 months.

Acknowledging the potential benefits of a climate-ocean web portal and regular updates on these influences to the SC and WPs, the SC **RECOMMENDED** a scoping study into how ocean-climate information as described in the proposal could be made available through the IOTC webpage and how this information would be presented to the WPs and SC. The scoping study should also consider the currency and quality of the information sources to be used.

APPENDICES

Appendix A: Consolidated set of recommendations of the 21st Session of the Scientific Committee to the Commission, relevant to the Working Party on Ecosystems and Bycatch.
Appendix B: Program of Work (2019–2023) for the IOTC Working Party on Ecosystems and Bycatch (WPEB).
Appendix C: Schedule of stock assessment for the WPEB (2019–2023).

APPENDIX A

CONSOLIDATED SET OF RECOMMENDATIONS OF THE 21st SESSION OF THE SCIENTIFIC COMMITTEE TO THE COMMISSION RELEVANT TO THE WORKING PARTY ON ECOSYSTEMS AND BYCATCH

Extract of the Report of the 21st Session of the Scientific Committee

(IOTC–2018–SC21–R; Appendix 40, Page 246)

STATUS OF MARINE TURTLES, SEABIRDS AND SHARKS IN THE INDIAN OCEAN

Status of Marine Turtles, Seabirds and Sharks in the Indian Ocean

Sharks

SC21.04 (para. 201) The SC **RECOMMENDED** that the Commission note the management advice developed for a subset of shark species commonly caught in IOTC fisheries for tuna and tuna-like species:

- Blue shark (*Prionace glauca*) – Appendix 23
- Oceanic whitetip shark (*Carcharhinus longimanus*) – Appendix 24
- Scalloped hammerhead shark (*Sphyrna lewini*) – Appendix 25
- Shortfin mako shark (*Isurus oxyrinchus*) – Appendix 26
- Silky shark (*Carcharhinus falciformis*) – Appendix 27
- Bigeye thresher shark (*Alopias superciliosus*) – Appendix 28
- Pelagic thresher shark (*Alopias pelagicus*) – Appendix 29

Marine turtles

SC21.05 (para. 202) The SC **RECOMMENDED** that the Commission note the management advice developed for marine turtles, as provided in the Executive Summary encompassing all six species found in the Indian Ocean:

- Marine turtles – Appendix 30

Seabirds

SC21.06 (para. 203) The SC **RECOMMENDED** that the Commission note the management advice developed for seabirds, as provided in the Executive Summary encompassing all species commonly interacting with IOTC fisheries for tuna and tuna-like species:

- Seabirds – Appendix 31

Cetaceans

SC21.07 (para. 204) The SC **RECOMMENDED** that the Commission note the management advice developed for cetaceans, as provided in the newly developed Executive Summary encompassing all species commonly interacting with IOTC fisheries for tuna and tuna-like species:

- Cetaceans – Appendix 32

GENERAL RECOMMENDATIONS TO THE COMMISSION

SC21.15 (para. 71) The SC **RECOMMENDED** that data collection for mobulid rays (if possible to species level) should be improved, that by-catch mitigation methods should be investigated and that safe release techniques and best practices should be implemented.

SC21.16 (para 72) The SC noted the status and declines of Mobula spp. in the Indian Ocean (which under current taxonomic revisions include the manta rays as well). Given the significant declines of these species across their range in the Indian Ocean along with evidence of these species' interaction with pelagic fisheries, in particular tuna gillnet, purse seine, and occasionally longline fisheries, the SC **RECOMMENDED** that management actions, such as non-retention measures in the IOTC Area of Competence (as a first step considering the Precautionary Approach) among others, are required to enable these species to recover and must immediately be adopted instead of waiting until 2020

Bycatch species identification and data issues

SC21.17 (para. 76) Despite identification cards being available, the SC noted ongoing issues around species identification data for sea turtles, sharks, cetaceans and other bycatch species and **AGREED** that improvements to the collection of data for all bycatch species is required. The Secretariat noted that these data are currently collected through national reports and observer data submissions, but were often limited. Consequently, the SC **RECOMMENDED** to the Commission that the species reporting of turtles (as a first step) is improved through an amendment to Annexes II and III in Resolution 15/01.

Status of development and implementation of National Plans of Action for seabirds and sharks, and implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations

SC21.18 (para. 85) The SC **RECOMMENDED** that the Commission note the current status of development and implementation of National Plans of Action (NPOAs) for sharks and seabirds, and the implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations, by each CPC as provided in Appendix 5, recalling that the IPOA-Seabirds and IPOA-Sharks were adopted by the FAO in 1999 and 2000, respectively, and recommended the development of NPOAs.

Progress towards Ecosystem Based Fisheries Management (EBFM) in IOTC – Preliminary Ecosystem Report Cards

SC21.19 (para. 101) Acknowledging the potential benefits of a climate-ocean web portal and regular updates on these influences to the SC and WPs, the SC **RECOMMENDED** a scoping study into how ocean-climate information as described in the proposal could be made available through the IOTC webpage and how this information would be presented to the WPs and SC. The scoping study should also consider the currency and quality of the information sources to be used.

Summary discussion of matters common to Working Parties (capacity building activities – stock assessment course; connecting science and management, etc.)

Invited Expert(s) at the WP meetings

SC21.29 (para. 177) Given the importance of external peer review for working party meetings, the SC **RECOMMENDED** that the Commission continues to allocate sufficient budget for an invited expert to be regularly invited to all scientific WP meetings.

Meeting participation fund

SC21.30 (para. 178) The SC reiterated its **RECOMMENDATION** that the IOTC Rules of Procedure (2014), for the administration of the Meeting Participation Fund be modified so that applications are due not later than 60 days, and that the full Draft paper be submitted no later than 45 days before the start of the relevant meeting. The aim is to allow the Selection Panel to review the full paper rather than just the abstract, and provide guidance on areas for improvement, as well as the suitability of the application to receive funding using the IOTC MPF. The earlier submission dates would also assist with visa application procedures for candidates.

IOTC species identification guides: Tuna and tuna-like species

SC21.31 (para. 179) The SC reiterated its **RECOMMENDATION** that the Commission allocates budget towards continuing the translation and printing of the IOTC species ID guides so that hard copies of the identification cards can continue to be printed as many CPCs scientific observers, both on board and port, still do not have smart phone technology/hardware access and need to have hard copies on board.

IOTC Secretariat staffing

SC21.32 (para. 180) Noting the very heavy workload at the IOTC Secretariat and the ever increasing demands by the Commission and the Scientific Committee, and also the capacity to respond to requests for assistance by countries, the SC **RECOMMENDED** that the recommendation from the Performance Review PRIOTC02.07(g) is implemented, and that permanent staff of the IOTC Data and Science Section be increased by two (2) (1 x P4 and 1 x P3 level positions), supplemented by additional short-term consultants. Funding for these new positions should come from both the IOTC regular budget and from external sources to reduce the financial burden on the IOTC membership.

Chairpersons and Vice-Chairpersons of the SC and its subsidiary bodies

SC21.33 (para. 181) The SC **RECOMMENDED** that the Commission note and endorse the Chairpersons and Vice-Chairpersons for the SC and its subsidiary bodies for the coming years, as provided in Appendix 7.

PROGRESS ON THE IMPLEMENTATION OF THE RECOMMENDATIONS OF THE PERFORMANCE REVIEW PANEL

SC21.34 (para. 214) The SC **RECOMMENDED** that the Commission note the updates on progress regarding Resolution 16/03, as provided at Appendix 33.

PROGRAM OF WORK AND SCHEDULE OF WORKING PARTY AND SCIENTIFIC COMMITTEE MEETINGS

Consultants

SC21.35 (para. 234) Noting the highly beneficial and relevant work done by IOTC stock assessment consultants in previous years, the SC **RECOMMENDED** that the engagement of consultants be continued for each coming year based on the Program of Work. Consultants will be hired to supplement the skill set available within the IOTC Secretariat and CPCs.

IOTC SCIENTIFIC STRATEGIC PLAN

SC21.36 (para. 247) The SC **AGREED** that the draft IOTC Strategic Science Plan 2020–2024 will be distributed to Heads of Delegation from each CPC for comment during early 2019, following which time comments will be collated and consolidated and another version sent to CPCs for final review. Pending agreement of CPCs, and noting that the IOTC Strategic Science Plan would be a dynamic document that would change over time, the SC **RECOMMENDED** that the revised draft of the IOTC Strategic Science Plan 2020–2024 be tabled at the Commission meeting in 2019.

REVIEW OF THE DRAFT, AND ADOPTION OF THE REPORT OF THE 18TH SESSION OF THE SCIENTIFIC COMMITTEE

SC21.37 (para. 250) The SC **RECOMMENDED** that the Commission consider the consolidated set of recommendations arising from SC21, provided at Appendix 40.

APPENDIX B
PROGRAM OF WORK (2019–2023) FOR THE SCIENTIFIC COMMITTEE AND ITS SUBSIDIARY BODIES

The SC **NOTED** the proposed Program of Work and priorities for the Scientific Committee and each of the Working Parties and **AGREED** to a consolidated Program of Work as outlined in Appendix 35. The Chairpersons and Vice-Chairpersons of each working party shall ensure that the efforts of their working party are focused on the core areas contained within the appendix, taking into account any new research priorities identified by the Commission at its next Session (IOTC–2018–SC21–R, Para. 220).

Working Party on Ecosystems and Bycatch (WPEB)

(Extracts from IOTC–2018–SC21–R: Appendix 35d, *Page 213)*

Table 1. Priority topics for obtaining the information necessary to develop stock status indicators for bycatch species in the Indian Ocean

Topic	Sub-topic and project	Priority	Ranking	Lead	Est. budget (potential source)	Timing				
						2019	2020	2021	2022	2023
	SHARKS									
1. Stock structure (connectivity and diversity)	1.1 Genetic research to determine the connectivity of select shark species throughout their distribution (including in adjacent Pacific and Atlantic waters as appropriate) and the effective population size.	High	17	CSIRO/AZTI/IRD/RITF	Financed (1.3m Euro (EU + 20% additional co-financing)					
	1.1.1 Next Generation Sequencing (NGS) to determine the degree of shared stocks for select shark species (highest priority species: blue shark, scalloped hammerhead shark, oceanic whitetip shark and shortfin mako shark) in the Indian Ocean with the southern Atlantic Ocean									

and Pacific Ocean, as appropriate. Population genetic analyses to decipher inter- and intraspecific evolutionary relationships, levels of gene flow (genetic exchange rate), genetic divergence, and effective population sizes.									
1.1.2 Nuclear markers (i.e. microsatellite) to determine the degree of shared stocks for select shark species (highest priority species: blue shark, scalloped hammerhead shark and oceanic whitetip shark) in the Indian Ocean with the southern Atlantic Ocean and Pacific Ocean, as appropriate.									
1.2 Connectivity, movements and habitat use	High	3							
1.2.1 Connectivity, movements, and habitat use, including identification of hotspots and investigate associated environmental conditions affecting the sharks distribution, making use of conventional and electronic tagging (PSAT).				AZTI, IRD, Others	Partially funded (153,000€ IOTC + 100.000€ EU/DCF)	SMA, PTH			
1.2.2 Whale sharks (RHN): Connectivity, movements, and habitat use, including identification of hotspots and investigate associated environmental conditions affecting distribution, making use of conventional and electronic tagging (P-SAT).					Funded (50,000€ EU/DCF)	RHN			

2. Fisheries data collection	2.1 Historical data mining for the key species and IOTC fleets (e.g. as artisanal gillnet and longline coastal fisheries) including:	High	1							
	2.1.1 Capacity building of fisheries observers (including the provision of ID guides, training, etc.)			WWF-Pakistan/ ACAP (seabirds)	US$20,000 (ID guides)					
	2.1.2 Historical data mining for the key species, including the collection of information about catch, effort and spatial distribution of those species and fleets catching them			CPCs with assistance from secretariat	TBD					
	2.2 Implementation of the Pilot Project (Resolution 16/04) for the Regional Observer Scheme	High	4							
	2.2.1 Definition of minimum standards and development of a training package for the ROS to be reviewed and rolled out in voluntary CPCs (Sri Lanka, I.R.Iran, Tanzania)				Funded (EC)					
	2.2.2 Development of a Regional Observer database and population with historic observer data				Funded (NOAA and EC)					
	2.2.3 Development, piloting and implementation of an electronic reporting tool to facilitate data reporting				Funded (NOAA and EC)					
	2.2.4 Development and trial of Electronic Monitoring Systems for gillnet fleets				Partially funded (EC)					

	2.2.5 Port sampling protocols for artisanal fisheries				to be funded					
	2.3 Review the status of manta and mobula rays and their interaction with IOTC fisheries. Evaluation of data availability and data gaps. Include ID guide revision and translation.	High	X?	Consultant?	US$?? (TBD)					
3. Biological and ecological information (incl. parameters for stock assessment)	3.1 Age and growth research (Priority species: blue shark (BSH), shortfin mako shark (SMA) and oceanic whitetip shark (OCS); Silky shark (FAL))	High	6		US$?? (TBD)					
	3.1.1 CPCs to provide further research reports on shark biology, namely age and growth studies including through the use of vertebrae or other means, either from data collected through observer programs or other research programs.			CPCs directly	US$?? (TBD)	OCS				
	3.2 Post-release mortality	High	16							
	3.2.1 Post-release mortality (electronic tagging), to assess the efficiency of management resolutions on no retention species (i.e. oceanic whitetip shark (OCS) and thresher sharks), shortfin mako shark SMA) ranked as the most vulnerable species to longline fisheries, and blue shark as the most frequent in catches			IRD/ NRIFSF	Partially funded (IOTC + EU/DCF)	, BTH OCS				

	3.2.2Post-release mortality (electronic tagging), to assess the efficiency of management resolutions on no retention species ranked as the most vulnerable species to longline fisheries, and blue shark as the most frequent in catches			IRD/ NRIFSF	TBD	SMA, PTH				
	3.2.3 Post-release mortality (electronic tagging), to assess the efficiency of management resolutions on no retention species (i.e. oceanic whitetip shark (OCS)) for purse seine and longline fisheries			IRD/AZTI/IPMA/CAPRUN	Funded (EU/DCF)	OCS				
	3.2.4 Post-release survivorship (electronic tagging) on whale shark to assess the effect of unintended interaction and efficiency of management resolution of non-intentioned encirclement on purse seine			IRD/AZTI	Funded (EU/DCF)					
	3.3 Reproduction research Priority species: blue shark (BSH), shortfin mako shark (SMA) and oceanic whitetip shark (OCS), and silky shark (FAL))	High	7	CPCs directly	US$??(TBF)					
	3.4 Ecological Risk Assessment (sharks & rays)	High	2	AZTI	Funded (EU/DCF)					
	3.5 Close kin feasibility study for sharks	High	X	Consultant	TBD					
4. Shark bycatch mitigation measures	4.1 Develop studies on shark mitigation measures (operational, technological aspects and best practices)	High	14							

	4.1.1 Longline selectivity, to assess the effects of hooks styles, bait types and trace materials on shark catch rates, hooking-mortality, bite-offs and fishing yield (socio-economics)				US$?? (TBD)					
	4.1.2 Gillnet selectivity, to assess the effect of mesh size, hanging ratio and net twine on sharks and rays catches composition (i.e. species and size), and fishing yield (socio-economics)			WWF-Pakistan	US$?? (ABNJ funding to WWF)					
	4.1.3 Develop guidelines and protocols for safe handling and release of sharks and rays caught on longlines and gillnets fisheries									
	4.1.4 Biodegradable FADs testing and implementing biodegradable FADs in the IO Purse Seine fleet to reduce environmental footprint of the gear			EU Consortium + ISSF	Funded					
5. CPUE standardisation / Stock Assessment / Other indicators	5.1 Develop standardised CPUE series for each key shark species and fishery in the Indian Ocean	High	13		US$?? (TBD)					
	5.1.1 Development of CPUE guidelines for standardisation of CPC data.			TBD	TBD					
	5.1.2 Blue shark: Priority fleets: TWN,CHN LL, EU,Spain LL, Japan LL; Indonesia LL; EU,Portugal LL			CPCs directly						
	5.1.3 Shortfin mako shark: Priority fleets: Longline and Gillnet fleets			CPCs directly						

	5.1.4 Oceanic whitetip shark: Priority fleets: Longline fleets; purse seine fleets			CPCs directly		
	5.1.5 Silky shark: Priority fleets: Purse seine fleets			CPCs directly		
	5.2 Joint CPUE standardization across the main LL fleets for SLK?, using detailed operational data	High	11	Consult.	30,000 €	
	5.3 Stock assessment and other indicators	High	12			
	MARINE TURTLES					
6. Marine turtle bycatch mitigation measures	6.1 Review of bycatch mitigation measures	High	8			
	6.1.1 Res. 12/04 (para. 11) Part I. The IOTC Scientific Committee shall request the IOTC Working Party on Ecosystems and Bycatch to:			CPCs directly	US$??	
	a) Develop recommendations on appropriate mitigation measures for gillnet, longline and purse seine fisheries in the IOTC area; [mostly completed for LL and PS]				(TBD)	
	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. [partially completed for					

non-entangling FADS; ongoing or biodegradable FADs)]								
6.1.2 Res. 12/04 (para. 11) Part II. 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.		CPCs directly	US$?? (TBD)					

	6.1.3 Res. 12/04 (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.			CPCs directly	Nil					
	6.1.4 Regional workshop to review the effectiveness of marine turtle mitigation measures (Recommendation SC20.23)				TBD					
	6.1.5 Review mortality studies for sea turtles, particularly for PS and gillnets									
	SEABIRDS									
7. Seabird bycatch mitigation measures	7.1 Review of bycatch mitigation measures	High	10							
	7.1.1 Res. 12/06 (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.			Rep. of Korea, Japan, Birdlife Int.	US$?? (TBD)					

	7.1.2 Bycatch assessment for seabirds taking into account the information from the various ongoing initiatives in the IO and adjacent oceans 7.1.3 Study on cryptic mortality of seabirds in tuna LL fisheries. 7.1.4 Post release survival rates for seabirds and review of safe release techniques.			ACAP, Birdlife					
	CETACEANS								
8.Bycatch assessment and mitigation	8.1 Review and development of cetacean bycatch mitigation measures	High	9						
	8.1.1 Collate all data available on bycatch of key species interacting with all tuna fisheries in the IOTC area (tuna drift gillnets, longlines, purse seines)			Consultancy?	U.S.$??				
	8.1.3 Conduct an ecological risk assessment for cetaceans in the IOTC area			CPCs directly					
	8.1.4 Collaborate with other organisations on the assessment of marine mammal abundance and collect data on marine mammal bycatch interactions with gillnets across the IOTC region			FIU/WWF-Pakistan?	U.S.$? (IWC)				
	8.1.5 Testing mitigation methods for cetacean bycatch in tuna drift gillnet fisheries			WWF Pakistan	U.S. MM Commission? Others?				
	DISCARDS								

9. Bycatch mitigation measures	9.1 Review proposal on retention of non-targeted species	High	5							
	9.1.1 The Commission requested that the Scientific Committee review proposal IOTC–2014–S18–PropL Rev_1, and to make recommendations on the benefits of retaining non-targeted species catches, other than those prohibited via IOTC Resolutions, for consideration at the 19th Session of the Commission. (S18 Report, para. 143). Noting the lack of expertise and resources at the WPEB and the short timeframe to fulfil this task, the SC RECOMMENDED that a consultant be hired to conduct this work and present the results at the next WPEB meeting. The following tasks, necessary to address this issue, should be considered for the terms of reference, taking into account all species that are usually discarded on all major gears (i.e., purse-seines, longlines and gillnets), and fisheries that take place on the high seas and in coastal countries EEZs:			Consultant – status to be checked	US$?? (TBD)					
	i) Estimate species-specific quantities of discards to assess the importance and potential of this new product supply, integrating data available at the Secretariat from the regional observer programs,									

ii) Assess the species-specific percentage of discards that is captured dead versus alive, as well as the post-release mortality of species that are discarded alive, in order to estimate what will be the added fishing mortality to the populations, based on the best current information,					
iii) Assess the feasibility of full retention, taking into account the specificities of the fleets that operate with different gears and their fishing practices (e.g., transhipment, onboard storage capacity).					
iv) Assess the capacity of the landing port facilities to handle and process this catch.					
v) Assess the socio-economic impacts of retaining non-target species, including the feasibility to market those species that are usually not retained by those gears,					
vi) Assess the benefits in terms of improving the catch statistics through port-sampling programmes,					
vii) Evaluate the impacts of full retention on the conditions of work and data quality collected by onboard scientific observers, making sure that there is a strict distinction between scientific observer tasks and compliance issues.					

		ECOSYSTEMS					
10.	Ecosystems	10.1 Develop a plan for Ecosystem Based Fisheries Management (EBFM) approaches in the IOTC, in conjunction with the Common Oceans Tuna Project.	High	15	WPEB	US$?? (TBD)	
		10.1.1 Training workshop for CPCs on EBFM Introduction and review of case studies and approaches and discussion on ecological and socio economic components that are needed. Ideally 2020					
		10.1.2 Workshop for CPCs on developing strategic plan for formalized implementation of EBFM (2019) including delineation of candidate eco regions within IOTC.					
		10.1.3 Practical Implementation of EBFM with the development and testing of ecosystem report cards.					
		10.1.4 Evaluation of EBFM plan in IOTC area of competence by the WPEB to review its elements components and make any corrective measures.					
		10.2 Assessing the impacts of climate change and socio-economic factors on IOTC fisheries				TBD	
		10.3 Evaluate alternative approaches to ERAs to assess ecological risk				TBD	

APPENDIX C

SCHEDULE OF STOCK ASSESSMENTS FOR IOTC SPECIES AND SPECIES OF INTEREST FROM 2019–2023, AND FOR OTHER WORKING PARTY PRIORITIES

The SC **ADOPTED** a revised assessment schedule, ecological risk assessment and other core projects for 2019–23, for the tuna and tuna-like species under the IOTC mandate, as well as the current list of key shark species of interest, as outlined in Appendix 36 (IOTC–2018–SC21–R, Para. 232)

Extract of the Report of the 21st Session of the Scientific Committee

(IOTC–2018–SC21–R; Appendix 36, Page 238)

Working Party on Ecosystems and Bycatch					
Species	**2019**	**2020**	**2021**	**2022**	**2023**
Blue shark		Indicators	Full assessment*	Indicators	–
Oceanic whitetip shark	Indicators	Full assessment*	–	Indicators	–
Scalloped hammerhead shark		–	–	Indicators	–
Shortfin mako shark	Indicators	Full assessment*	–	–	Indicators
Silky shark	Full assessment*	-	Indicators;	Full assessment*	–
Bigeye thresher shark	–	–	–	–	Indicators
Pelagic thresher shark	–	–	–	–	Indicators
Porbeagle shark	–	–	–	–	Indicators
Marine turtles		Interactions/Indicators			
Seabirds	–	Review of mitigation measures in Res. 12/04	–	–	Indicators
Marine Mammals	ERA; Review of mitigation measures in Res. 12/06	–	-	Review of mitigation measures in Res. 12/06	–

Ecosystem Based Fisheries Management (EBFM) approaches	Report from the IWC	–	ERA	–	–

*Including data poor stock assessment methods; Note: the assessment schedule may be changed dependent on the annual review of fishery indicators, or SC and Commission requests.