Report of the 21st Session of the IOTC Working Party on Ecosystems and Bycatch

Station Ifremer, Sète, France and Zoom, 9 – 13 September 2025

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ACRONYMS

ABNJ	Areas Beyond National Jurisdiction
ACAP	Agreement on the Conservation of Albatrosses and Petrels
BPUE	Bycatch Per Unit of Effort
BSH	Blue shark
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CKMR	Close-Kin-Mark-Recapture
CMM	Conservation and Management Measure (of the IOTC; Resolutions and Recommendations)
CMS	Convention on Conservation of Migratory Species of Wild Animals
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
EMS	Electronic Monitoring System
ERA	Ecological Risk Assessment
ETP	Endangered, Threatened and Protected Species
EU	European Union
F	Fishing mortality; F_{2015} is the fishing mortality estimated in the year 2015
FAD	Fish Aggregation Device
FAO	Food and Agriculture Organization of the United Nations
FOB	Floating Object
F_{MSY}	Fishing mortality at MSY
GAM	Generalised Additive Model
GLM	Generalised liner model
HBF	Hooks between floats
IO	Indian Ocean
IOTC	Indian Ocean Tuna Commission
IOSEA	Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia
IPOA	International Plan of Action
IUU	Illegal, Unreported and Unregulated, fishing
IWC	International Whaling Commission
LL	Longline
LSTLV	Large-scale tuna longline vessel
MoU	Memorandum of Understanding
MPF	Meeting Participation Fund
MSY	Maximum sustainable yield
n.a.	Not applicable
NDF	Non Detriment Finding
NGO	Non-Governmental Organisation
NOAA	National Oceanic and Atmospheric Administration
NPOA	National Plan of Action
PSA	Productivity Susceptibility Analysis
RPOA	Regional Plan of Action
ROS	Regional Observer Scheme
SC	Scientific Committee of the IOTC
SB	Spawning biomass (sometimes expressed as SSB)
SB_{MSY}	Spawning stock biomass which produces MSY
SMA	Shortfin mako shark
Taiwan,China	Taiwan, Province of China
UN	United Nations
WPDCS	Working Party on Data Collection and Statistics, of the IOTC
WPEB	Working Party on Ecosystems and Bycatch, of the IOTC
WWF	World Wildlife Fund

KEY DEFINITIONS

Bycatch	All species, other than the 16 species listed in Annex B of the IOTC Agreement, caught or interacted with by fisheries for tuna and tuna-like species in the IOTC area of competence.
Discards	Any species, whether an IOTC species or bycatch species, which is not retained onboard for sale or consumption.
Large-scale driftnets	Gillnets or other nets or a combination of nets that are more than 2.5 kilometres in length whose purpose is to enmesh, entrap, or entangle fish by drifting on the surface of, or in, the water column.

STANDARDISATION OF IOTC WORKING PARTY AND SCIENTIFIC COMMITTEE REPORT TERMINOLOGY

SC16.07 (para. 23) The SC **ADOPTED** the reporting terminology contained in Appendix IV and **RECOMMENDED** that the Commission considers adopting the standardised IOTC Report terminology, to further improve the clarity of information sharing from, and among its subsidiary bodies.

HOW TO INTERPRET TERMINOLOGY CONTAINED IN THIS REPORT

Level 1: From a subsidiary body of the Commission to the next level in the structure of the Commission:

RECOMMENDED, RECOMMENDATION: Any conclusion or request for an action to be undertaken, from a subsidiary body of the Commission (Committee or Working Party), which is to be formally provided to the next level in the structure of the Commission for its consideration/endorsement (e.g. from a Working Party to the Scientific Committee; from a Committee to the Commission). The intention is that the higher body will consider the recommended action for endorsement under its own mandate, if the subsidiary body does not already have the required mandate. Ideally this should be task specific and contain a timeframe for completion.

Level 2: From a subsidiary body of the Commission to a CPC, the IOTC Secretariat, or other body (not the Commission) to carry out a specified task:

REQUESTED: This term should only be used by a subsidiary body of the Commission if it does not wish to have the request formally adopted/endorsed by the next level in the structure of the Commission. For example, if a Committee wishes to seek additional input from a CPC on a particular topic, but does not wish to formalise the request beyond the mandate of the Committee, it may request that a set action be undertaken. Ideally this should be task specific and contain a timeframe for the completion.

Level 3: General terms to be used for consistency:

AGREED: Any point of discussion from a meeting which the IOTC body considers to be an agreed course of action covered by its mandate, which has not already been dealt with under Level 1 or level 2 above; a general point of agreement among delegations/participants of a meeting which does not need to be considered/adopted by the next level in the Commission's structure.

NOTED/NOTING: Any point of discussion from a meeting which the IOTC body considers to be important enough to record in a meeting report for future reference.

Any other term: Any other term may be used in addition to the Level 3 terms to highlight to the reader of and IOTC report, the importance of the relevant paragraph. However, other terms used are considered for explanatory/informational purposes only and shall have no higher rating within the reporting terminology hierarchy than Level 3, described above (e.g. **CONSIDERED**; **URGED**; **ACKNOWLEDGED**).

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Executive summary

The 21st Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Ecosystems and Bycatch - WPEB was held in France and online via Zoom from 9-13 September 2025. A total of 87 participants (92 in 2024, 100 in 2023, 103 in 2022, and 93 in 2021) attended the Session. The list of participants is provided in Appendix I. The meeting was opened by the Chairperson, Dr Mariana Tolotti from IRD, France, who welcomed participants and formally opened the meeting.

The following are the complete **recommendations** from the WPEB21 to the Scientific Committee which are also provided in Appendix XVVIII:

4.1 Review of the statistical data available for ecosystems and bycatch species

WPEB21(AS).01 (para. 25) **NOTING** that data for bycatch species in IOTC fisheries are severely lacking, the WPEB **RECOMMENDED** that the SC ask the Commission and Compliance Committee to **ENCOURAGE** CPCs to provide observer data and work to reach at least the 5% minimum coverage level as required by Resolution 25/04.

6.1 Presentation of new information available on sharks

WPEB21(AS).02 (para. 103) The WPEB **RECOMMENDED** that the Scientific Committee take into account the criteria outlined in the IOTC-2025-WPEB21(AS)-24 (below) and points raised above when discussing the principles for conducting an experimental fishing trial(s) as requested per Resolution 25-08. For reference, the criteria outlined in IOTC-2025-WPEB21(AS)-24 are as follows:

- That the trial is conducted in areas and seasons with known high shark abundance (including of vulnerable shark species), using existing data from Indian Ocean Regional Observer Scheme (ROS) data or surveys to identify suitable hotspots.
- Before the trial, conduct a power analysis (following Watson et al. 2005) informed by historical bycatch data from the Indian Ocean to determine the number of sets required to detect a true effect (for each vulnerable species), thereby avoiding a Type II error.
- That the trial employs a "paired comparison" approach by alternating control (nylon monofilament) and experimental (wire) leaders along each longline section. Also, alternate the leader type on the first branch line for every subsequent fishing set to ensure a balanced design.
- That the trial standardises all gear and operational practices, including, *inter alia*, soak time, setting/hauling times, bait/hook types and branch line/leader lengths and other gear characteristics (e.g. use of lightsticks) to assist the trial in isolating the effect of leader material.
- Use at least one, and preferably two, independent observers or scientific researchers who are trained in longline operations and species identification to minimise human error and observational bias.
- Establish a standardised protocol for collecting data. Key metrics to record are species ID, leader material, fate (retained/discarded), condition at haulback, and the occurrence of bite-offs.
- Ensure the trial vessel skipper and crew are briefed on the trial's objectives and design, and that they support the experimental protocols.

- Develop the statistical analysis plan in collaboration with biostatisticians. Appropriate statistical approaches may include hierarchical or mixed-effect models (e.g., GLMMs) to analyse key response variables, including: CPUE, bite-off rate, and haulback mortality rate.

6.2 ***Development of shark research work plan***

WPEB21(AS).03 (para. 113) **NOTING** that Resolution 15/01 includes a list of species for which reporting catch data is mandatory/optional and that varies by gear and by fishery type (i.e. artisanal vs commercial fisheries), the WPEB **NOTED** that many species of interest to the WPEB are not mandatory for reporting for all gears or fishery type. The WPEB therefore **RECOMMENDED** that the SC review the list of species that are mandatory for reporting to species level while considering the feasibility of such data collection, and included the following suggested changes:

- Silky sharks to be added also for gillnets fisheries
- Hammerhead sharks to be reported at species level at least for scalloped, smooth and great hammerhead sharks for all gear types (explicitly including purse seine fisheries)
- Mantas and devil rays to be reported at species level differentiating at least between manta rays (giant manta and reef manta) and other devil rays adding them for mandatory reporting at least for purse seine fisheries and for gillnet fisheries instead of optional
- Great white sharks as mandatory for all gear types
- Oceanic whitetip sharks as mandatory for all gear types.

6.3 ***Review of the minimum standards for safe handling and live release procedures (Annex III of Resolution 25/08) (all)***

WPEB21(AS).04 (para. 120) The WPEB **REVIEWED** the minimum standards set out in Annex III of this Resolution and **ADOPTED** the revisions made by members of the group which can be found in Annex XVVII. The WPEB **RECOMMENDED** that the SC **ENDORSE** these handling guidelines for consideration by the Commission in 2026. The WPEB further **NOTED** that work on best practice handling guidelines is ongoing and frequently evolves. The WPEB therefore **RECOMMENDED** that the SC suggest that the Commission consider adopting a master document containing handling guidelines for all taxa, rather than requiring Resolutions containing such guidelines to be updated when new information becomes available. Future Resolutions could then refer back to this master document adopted by the SC. The WPEB **AGREED** that a small working group will work on compiling these intersessionally for review by the SC.

7.1 Review of indicators for blue shark

WPEB21(AS).05 (para. 148-151) The WPEB **NOTED** in its discussions of CPUEs, two additional issues.

Firstly, that the changing spatial distribution of the fleets which regularly provide CPUE series can make it challenging to determine which CPUE series are consistent and appropriate for use in assessments. The WPEB **NOTED** that it might be useful to consider a wider research project (or workshop) that attempts to compare CPUEs, by isolating sub-regions where fishing effort has been fairly consistent such as the South-West Indian Ocean. The WPEB **NOTED** that such a project/workshop would help to determine the similarities and conflicts between the various CPUE series and how well they are explaining the population trends. The WPEB **NOTED** that comparing and identifying which CPUE series are the most appropriate to include in assessments is a consistent challenge across all species, not just bycatch species so this type of analyses would benefit the work of all IOTC's Working Parties

Secondly, the need to homogenise CPUE standardization methods, as a diverse range of methods are used that calculate results in different ways, that might not always be comparable. One way in which this might be addressed, alongside other issues with CPUE data, is to undertake work to develop a joint longline index of blue shark abundance built from operational fleet data.

Subsequently, WPEB **RECOMMENDED** that to progress work towards resolving the issues above, the SC either a) commission a dedicated project; b) request such analyses to be undertaken as a standard part of developing standardised CPUEs for assessments; or c) build this work into a future CPUE workshop.

WPEB21(AS).06 (para. 152) The WPEB **NOTED** that CPUE series are being presented in a range of formats which makes it challenging to directly compare between different series and further **NOTED** that this is a problem for all species for which CPUE series are being produced, not just for bycatch species. The WPEB **NOTED** that guidelines for presenting CPUE series have been developed in the past both by the IOTC and other RFMOs but these do not appear to be consistently followed and may be outdated. Therefore, the WPEB **RECOMMENDED** that the SC review these guidelines and **REQUEST** CPCs to follow the guidelines when reviewed.

7.3 Review of proposed stock assessment of blue shark

WPEB21(AS).07 (para. 181) The WPEB **RECOMMENDED** based on the SS3 assessment results, that the SC advise the Commission that the current recommended catch for blue shark remain close to current catches, and below the MSY estimated by the SS3 assessment model for 2025 (< 31,000 t).

8.1 Review new information on the environment and ecosystem interactions and modelling, including climate change issues affecting pelagic ecosystems in the IOTC area of responsibility

WPEB21(AS).08 (para. 207) The WPEB **NOTED** the new loop gear known as “meka-ring/trap-line” that has been increasingly used in various oceans. Several papers have been recently prepared for ICCAT, including in the Mediterranean Sea where the gear started to be used several years ago, and more recently in the Atlantic Ocean. Currently, the scale of the use of this new gear in the IOTC area is unknown but the WPEB **NOTED** that it will have a potential effect on catch, mostly for swordfish. As such, the group **RECOMMENDED** that the SC takes note and **REQUESTED** CPC scientists to investigate within their fleets if such gear is in use in the Indian Ocean, and consider, taking into account the ongoing work at ICCAT, starting to include this type of gear in data collection methods in their logbook and/or observer program to collect the corresponding catch and effort data in the future. It is noted from some very preliminary literature that with this new loop gear the catch rates of swordfish are higher, while shark and turtle bycatch is much lower. As such, this new gear can also be further studied as a potential mitigation new measure for vulnerable species.

9.2 Other sharks and rays (all)

WPEB21(AS).09 (para. 246) The WPEB **NOTED** that while evidence on post-release survival of whale sharks from purse seine interactions suggests low mortality when best-practices are followed, data on bycatch in other fisheries, particularly gillnets, remains scarce**.** Therefore, the WPEB **RECOMMENDED** that the SC **ENCOURAGE** CPCs to improve data collection and reporting for interactions with whale sharks involving all gear types as well as purse seine.

WPEB21(AS).10 (para. 251) The WPEB **RECOMMENDED** that the SC should promote efforts to clarify the extent and nature of whale shark interactions with IOTC fisheries, and to assess the current stock status within the IOTC area of competence, **ACKNOWLEDGING** that the extent of the vulnerability of whale sharks to IOTC fisheries is unknown. Based on the available information presented in paper IOTC-2025-WPEB21(AS)-40, the WPEB **RECOMMENDED** that the SC classify whale sharks in the Indian Ocean as a **"**taxon of the greatest biological vulnerability and conservation concern for which there are very few data**"**, as defined in Resolution 25/08. The WPEB **NOTED** that this classification supports the consideration of precautionary management measures and prioritization of future research and data collection efforts by the Commission.

9.3 Mobulids

WPEB21(AS).11 (para. 276) The WPEB **RECOMMENDED** that the SC **ADVISE** the Commission to speak with CPCs to determine appropriate ways to improve data reporting from artisanal fisheries.

WPEB21(AS).12 (para. 277) The WPEB **NOTED** that in 2024, the group recommended the adoption of a revised set of handling guidelines for mobulids while **NOTING** that that work was required to further develop the guidelines for gillnets. The WPEB **NOTED** that the Secretariat worked intersessionally with the Manta Trust to further develop these guidelines which were reviewed by the group. After these had been reviewed, the WPEB **ADOPTED** the revised handling guidelines for mobulids and **RECOMMENDED** that the SC **ENDORSE** these handling guidelines for consideration by the Commission in 2026. The details of the suggested revisions to the handling procedures can be found in Appendix XVVI.

10.1 Revision of the WPEB Program of Work 2026-2030

WPEB21(AS).13 (para. 310) The WPEB **RECOMMENDED** that the SC consider and endorse the WPEB Program of Work (2026–2030), as provided in Appendix XVIV.

11.3 Review of the draft, and adoption of the Report of the 21st Session of the WPEB

WPEB21(AS).15 (para. 320) The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB21, provided at Appendix XVVIII, as well as the management advice provided in the draft resource stock status summary for each of the eight shark species, as well of those for marine turtles, seabirds, cetaceans and mobulids:

Sharks

- Blue shark (*Prionace glauca*) – Appendix VII
- Oceanic whitetip shark (*Carcharhinus longimanus*) – Appendix VIII
- Scalloped hammerhead shark (*Sphyrna lewini*) – Appendix IX
- Shortfin mako shark (*Isurus oxyrinchus*) – Appendix X
- Silky shark (*Carcharhinus falciformis*) – Appendix XI
- Bigeye thresher shark (*Alopias superciliosus*) – Appendix XII
- Pelagic thresher shark (*Alopias pelagicus*) – Appendix XIII
- Porbeagle shark (*Lamna nasus*) - Appendix XIV

Other species/groups

- Marine turtles – Appendix XV
- Seabirds – Appendix XVI
- Marine mammals – Appendix XVII
- Mobulids – Appendix XVIV

A summary of the stock status for some of the most commonly caught shark species caught in association with IOTC fisheries for tuna and tuna-like species is provided in Table 1.

The following are the **requests** from the WPEB21 to other working parties for their attention:

8.2 Examining the benefits of retaining non-targeted species catches (all)

(para. 210) The WPEB **NOTED** that no papers were presented on this topic and so **REQUESTED** the WPTT and other relevant working parties to discuss this as it is thought to be more relevant to that working party.

Table 1. Status summary for key shark species caught in association with IOTC fisheries for tuna and tuna-like species.

<table>
<tr><th>Stock</th><th colspan="2">Indicators</th><th>2020</th><th>2021</th><th>2022</th><th>2023</th><th>2024</th><th>2025</th><th>Advice to the Commission</th></tr>
<tr><td colspan="10">Sharks: Although sharks are not part of the 16 species directly under the IOTC mandate, sharks are frequently caught in association with fisheries targeting IOTC species. Some fleets are known to actively target both sharks and IOTC species simultaneously. As such, IOTC Contracting Parties and Cooperating Non-Contracting Parties are required to report information at the same level of detail as for the 16 IOTC species. The following are the main species caught in IOTC fisheries, although the list is not exhaustive</td></tr>
<tr><td rowspan="2">Blue shark
Prionace glauca</td><td>Nominal Reported catch 2023 (MT)
Estimated catch 2023 (MT)
Not elsewhere included (nei) sharks2 2023 (MT)
Average reported catch 2019-23 (MT)
Average estimated catch 2019-23 (MT)
Avg. not elsewhere included (nei) sharks2 2019-23 (MT)</td><td>26,354
27,722
28,179 t
13,072
26,690
27,279 t</td><td rowspan="2">72.6%</td><td rowspan="2">72.6%</td><td rowspan="2">99.9%</td><td rowspan="2">99.9%</td><td rowspan="2">99.9%</td><td rowspan="2">100%</td><td rowspan="2">Both 2025 stock assessments (JABBA and SS3) indicated that Indian Ocean blue shark is not overfished nor subject to overfishing. The SS3 assessment indicates current catches are near MSY, and significant increases could result in decreasing biomass and the stock becoming subject to overfishing in the future. The stock should be closely monitored, especially with respect to overall catch and discard reporting.

While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), these need to be further implemented by the Commission, so as to better inform scientific advice in the future.

Click below for a full stock status summary:
• Blue sharks – Appendix VII</td></tr>
<tr><td>MSY (1,000 t) (80% CI):
F_{MSY} (80% CI):
SSB_{MSY} (1,000 t) (80% CI):
F_{2015}/F_{MSY} (80% CI):
SSB_{2019}/SSB_{MSY} (80% CI):
SSB_{2019}/SSB_0 (80% CI):</td><td>0.31 (0.22 - 0.40)
0.18 (0.18 - 0.18)
52.87 (37.38 - 68.37)
0.39 (0.21 - 0.57)
2.22 (1.76 - 2.68)
0.73 (0.34 - 1.13)</td></tr>
<tr><td rowspan="2">Shortfin mako
Isurus oxyrinchus</td><td>Catches (SMA) 2023 (t)[2]
Average catches (SMA) 2019-23 (t)
Catches (SMA, MAK, MSK) in 2023[3]
Average catches (SMA, MAK, MSK) 2019-2023
Not elsewhere included (nei) sharks[2] 2023 (t)[4]
Av. Not elsewhere included (nei) sharks[2] 2019-23(t)</td><td>831
854
2021
2074
30202
28978</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">49.7%</td><td rowspan="2">49.7%</td><td rowspan="2">Current catches are higher than MSY, and the shortfin mako is currently overfished (B/Bmsy < 1) and undergoing overfishing (F/Fmsy > 1). Under those levels of catches, the biomass will continue to decline, and fishing mortality will continue to increase over time. In order to have a lower than 50% probability of exceeding MSY-reference points in 10 years, i.e., to recover the stock to the green quadrant of the Kobe plot with at least 50% probability in 10 years, future catches should not exceed 40% of current catches. This corresponds to an annual TAC of 1,217.2 t (representing all fishing mortality</td></tr>
<tr><td>MSY (1,000 t) (80% CI)
F_{MSY} (80% CI)
B_{MSY} (1,000 t) (80% CI)
F_{2022}/F_{MSY} (80% CI)</td><td>1,930 (0.985 – 3.313)
0.03 (0.01 – 0.07)
60.0 (35.7 – 103.8)
1.53 (0.65 – 3.71)</td></tr>
</table>

	B_{2022}/B_{MSY} (80% CI) 0.96 (0.58 – 1.41) B_{2022}/B_{0} (80% CI) 0.45 (0.27- 0.69)							including retention, dead discards and post-release mortality), noting that this TAC level should include and account for the SMA, MAK and MSK species codes as reported to IOTC. The Commission should take a cautious approach by implementing management actions that reduce fishing mortality on shortfin mako sharks, and the stock should be closely monitored. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), these need to be further implemented by the Commission so as to better inform future scientific advice. Click below for a full stock status summary: ● Shortfin mako sharks – Appendix X
Oceanic whitetip shark *Carcharhinus longimanus*	Reported catch 2023: Not elsewhere included (nei) sharks 2023: 42 t 28,179 t Average reported catch 2019–2023: 36 t Not elsewhere included (nei) sharks 2019-2023: 27,279 t							There is a paucity of information available for these species and this situation is not expected to improve in the short to medium term. There is no quantitative stock assessment and limited basic fishery indicators currently available. Therefore, the stock status is highly uncertain. The available evidence indicates considerable risk to the stock status at current effort levels. The primary source of data that drive the assessment (total catches) is highly uncertain and should be investigated further as a priority. Click below for a full stock status summary: ● Oceanic whitetip sharks – Appendix VIII
Scalloped hammerhead shark *Sphyrna lewini*	Reported catch 2023: Not elsewhere included (nei) sharks 2023: 1,397 t 29,950 t Average reported catch 2019–2023: 470 t Not elsewhere included (nei) sharks 2019-2023 28,729 t							
Silky shark *Carcharhinus falciformis*	Reported catch 2023: Not elsewhere included (nei) sharks 2023: 1,579 t 28,179 t Average reported catch 2019–2023: 1,750 t Not elsewhere included (nei) sharks 2019-2023 27,279 t							

Bigeye thresher shark *Alopias superciliosus*	Reported catch 2023: <1 t Not elsewhere included (nei) sharks 2023: 33,043 t Thresher sharks nei 2023: 4,863 t Average reported catch 2019–2023: <1 t Not elsewhere included (nei) sharks 2019-2023: 28,685 t Av. Thresher sharks nei 2019-2023: 1,356 t							• Scalloped hammerhead sharks – Appendix IX • Silky sharks – Appendix XI • Bigeye thresher sharks – Appendix XII • Pelagic thresher sharks – Appendix XIII • Porbeagle sharks – Appendix XIV
Pelagic thresher shark *Alopias pelagicus*	Reported catch 2023: 136 t Not elsewhere included (nei) sharks 2023: 33,043 t Thresher sharks nei 2023: 4,863 t Average reported catch 2019–2023: 162 t Not elsewhere included (nei) sharks 2019-2023: 28,635 t Av. Thresher sharks nei 2019-2023 1,356 t							
Porbeagle shark *Lamna nasus*	Reported catch 2023: 28t Not elsewhere included (nei) sharks 2023: 28,179t Average reported catch 2019–2023: 6t Not elsewhere included (nei) sharks 2019-2023 27,279t							

Colour key for Table 1	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 21st Session of the Indian Ocean Tuna Commission's (IOTC) Working Party on Ecosystems and Bycatch - WPEB was held in France and online via Zoom from 9-13 September 2025. A total of 87 participants (92 in 2024, 100 in 2023, 103 in 2022, and 93 in 2021) attended the Session. The list of participants is provided in Appendix I. The meeting was opened by the Chairperson, Dr Mariana Tolotti from IRD, France, who welcomed participants and formally opened the meeting.

2. Adoption of the Agenda and arrangements for the Session

2. The WPEB **ADOPTED** the Agenda provided in Appendix II. The documents presented to the WPEB are listed in Appendix III.

3. The IOTC process: outcomes, updates and progress

3.1 Outcomes of the 27th Session of the Scientific Committee

3. The WPEB **NOTED** paper IOTC–2025–WPEB21(AS)–03 which outlined the main outcomes of the 27th Session of the Scientific Committee, specifically related to the work of the WPEB.

"At the 27th Session of the SC, the SC noted and considered the recommendations made by the WPEB in 2024 that included: recommendations arising from the shark mitigation workshop; asking the SC to provide clarification on the nature of workshop and working party data preparatory meetings and their capacity to submit recommendations directly to the SC; and asking the SC to consider endorsing a revision to the live release handling procedures developed for mobulids.

There were detailed discussions around the recommendations from the shark mitigation workshop. The SC noted the comprehensive research review summary table and recommended the Commission to consider this table.

Other discussions related to: the process of revising best practices on branch line weighting; poor species level data for marine turtles; and holding a bycatch mitigation in gillnets workshop. The SC also noted the management advice arising from the shortfin mako assessment conducted in 2024.

Based on the recommendations arising from the WPEB20, the SC27 adopted a set of recommendations, which were provided to the Commission for consideration at its 29th Session which was held in April 2025.

In addition, the SC27 reviewed and endorsed a Program of Work for the WPEB, including a revised assessment schedule."

3.2 Outcomes of the 29th Session of the Commission

4. The WPEB **NOTED** paper IOTC–2025–WPEB21(AS)–04 which outlined the main outcomes of the 29th Session of the Commission, specifically related to the work of the WPEB.

5. The WPEB **NOTED** that there was little discussion related to the WPEB at the Commission meeting and that the main items were the endorsement by the Commission of the SC information on stock status. However, the WPEB **NOTED** that proposals for Resolutions relating to implementing more management measures for sharks were adopted by the Commission.

*"(para. 37) The Commission **NOTED** the stock status summaries for species of tuna and tuna-like species under the IOTC mandate, as well as other species impacted by IOTC fisheries and considered the recommendations made by the Scientific Committee to the Commission. The Commission **ENDORSED** the Scientific Committee's 2024 list of recommendations as its own.*

*(para. 40) The Commission **ENDORSED** those officials elected for the SC and its subsidiary (scientific) bodies for the coming years, as listed in Appendix 7 of the 2024 Scientific Committee Report.*

*(para. 41) The Commission **NOTED** that Resolution 16/07 On the use of artificial lights to attract fish (which prohibits using artificial lights for the purpose of aggregating tuna and tuna-like species) requires further clarifications as to which fishery/gear this measure should apply. The Commission **REQUESTED** CPCs to provide proposals to revise the resolution.*

*(para. 42) The Commission **ACKNOWLEDGED** that Indonesia has completed the work undertaken to re-estimate the tuna catches from Indonesian fisheries. The revised catches have been endorsed by the WPDCS and SC. The Commission **NOTED** that given the importance of Indonesia's fisheries and their large volume of tuna catches, this catch reconstruction work is important to the scientific work of this Commission. The Commission also **REQUESTED** Indonesia to work with the Secretariat and to ensure that the estimation methodologies are automated. The Commission also **NOTED** the need for other fishing fleets such as Oman, which the Commission has raised concerns regarding the reported catch data, to initiate and undergo a similar process to reconstruct the catch data.*

*(para. 43) The Commission **URGED** all CPCs to actively participate in IOTC Scientific Committee's subsidiary body meetings.*

*(para. 44) The Commission **NOTED** paper IOTC–2024–SC27–18 which provided the draft updated IOTC Strategic Science Plan for 2025–2029 for the Commission to consider.*

*(para. 45) The Commission **NOTED** the first IOTC Strategic Science Plan 2020 - 2024 was developed in 2018 and adopted by the Commission, at its 23rd session.*

(para. 46) Following a similar review process, an update of the Strategic Science Plan for 2025 – 2029 was presented to the SC in 2024, for review. The plan was then disseminated to the Commission via Circular 2025-01 in January 2025 with comments due by 28 February 2025. The comments received from Members have been addressed in the final draft.

*(para. 47) The Commission **NOTED** the updated Strategic Science Plan incorporated requests made to the SC from recent resolutions and reflected emerging research activities within the IOTC scientific community. It Included a proposed timetable for meetings from 2025 to 2029, and schedules for running stock assessments and the adopted MPs.*

*(para. 48) **NOTING** the importance of this work in communicating targets, objectives and indicators for monitoring progress on scientific work of the IOTC to the Commission, the Commission **ENDORSED** the IOTC Strategic Science Plan 2025-2029."*

6. The WPEB **NOTED** a request from the Commission that the consideration of operational, economic and social impacts of mitigation approaches be confined to the WPSE, not the WPEB (which considers scientific matters).
7. The WPEB **NOTED** the discussions regarding the workload of the WPEB as well as the relationship between data preparatory and assessment meeting that were held during WPEB last year as well as the SC. The WPEB **NOTED** that during the Commission it was agreed that a small working group would discuss this and report back to the Commission.

3.3 Review of Conservation and Management Measures relevant to Ecosystems and Bycatch

8. The WPEB **NOTED** paper IOTC–2025–WPEB21(AS)–05 which aimed to encourage participants to review some of the existing Conservation and Management Measures (CMM) relevant to ecosystems and bycatch.
9. The WPEB **NOTED** that four CMMs relevant to ecosystems and bycatch were adopted by the Commission in 2025:

- Resolution 25/01: *On climate change as it relates to the Indian Ocean Tuna Commission*
- Resolution 25/06: *On a Regional Observer Scheme*
- Resolution 25/08: *On the conservation of sharks caught in association with fisheries managed by IOTC*
- Resolution 25/09: *On the conservation of shortfin and longfin mako sharks caught in association with IOTC fisheries*

10. The WPEB **NOTED** that Resolution 25/08 includes a number of requests for work to be done by the WPEB and SC including:

    - Reviewing available data pertaining to spatial and temporal trends in the relative distribution of vulnerable shark species, the distribution of total longline fishing effort, and the distribution and level of use of wire and monofilament leaders by 2026. Providing advice regarding spatial options for the application of a prohibition of wire trace taking into account the distribution of the vulnerable and target shark species by 2027.
    - Reviewing the minimum standards for safe handling and live release procedures set out in Annex III of the Resolution by 2025 and provide recommendations to the Commission on any further improvements required.
    - In 2025, review existing data and information relating to the life history and conservation status of whale sharks and confirm whether they meet the definition of being a taxon of the greatest biological vulnerability and conservation concern for which there are very few data and advise the Commission on the appropriateness of applying precautionary management measures in IOTC fisheries.
    - Establish ToRs for a long-term project on sharks to be considered by the Commission in 2026 with the aim to ensuring the collection of data required for performing reliable stock assessments for key species

3.4 Progress on the recommendations of WPEB20

11. The WPEB **NOTED** paper IOTC–2025–WPEB21(AS)–06 which provided an update on the progress made in implementing the recommendations from the previous WPEB meeting WPEB20 which were endorsed by the Scientific Committee (SC27) in 2024.

12. The WPEB **NOTED** that good progress had been made on these Recommendations and Requests. The WPEB participants were **ENCOURAGED** to review IOTC–2025–WPEB21(AS)–06 during the meeting and report back on any progress in relation to requests or actions by CPCs that have not been captured by the report, and to note any pending actions for attention before the next meeting (WPEB22).

4. Review of data available on ecosystems and bycatch

4.2 Review of the statistical data available for ecosystems and bycatch species

13. The WPEB **NOTED** paper IOTC–2025–WPEB21(AS)–07 which provided an overview of the data managed by the IOTC Secretariat for bycatch species for the period 1950–2022. A summary for shark and ray species is provided in Appendix IV.

14. The WPEB **RECALLED** that with the term *bycatch* the IOTC refers to all those species other than the 16 managed by the IOTC, regardless of their being targeted, incidentally caught, or elsewhere affected by IOTC fisheries.

15. The WPEB **NOTED** that in the sharks catch data series the period from 2018 to 2022 saw the most significant changes, with an average catch reduction of 40%, due to Indonesia's catch re-estimation endorsed by SC27.

16. The WPEB **NOTED** that the reporting at species-level has accounted for 40% of total shark catches reported in recent years. Blue sharks account for 55% of reported shark catches at species level, followed by silky sharks (about 12%) and shortfin mako sharks (7%).

17. The WPEB **NOTED** that aggregate shark catches represent around 60% of the total shark catches and in some cases the data are obtained from other sources (e.g. FAO) or repeated from year to year (e.g. MDG) due to inconsistency or lack of reporting by some fleets, which increases the uncertainty of the shark catch series.

18. The WPEB **NOTED** that while acknowledging that blue shark catches remain associated with considerably uncertainties due to estimates of blue shark catches from Indonesian artisanal fisheries, the catch trend was reversed in 2023 with blue shark catches increasing by 70% and 30% for the EU-Spain and Taiwan,China respectively. Although to a lesser degree, China, Mauritius, Sri Lanka and Tanzania also reported considerable increases in blue shark catches. The WPEB **NOTED** that the sharp increase in line and gillnet catches of blue sharks in 2023 is entirely related to Indonesia's reported catches and is subject to review.

19. The WPEB **NOTED** that for blue shark, the ROS data is mostly coming from Japanese vessels, but the time series is not complete. The length data has mostly been reported from French longline fleet with some also coming from the Spanish and Portuguese longline fleets.

20. The WPEB **NOTED** that there are some discards of blue shark reported by the Reunion fleet and **NOTED** that just based on the data reported, this appears to be the only fleet discarding the species. However, the WPEB **NOTED** that it is likely to be the case that other fleets are just not reporting their discards of the species and so the WPEB **NOTED** that the maps showing the distribution of discards are not representative of the whole Indian Ocean, they are simply showing the discards that have been reported to the Secretariat. The WPEB **NOTED** that when the ROS database has been updated, there should be a more representative picture of where the discards have been occurring.

21. The WPEB **NOTED** that the differences seen between length frequency data originating from logbooks compared with the observer data could be a large source of uncertainty in the blue shark assessment.

22. The WPEB **NOTED** that CPCs are using different size bins to report their length frequency data which results in odd distribution patterns in the data. The WPEB therefore **SUGGESTED** that all length frequency data are sorted into 10 cm bins to avoid this issue.

23. The WPEB **NOTED** that observer coverage is still very low across most fleets despite the fact that EMS can be used to complement onboard observers in order to reach the 5% minimum requirement across fishing operations. The WPEB **NOTED** that EMS data have only been provided by one CPC to date (Australia).

24. The WPEB **NOTED** that increasing observer coverage would help to improve data coming from the longline fleets. The WPEB **NOTED** that various studies recommend a 20% minimum coverage. However, the WPEB further **NOTED** that as many fleets are unable to meet the current 5% requirement, the 20% suggested minimum is unrealistic for most fleets.

25. **NOTING** that data for bycatch species in IOTC fisheries are severely lacking, the WPEB **RECOMMENDED** that the SC ask the Commission and Compliance Committee to **ENCOURAGE** CPCs to provide observer data and work to reach at least the 5% minimum coverage level as required by Resolution 25/04.

5. Review of national bycatch issues in IOTC managed fisheries and National Plans of Action

5.1 Updated status of development and implementation of National Plans of Action for seabirds and sharks, and the implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations (CPCs and IOTC Secretariat).

26. The WPEB **NOTED** paper IOTC–2025–WPEB21(AS)–08 which provided the 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.

27. The WPEB **NOTED** that the Secretariat continues to collect information on NPOAs from CPCs and provides links in the NPOA portal on the IOTC website (http://iotc.org/science/status-of-national-plans-of-action-and-fao-guidelines) to the actual plan documents.

28. The WPEB **THANKED** those CPCs who had already submitted these documents and **REQUESTED** CPCs who had not yet done so to submit their NPOAs to the Secretariat to be uploaded onto the NPOA portal. The WPEB **ENCOURAGED** participants to view these documents.

29. The WPEB **NOTED** small revisions to the previous update on NPOA including the revision of outdated plans and updates to the progress of developing new plans of action for CPCs that do not yet have NPOAs in place.

30. The WPEB **NOTED** that India published their NPOA for sharks in 2024 but this has not yet been made available to the IOTC.

31. The WPEB **NOTED** that Sri Lanka has reviewed a new NPOA for sharks but this is awaiting final approval.

32. The WPEB **NOTED** that Tanzania has developed a NPOA for sharks which is expected to be published in September 2025.

33. The WPEB **NOTED** that Thailand finalised a NPOA for seabirds and submitted this to the Secretariat.

34. The WPEB **NOTED** a suggestion to distinguish between NPOAs which have been recently reviewed with those that were reviewed a while ago suggesting that a revision could be beneficial.

5.2 Updated status of national fisheries and bycatch (CPCs)

35. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-12 on Blue shark (*Prionace glauca*) bycatch in the tuna longline fishery in Sri Lanka, including the following abstract provided by the authors:

    "Growing conservation concerns have arisen for sharks due to their high vulnerability to the tuna longline fishery. The Blue shark (Prionace glauca) is commonly identified as a bycatch species associated with the tuna longline fishery in Sri Lanka. However, there is a paucity of species-specific data on blue shark landings in Sri Lanka. Therefore, the present study aims to assess key fisheries aspects and reproductive features, including bycatch composition, Catch-per-Unit-Effort (CPUE), the effect of bait and hook type, length distribution, sex ratio, and spatial distribution of blue sharks based on data collected from port sampling, logbooks, and the observer programme from 2020 to 2023. A total of 218 male (102-310 cm TL) and 209 female (113–298 cm TL) blue sharks were studied. The results indicated that blue sharks (43%) were the second most dominant species, followed by Silky shark (33.1%) and Shortfin Mako shark (8.3%). The maximum nominal CPUE value was 0.16 in 2023, subject to variations related to fishing operations. J hooks contributed to the highest CPUE (1.8 indi/1000 hooks), while squid and "other" bait types were identified as the dominant baits, influencing blue sharks entangling in longlines. The length frequency distribution was normal. The sex ratio among the samples was approximately 1:1. Maturity stages were analyzed solely for male sharks based on clasper length and calcification. Clasper length of mature males was greater than 12

cm. The highest percentage of sexually mature male sharks was recorded in March and September-October each year."

36. The WPEB **NOTED** that approximately 1,000 t of all shark species are caught yearly in all Sri Lankan fisheries.

37. The WPEB **NOTED** the increase in the CPUE rate since 2021 and **NOTED** that during the pandemic the port sampling was restricted and logbook data catches were very low for blue shark so this impacted the CPUE. The WPEB **NOTED** that previous studies had recorded much higher CPUE rates prior to the pandemic.

38. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-13 on Impacts of Industrial Longline Fisheries on Elasmobranch Species Captured in Kenya's Exclusive Economic Zone, including the following abstract provided by the authors:

    "This study presents the first comprehensive assessment of industrial longline fisheries and their interactions with elasmobranch species within Kenya's Exclusive Economic Zone (EEZ). It analyzes the spatial distribution of longline catches within Kenya's Exclusive Economic Zone (EEZ) and beyond, with a specific focus on the incidental capture of vulnerable shark species." – see paper for full abstract

39. The WPEB **NOTED** that the catches of silky shark and other species were highly variable between the years and **NOTED** that this is likely due to the changing fleet dynamics both within each year and between years.

40. The WPEB **NOTED** that there has been one vessel targeting tuna since 2016 then others have been targeting swordfish since 2020. The WPEB **NOTED** that the target species will impact the type of bycatch caught due to the depth distribution of hooks set when targeting tuna compared with swordfish. Therefore, the WPEB **SUGGESTED** that the target species as well as the hook soak time are investigated in future work.

41. **NOTING** the species distribution data presented in the paper, the WPEB **ENCOURAGED** the inclusion of these data in wider species distribution datasets that are under development.

42. The WPEB **NOTED** that CPUE rates were not calculated as part of this study as the focus was to examine the impact of the fisheries on the shark populations specifically as well as their catch rates and distribution.

43. The WPEB **NOTED** that the study found that the catch rates of blue shark were higher than for any other species. The WPEB further **NOTED** that fleets had been retaining shortfin mako until Resolution 25/08 was brought in.

44. The WPEB **NOTED** that the Secretariat has seen improvements to the shark (and other species) catch data being submitted by Kenya in recent years and **NOTED** that this could be attributed to a data reporting workshop that was facilitated by the IOTC Secretariat for Kenya.

45. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-14 on Bycatch of Thai handline fishery in Western Indian Ocean, including the following abstract provided by the authors:

    "This study investigates bycatch in Thai handline fishery operations in the Western Indian Ocean. Data were collected by scientific onboard observers during a 44-day fishing trip in April-May 2024, operating in the area of 9°-11°S, 60°-62°E. The handline fishery reported a total catch of 170.42 tons, with 4.47 tons of bycatch (2.62% of total catch). Bycatch occurred in 31 out of 55 hauls (56% encounter frequency). All bycatch comprised elasmobranch species, including five shark species and one ray species. Requiem sharks (Carcharhinus spp.) were most frequently caught, followed by Tawny nurse shark (Nebrius ferrugineus) and Brown stingray (Bathytoshia lata). Nearly all catch (99.9%) was

retained onboard for landing. Length analysis of 40 measured specimens revealed that some shark species were caught below their length at first maturity while others were above, indicating the area serves as habitat for various life stages. The findings demonstrate that Thai handline fishery has relatively low bycatch rates, though the exclusive capture of elasmobranch species raises conservation considerations for these vulnerable taxa in the Western Indian Ocean."

46. The WPEB **NOTED** that there appear to be some issues with the identification of shark species in Thailand and **NOTED** that this is thought to also be an issue in other CPCs.

47. The WPEB **NOTED** that the Secretariat organised a species ID workshop in Sri Lanka in 2024 and will be holding another in India in September 2025. The WPEB **NOTED** that by October, participants from around 20 CPCs will have received this training and the participants are encouraged to share what they have learnt with their colleagues and enumerators in their countries. The WPEB **NOTED** that these workshops cover identification of the main tuna and tuna-like species as well as the key shark species encountered in IOTC fisheries. The WPEB **NOTED** that these workshops should help to improve the reporting of data to species level.

48. The WPEB **NOTED** that Shark Trust has been developing a range of guidance and identification materials for European fisheries and is also planning to develop these for RFMOs in the near future.

49. The WPEB **NOTED** that only two Thai vessels have been operating in the Western Indian Ocean and high seas areas. The WPEB further **NOTED** that these vessels conduct both demersal and pelagic fisheries using handlines.

50. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-15 on Status of sharks in India's artisanal fisheries with a focus on shark conservation in India, including the following abstract provided by the authors:

    "India's marine artisanal fisheries involve diverse fleets, fishing crafts (<24 m OAL), area of operation and species. Sharks are an economically important group in artisanal fisheries, as sharks are retained fully, traded and consumed in various forms, and are also part of local culture. Sharks are mainly landed as bycatch in the artisanal fisheries of the country, including the tuna fisheries as there is very limited and localized targeted fishing of the group. Though more than 80 species of sharks are reported in Indian fisheries, only a few species form regular component in the country's artisanal fisheries. In this working paper, we highlight the status of sharks with a focus on the sharks which are presently the current priority for the WPEB of the IOTC. Of the shark species focused by the WPEB, this work highlights the fishery status including contribution to landings, major landing sites and size composition of the scalloped hammerhead shark Sphyrna lewini, the silky shark Carcharhinus falciformis, two species of thresher sharks Alopias spp. and two species of the mako sharks Isurus spp. in India's artisanal fisheries. We also highlight the conservation measures India has adopted to protect shark species and to ensure sustainability of threatened marine fauna, including NPOA Sharks and NDFs."

51. The WPEB **NOTED** that the data presented include catches from the entire artisanal fleet in India, not just from the fleets targeting tunas.

52. The WPEB **RECALLED** information that has been presented in the past which casted doubt over whether common thresher sharks are actually found in the Indian Ocean. The WPEB **ENCOURAGED** experts in India to investigate whether this species is actually being landed there.

53. The WPEB **NOTED** that reported landings of thresher shark species remain high despite the fact that IOTC Resolution 12/09 bans the retention of these species. The WPEB **NOTED** that India has a negative Non-Detrimental Finding (NDF) for thresher sharks which indicates that the trade of these species would be detrimental to the survival of their populations so export is prohibited. However, the WPEB **NOTED** that there is not yet any domestic law protecting these species unlike oceanic

whitetip shark which is also prohibited from retention by IOTC Resolution 25/08 (previously 13/06) but does have the protection of domestic legislation.

54. The WPEB **NOTED** that historically the whole animal has been used so finning has never been seen as a large problem and further **NOTED** that India has a domestic ban on exporting shark fins.

55. The WPEB **NOTED** that currently the Secretariat only holds species aggregated data for sharks from India despite the paper making it clear that species disaggregated data do exist. The WPEB therefore **ENCOURAGED** India to work with the Secretariat to reconstruct the species composition data series.

56. The WPEB **NOTED** that India objected to Resolution 25/08 due to concerns about the additional reporting burden that it entailed but **NOTED** that they do not specifically object to the conservation measures within the Resolution.

6. Review information on biology, ecology, fisheries and environmental data relating to sharks

6.1 Presentation of new information available on sharks

57. The WPEB **NOTED** paragraph 41 of Resolution 25/08:

    "The IOTC Scientific Committee shall review annually the information reported by CPCs pursuant to this Resolution and the results of the research project pursuant to paragraph 38, on a gear-by-gear-basis. On this basis, the IOTC Scientific Committee shall, as appropriate and on an annual basis, provide recommendations to the Commission on ways to strengthen the conservation and management of sharks within IOTC."

58. To address this, the WPEB **AGREED** that on an annual basis the WPEB will review which other sharks are considered vulnerable in need of specific protection by prohibition of their retention and / or in need of specific measures to reduce mortality and propose identified species / measures to the SC.

59. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-17 on an update for 2024-2025 on the development of IOTC BTH PRM Project, including the following abstract provided by the authors:

    "This note provides recent updates on IOTC bigeye thresher shark (Alopias superciliosus, BTH) post-release mortality study project (IOTC BTH PRM Project). The objective of the study is to evaluate the efficiency of the IOTC Conservation and Management Measure on non-retention of thresher sharks of the genus Alopias (Resolution 12/09). The summary of collective efforts since the 13th, 14th, 15th, 16th, 17th, 18th, 19th, and 20th IOTC WPEB are presented."

60. The WPEB **NOTED** that good progress has been made in 2024-2025 with the deployment of 5 miniPATs and 3 sPATs and all sharks tagged were found to have survived post-release until the pre-programmed pop-off date.

61. The WPEB **NOTED** that 23 tags remain available for tagging. The WPEB **NOTED** the suggestion by the author to extend the project until 2028 to allow time to deploy all tags and conduct the analyses – the author expects to finish all field operations by the end of 2026/early 2027 if the deployment continues at a similar rate.

62. The WPEB **NOTED** that technical issues related to batteries with Wildlife Computers described by the authors were also found in other tagging experiments, such as those conducted by Portuguese scientists. However, the WPEB also **NOTED** that battery issues have recently improved and that Wildlife Computers is offering full warranty and therefore replacing failed tags.

63. The WPEB **NOTED** that Portuguese scientists are also looking into other tag providers such as Lotek, which the authors discouraged based on previous experience with PSAT tags from Lotek, notably

because they do not have a depth-based release mechanism, as well as the fact that the customer support is not reactive when there are issues.

64. Scientists conducting tagging experiments were also **ENCOURAGED** by the WPEB to share information about other issues they might have encountered, especially to explain premature releases. Premature releases are believed to be mostly explained by anchor choice and quality of anchoring.

65. The WPEB **NOTED** that China was initially involved in the project but withdrew and returned tags to the project leader. The WPEB **NOTED** that CPCs that have fisheries where bigeye thresher sharks are caught are **ENCOURAGED** to join the project. The WPEB further **NOTED** that tagging training will be provided.

66. The WPEB **NOTED** that collaboration in tagging projects within IOTC face persistent challenges, notably limited time and funding, uneven participation among CPCs, and the absence of a dedicated coordinator. Although the project leader contributed voluntarily, reliance on unpaid efforts is unsustainable. Increasing MPF for emerging countries and allocating more budget to field operations could ease financial barriers, while appointing a focal point within the Secretariat could improve coordination and follow-up. Incentives such as recognition, training, and involvement in publications could encourage scientists to engage more actively. As highlighted by comparisons with ICCAT's tagging program, sustained participation takes time, but targeted incentives and structured coordination could significantly strengthen regional collaboration.

67. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-18 on Standardized CPUE of oceanic whitetip shark bycaught by the French Reunion-based pelagic longline fishery (2007-2024), including the following abstract provided by the authors:

    "The oceanic whitetip shark Carcharhinus longimanus is a relatively common bycatch of the French swordfish-targeting longline fishery operating in the southwestern Indian Ocean. Using observer and self-reported data collected aboard these longliners between 2007 and 2024, we present a standardized CPUE series for oceanic whitetip shark. The index was estimated using a Generalized Additive Mixed Model (GAMM) with a Negative Binomial distribution, which appropriately handled the high proportion of zero catches in the data. For the upcoming stock assessment, we recommend using the standardized CPUE for the period comprised between 2011 and 2024 where the monitoring effort has been consequent in comparison with previous years. Throughout this period, the standardized CPUE for the oceanic whitetip shark shows a slight but significant increasing trend."

68. The WPEB **NOTED** that the increase in nominal oceanic whitetip shark CPUE in recent years can be attributed to increased fishing in the Mozambique Channel, more hooks deployed per set than usual, longer soaking time, and day-round fishing operations, leading to higher shark catches. The WPEB further **NOTED** that the standardisation model does include the area effect (5x5 squares) to correct for this recent pattern in the French longline fishery, and the authors consider that it is likely to provide a reliable abundance index. The WPEB **NOTED** that only monofilament leaders are used in this fishery.

69. **ACKNOWLEDGING** concerns about overfitting in the model, the WPEB **NOTED** that there are adjustments that could be made to avoid this such as binning percentages of circle hooks into categories, which the authors **AGREED** to investigate.

70. **ACKNOWLEDGING** the relative gap in the percentage of observations with squid-baited hooks below 40%, the WPEB **ADVISED** the authors to trim the dataset in order to remove those observations and obtain a more reliable partial effect of the percentage of squid-baited hooks.

71. The WPEB **NOTED** that model selection was based on AIC and on residuals analysis.

72. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-19 on Distribution of blue sharks and shortfin mako sharks across the IOTC/ICCAT tRFMO boundary, including the following abstract provided by the authors:

    "Pelagic sharks, including the blue shark Prionace glauca and the shortfin mako Isurus oxyrinchus, exhibit extensive spatial distributions that may extend across jurisdictional boundaries of tuna Regional Fisheries Management Organisations (tRFMOs). Such transboundary movements present challenges for data reporting, stock assessment and management. Using satellite telemetry of a small number of individuals tagged off South Africa, this study demonstrates that both species routinely cross the IOTC/ICCAT boundary at 20°E. For blue sharks, although only three individuals' tracks were used, their movements suggest the potential for localised residency in addition to broad-scale dispersal. Furthermore, previous research has provided evidence for parturition habitats within the Benguela–Agulhas transition zone that straddles the boundary. Since this boundary encompasses an area of biological importance that is closely linked to dynamic environmental conditions, the location and extent of parturition habitats are likely to fluctuate over time, further complicating the delineation of management units and the interpretation of fisheries-dependent indices. Shortfin mako sharks displayed consistent site fidelity to the Agulhas Bank shelf edge, with movement patterns strongly associated with the Agulhas Current retroflection and associated mesoscale eddies. These findings align with previous work (e.g. Parker et al. 2017), which highlighted how the application of the IOTC/ICCAT boundary can introduce spurious variability into reported shortfin mako statistics. Collectively, the results indicate that truncating datasets or CPUE indices at this boundary is biologically unjustified and potentially risks introducing bias into assessments of wide-ranging pelagic sharks."

73. The WPEB **NOTED** that shortfin mako sharks reproduce off the west coast of South Africa and that juveniles move south and east towards the boundary between the ICCAT and IOTC areas of competence, where they are consistently caught.

74. The WPEB **NOTED** that the Agulhas bank should be considered as a transition zone for sharks between ICCAT and IOTC areas of competence, rather than a boundary.

75. The WPEB **SUGGESTED** that sharks caught in the ICCAT area could be used as an explanatory variable in the CPUE analyses.

76. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-20 on Updated Insights into the Reproductive Biology of Blue Sharks (*Prionace glauca*) in the Western Indian Ocean Based on Longline Observer Data from 2010–2023, including the following abstract provided by the authors:

    "This study updates and expands knowledge of the reproductive biology of blue sharks (Prionace glauca) in the western Indian Ocean, based on longline observer data collected between 2010 and 2023. Biological and georeferenced data were analyzed to examine fork length distribution, size at sexual maturity, fecundity, and seasonal patterns. A total of 791 males (33–249.5 cm FL) and 803 females (12–349.6 cm FL) were recorded during 2010–2020, while 403 males (109–286 cm FL) and 629 females (87–286 cm FL) were sampled from equatorial waters in 2022–2023. The recent dataset showed a female-biased sex ratio and a greater prevalency of larger individuals. Sexual maturity was assessed from reproductive organ morphology. Fork length at 50% maturity was estimated at 161.4 cm for males and 179.3 cm for females in the earlier period, compared with 163.7 cm and 197.6 cm, respectively, in the recent dataset. Average litter size increased from 30.1 pups in 2010–2020 to 48.2 pups in 2022–2023, with an overall mean of 36.8 pups. Variation in size at maturity and fecundity may reflect regional variation in population structure or gear selectivity, and warrants further investigation. These findings provide essential biological parameters for future stock assessments and support the sustainable conservation and management of blue sharks in the Indian Ocean."

77. The WPEB **NOTED** an asymmetry in embryo sex ratio which appears to be consistent among all females sampled.
78. The WPEB **NOTED** that the maturity scale used for blue shark is based on Fujinami et al. (2017) and Hazin (2011).
79. The WPEB **ADVISED** the authors to include the spatial effect in the model to remove the effect of the year and spatial distribution.
80. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-21 on Best practices, habitat and survival rate of elasmobranch caught by French tropical tuna purse seiners - BEHAVE project, including the following abstract provided by the authors:

    "*In recent decades, the incidental mortality of sensitive species caught by fishing vessels has become a major concern for the sustainability of fisheries. In 2012, French scientists from IRD and Ifremer developed the first guidelines for the safe handling and release of sharks, whale sharks, rays and sea turtles. A decade later, in 2022, a comprehensive review assessed how these "Best Practices" were being applied onboard French and associated-flag purse seiners operating in the Atlantic and Indian oceans. This study revealed persistent challenges, particularly with the release of large or potentially dangerous animals such as sharks and large pelagic rays. To address this issue, the BEHAVE project, funded by the European Union, was launched in June 2024. Its objectives are to (i) test new release equipments for sharks and large rays, (ii) evaluate the effectiveness of these new equipments and techniques in improving post-release survival, and (iii) advance scientific knowledge on the migrations, habitat and behaviour of large rays. This document provides a detailed overview of the BEHAVE project and the progress made since its launch in June 2024.*"
81. The WPEB **NOTED** that similar trials were conducted on Spanish purse seine vessels. The WPEB further **NOTED** that details on releasing devices will be shared between France and Spain.
82. The WPEB **NOTED** that the BEHAVE project is very ambitious, planning to deploy a large number of tags on mobula rays (40) considering that the interaction rate with those species is quite low. The WPEB further **NOTED** that tags will be deployed by observers and potentially trained crew members to increase the chances of tagging mobula rays. The WPEB also **NOTED** that Spanish scientists offered help with deploying tags.
83. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-22 on Comparison of catch rate and mortality of sharks by leader-type based on observer data in the Indian Ocean, including the following abstract provided by the authors:

    "In this document, we report the usage of wire leader by Japanese tuna longline fishery in the Indian Ocean and the results of analysis on the effects of the leader types on the catch rate and mortality of blue shark, based on the observer data for Japanese commercial tuna longline vessel collected between 2011 and 2024.

    A total of 93 cruise and 6,113 operations were available, and these operations covered the wide areas ranging from tropical to temperate waters of Indian Ocean. While the ratio of wire leader per total hook ranged from 0 % (monofilament leader only) to 100 % (wire leader only) on operational base, the actual utilization of wire leader (28% of total operation) was limited.

    The effects of leader type on the CPUE (catch number of blue shark per 1,000 hooks) and mortality for blue shark were evaluated using statistical models (GLMM/GLM), considering the various covariates such as the ratio of wire leader, year, area, season, hook type, and sea surface temperature (SST). For CPUE analysis, the effect of leader type was not statistically significant (p=0.34), while the effect of leader type on mortality was statistically significant (p < 0.05), and the mortality rate decreased with the increase of the ratio of wire leader.

Additional analysis with the aim of improving the bias of dataset did not support the positive conservation impact by the use of monofilament leader in terms of catch rate and mortality, compared to wire leader in several types of longline operations. This result needs to be confirmed by further data collection, research and discussion, followed by the evaluation on the conservation effect of replacement of wire leader to monofilament leader on shark species in the Indian Ocean."

84. The WPEB **THANKED** the authors for this updated analysis and **ACKNOWLEDED** that it shows some good improvements compared to the previous analyses as it includes a much larger dataset and improved data analysis techniques.

85. The WPEB **NOTED** that the main challenge was the difficulty in modelling the spatial effects and that the results of the analysis may reflect differences in fishing area confounded with changes in subregional abundance and subregional differences in the use of different leader types. This means it's not possible to draw firm conclusions on leader effects and relative conservation benefits of different leader materials from this paper.

86. The WPEB **ENCOURAGED** the inclusion of bait type (squid or fish), soaking time, and hooking time in future analyses, **ACKNOWLEDGING** however, that tuna hooks clearly dominated across fishing operations. The WPEB further **NOTED** that there is a correlation between the number of hooks per basket (HPB) and fishing area, which is why HPB was removed from the model.

87. **ACKNOWLEDGING** that the choice between wire and monofilament leaders is often based on fishermen preferences and that confusion may arise when multiple leader types are used, making it difficult to assess the individual effect of each, the WPEB **ENCOURAGED** the development of an index to quantify the extent of wire leader usage.

88. The WPEB **ACKNOWLEGED** the difficulty of conducting a fine-scale analysis of bait type proportions, citing the example of the Japanese fleet where fish-baited hooks predominate, relative to squid-baited hooks.

89. Finally, the WPEB **ENCOURAGED** the calculation of the ratio of blue shark to target species, to better assess the impact of fishing activities on the blue shark. The WPEB **NOTED** that this can be challenging as the targeted species vary a lot depending on area and latitude.

90. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-23 on Post-release mortality of pelagic sharks caught by longliners – POREMO and ASUR projects, including the following abstract provided by the authors:

"Pelagic sharks are occasionally caught incidentally by longliners operating in the Indian Ocean, among them species that are classified as vulnerable, endangered and critically endangered by IUCN and listed on CITES Annex II. Retention of some pelagic shark species is prohibited by IOTC (e.g. oceanic whitetip shark, thresher sharks) and despite the efforts made by fishing crew members to safely handling and releasing these sharks, post-release mortality (PRM) needs to be assessed. Projects POREMO (2018-2023) and ASUR (2020-2023) were dedicated to this task, the former solely on oceanic whitetip shark, and the latter on all shark species bycaught by longliners. Onboard observers deployed respectively 14 and 40 electronic popup tags on 6 shark species (blue shark – BSH, silky shark – FAL, oceanic whitetip – OCS, shortfin mako – SMA, scalloped hammerhead – SPL, smooth hammerhead – SPZ, tiger shark – TIG) bycaught and release by French and Portuguese longliners in the south-western Indian Ocean between 2018 and 2025. Based on 46 tags that reported data, we determined the overall PRM rate for each species and intended to explore the potential effect of tagging conditions, time spent on deck, hook type, hooking location, removal of hook, length of line trail, fish condition upon, length of the individual, and sex, on PRM. We found very few cases of mortality, hence high survival rate after release: 100 % for BSH, SMA, SPL and SPZ, 95 % for OCS, 75 % for FAL, and 67 % for TIG. Despite extensive information collected by observers, due to unbalanced

samples, drivers of PRM could not be thoroughly investigated. However, we were able to show that time spent on deck impairs FAL survivability, and that J-hooks yield higher mortality in OCS. Overall, this study suggests that retention bans for sharks together with best practices for releasing sharks would be an efficient conservation measure."

91. **ACKNOWLEDGING** that bait type (fish vs squid) may influence how sharks attack the bait and hence hooking location, the WPEB **SUGGESTED** that this information is collected in future tagging experiments looking to estimate post-release mortality.

92. The WPEB **NOTED** that longliners in Reunion mostly used circle and J-hooks even though tuna hooks have also been used and still are used to a much lesser extent by a few vessels. The WPEB further **NOTED** that Reunionese longliners use large circle hooks (size 16/0).

93. The WPEB **NOTED** that tagging operations generally involve 2 to 4 persons on board, including the tagger.

94. The WPEB **NOTED** that titanium anchors were used for sharks tagged on longliners and that premature detachment rate was lower by 2-fold than when Domeier anchors were used for tagging oceanic whitetip sharks on purse seiners from the same project (POREMO). The WPEB also **NOTED** that very premature releases may have been caused by either poor anchoring or poorly rigged tags provided by the tag provider, where sleeves crimped on the tag tether were loose.

95. **NOTING** that both this study and a previous study examining post release mortality of oceanic whitetip sharks in the purse seine fishery showed a very high survival rate by these sharks, the WPEB **NOTED** that the introduction of conservation measures relating to prompt release of sharks or prohibiting their handling could help to conserve the species.

96. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-24 on Designing experimental fishing trials to explore the effects of leader material on catch and mortality of sharks: A review of best practice, principles and criteria, including the following abstract provided by the authors:

    "This paper presents a review of, and recommendations relating to, best practice principles and criteria for designing and conducting scientific fishing trials that aim to assess the relative effects of wire and nylon monofilament leader materials on the catch and mortality of sharks. More specifically, the papers recommendations are a response to the requirement specified in Paragraph 17 of IOTC Resolution 25-08 (On the conservation of sharks caught in association with fisheries managed by IOTC), which states that any such scientific trial "will be conducted using an appropriate experimental design and analysed using appropriate statistical methods, the criteria and principles of which will be developed and agreed by the IOTC Scientific Committee at the annual Session in 2025". – see paper for full abstract.

97. The WPEB **NOTED** that scientific trials differ from commercial fishing operations and may not be directly applicable in commercial fishing operations. The WPEB therefore **EMPHASISED** the importance of considering the practicality and feasibility of proposed measures when conducting such trials.

98. The WPEB also **NOTED** that it would be preferable for future studies to be conducted collaboratively by multiple CPCs across different regions, rather than by a single CPC in a specific area. This would help ensure broader coverage across fleets and fishing zones and would help to cover the distribution of more species. While **ACKNOWLEDGING** that operational aspects of each fleet may differ, the WPEB **NOTED** that such trials conducted in collaboration with multiple CPCs would still require as much consistency as possible in trial methodology.

99. The WPEB **ENCOURAGED** the collection of more detailed information on bait types (e.g. fish vs. squid) during future trials, as bait appears to influence hook placement in sharks. The WPEB also

NOTED that data on the branchline length pulled by sharks (i.e., how much line is taken during an interaction) could be valuable.

100. The WPEB **NOTED** that Resolution 25-08 requires that:

- *Paragraph 15 - In order for any CPCs to continue to use wire trace north of 20S at least one CPCs will undertake scientific fishing trials to assess the effects of leader materials on the mortality of vulnerable shark species (including oceanic whitetip shark, silky shark, shortfin mako and thresher sharks) and blue sharks...*
- *Paragraph 16 - The trials objective will be to determine if, for the CPCs fleet, the use of wire leaders has a higher catch and mortality for the vulnerable and target shark species (both in total and by species) than does use of nylon monofilament leaders.*
- *Paragraph 17 - The trials will be conducted using an appropriate experimental design and analysed using appropriate statistical methods, the criteria and principles of which will be developed and agreed by the IOTC Scientific Committee at the annual Session in 2025.*

101. The WPEB **REQUESTED** that the SC consider and discuss how best to conduct trials to test leader effects on vulnerable species to take into account when they have differing distributions and core areas of abundance.

102. With respect to paragraph 17 in particular, the WPEB discussed the recommended criteria and principles proposed by paper IOTC-2025-WPEB21(AS)-24. In general, the WPEB **NOTED** that the proposed criteria and principles were appropriate and based on well-established and tested scientific principles and practice for scientific experiments. WPEB **NOTED** the following points raised by participants during discussion:

- The conducting of scientific fishing trials can be logistically intensive and challenging (including to find appropriate survey design as well as candidate vessels and required funds), and the interpretation of results can be subject to limitations due to pragmatic difficulty of covering all key variables in particular time, area, and operational differences.
- Scientific fishing trials are the approach required under Resolution 25/08, however, some participants considered that careful consideration would be needed before determining that scientific fishing trials are the best way to evaluate the objective, from the practicality and feasibility aspects.
- Prior to scientific fishing trials being conducted, the Scientific Committee should discuss and agree on the handling of logistical matters, including who bears the cost, accessibility to obtained information, treatment of tunas and shark catch taken, review mechanism of results, and corresponding risks in management.
- If possible, those CPCs wishing to continue to use wire trace north of 20ºS should collaborate to conduct such trials, as it may be more difficult for one CPC to cover different areas (if required) or collect sufficient data in the IOTC region. A collaboration approach was also proposed by the authors of paper IOTC-2025-WPEB21(AS)-22.
- The scientific fishing trials can be conducted either via scientific research vessels or on commercial fishing vessels (with scientific observers coordinating trial activities). Conducting trials on commercial vessels may ensure more authentic fishing conditions but can sometimes add additional constraints to survey design.
- Any trial should consider adding additional data collection fields to those mentioned under criteria #6 in the paper IOTC-2025-WPEB21(AS)-24 (for example time since hooking using hook-timers, mean fishing depth using temperature-depth recorders (TDRs), the length of the leader remaining in the bite-offs, estimated fish length) and should also consider if other variables (e.g. bait type) should be included in the trial design, if they are considered likely to interact with leader type effects, with at-haulback mortality risk or with the number of bite-offs.

103. The WPEB **RECOMMENDED** that the Scientific Committee take into account the criteria outlined in the IOTC-2025-WPEB21(AS)-24 (below) and points raised above when discussing the principles for conducting an experimental fishing trial(s) as requested per Resolution 25-08. For reference, the criteria outlined in IOTC-2025-WPEB21(AS)-24 are as follows:

- That the trial is conducted in areas and seasons with known high shark abundance (including of vulnerable shark species), using existing data from Indian Ocean Regional Observer Scheme (ROS) data or surveys to identify suitable hotspots.
- Before the trial, conduct a power analysis (following Watson et al. 2005) informed by historical bycatch data from the Indian Ocean to determine the number of sets required to detect a true effect (for each vulnerable species), thereby avoiding a Type II error.
- That the trial employs a "paired comparison" approach by alternating control (nylon monofilament) and experimental (wire) leaders along each longline section. Also, alternate the leader type on the first branch line for every subsequent fishing set to ensure a balanced design.
- That the trial standardises all gear and operational practices, including, *inter alia*, soak time, setting/hauling times, bait/hook types and branch line/leader lengths and other gear characteristics (e.g. use of lightsticks) to assist the trial in isolating the effect of leader material.
- Use at least one, and preferably two, independent observers or scientific researchers who are trained in longline operations and species identification to minimise human error and observational bias.
- Establish a standardised protocol for collecting data. Key metrics to record are species ID, leader material, fate (retained/discarded), condition at haulback, and the occurrence of bite-offs and the length of the leader remaining in the branchline of bite-offs.
- Ensure the trial vessel skipper and crew are briefed on the trial's objectives and design, and that they support the experimental protocols.
- Develop the statistical analysis plan in collaboration with biostatisticians. Appropriate statistical approaches may include hierarchical or mixed-effect models (e.g., GLMMs) to analyse key response variables, including: CPUE, bite-off rate, and haulback mortality rate.

6.2 Development of shark research work plan

104. The WPEB **NOTED** that TORs for a shark research plan have been requested by the Commission. The WPEB **NOTED** that a shark research plan has been in discussion for the last couple of years and that in 2024, the WPEB **AGREED** that a workshop should be held in 2026 to update the shark year plan that was developed by IOTC a few years ago. The WPEB **NOTED** that this update is scheduled for next year and would include a small group of experts, including the original authors.

105. The WPEB **NOTED** the intention to hold this workshop in person and so **NOTED** that funding may be required from IOTC for this.

106. The WPEB **NOTED** that this request from the Commission can be properly addressed once the workshop has been held.

107. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-25 on Resolution 2025-08 as an opportunity to step up science driven conservation and management measure at IOTC for both sharks that are directly targeted and sharks caught as a bycatch in tuna and multi-species fisheries, including the following abstract provided by the authors:

"*In 2025 the IOTC Commission adopted a new Resolution 25/08 On the Conservation of Sharks in Association with Fisheries managed by IOTC after having failed to adopt meaningful measures for sharks over the last 10 years and having let stocks being overexploited without limits. While the adopted resolution includes many compromises so that consensus could be achieved for adoption after two failed attempts in the years before, there are several scientific tasks formulated that require* *follow up by the WPEB and the SC to be delivered for the 2026 Commission Meeting. While obviously requiring capacity these tasks include a long-awaited opportunity for scientists to step up management and conservation measures for sharks at IOTC by defining catch limits for blue sharks, best handling and release procedures for unwanted bycatch. Input to the design and objectives for a mortality comparison between gear modifications, improved reporting requirements at species level and a potential retention ban for endangered whale sharks. The paper analyses possible approaches to these requests and proposes respective measures integrating all of them into a systematic "bycatch mitigation" respectively a mortality reduction hierarchy which should be respected when agreeing on a way forward and potential terms of reference for the longtime shark project to be conducted within the IOTC's Area of Competence. Transitioning from a mostly research and remediation driven management approach to effective catch minimisation and/or avoidance strategies are discussed and measures identified for inclusion into the terms of reference for a long-term shark research project to be initiated. SMART objectives addressing mortality reductions should be agreed upon and could also be integrated into an IOTC Regional Plan of Action for elasmobranchs that could also inform regional NDFs for CITES listed Species*."

108. The WPEB **NOTED** several recommendations from the author regarding options to improve management of sharks caught in IOTC fisheries including improving knowledge of bycatch mitigation techniques, improving handling practices and improving data reporting on sharks.

109. The WPEB **ENCOURAGED** CPCs to conduct trials to test shark repellents, such as LED lights, in gillnet fisheries. The WPEB **NOTED** that LED lights efficiently repel sharks (95% reduction of elasmobranch catches) and hence appear to be a cost-effective and simple solution to reduce elasmobranch bycatch in gillnets, despite the fact that sharks are colour blind.

110. The WPEB also **NOTED** that retention bans already exist for the whale shark in the IOTC, ICCAT and WCPFC, even though the IOTC has a clause indicating that this ban has not yet come into effect and needs to be validated by the Scientific Committee.

111. The WPEB **RECALLED** that issues relating to the ban on finning and the compliance of each CPC with this ban should be addressed by the Compliance Committee, but further **NOTED** that this matter should also be discussed within the WPEB, as it is in the WCPFC.

112. The WPEB **NOTED** that interactions between IOTC fisheries and great white sharks exist but are rare and the species is not included in the list of species for which reporting is mandatory meaning that no catches have been reported to the Secretariat.

113. **NOTING** that Resolution 15/01 includes a list of species for which reporting catch data is mandatory/optional and that varies by gear and by fishery type (i.e. artisanal vs commercial fisheries), the WPEB **NOTED** that many species of interest to the WPEB are not mandatory for reporting for all gears or fishery type. The WPEB therefore **RECOMMENDED** that the SC review the list of species that are mandatory for reporting to species level while considering the feasibility of such data collection, and included the following suggested changes:

- Silky sharks to be added also for gillnets fisheries
- Hammerhead sharks to be reported at species level at least for scalloped, smooth and great hammerhead sharks for all gear types (explicitly including purse seine fisheries)
- Mantas and devil rays to be reported at species level differentiating at least between manta rays (giant manta and reef manta) and other devil rays adding them for mandatory reporting at least for purse seine fisheries and for gillnet fisheries instead of optional
- Great white sharks as mandatory for all gear types
- Oceanic whitetip sharks as mandatory for all gear types.

114. The WPEB further **NOTED** that reporting requirements on gear specifications may also require review especially considering the additional requirement in Resolution 25/08 to ‘report the distribution and level of the use of wire leaders and monofilament leaders (and other leader types, if applicable) by CPC’. The WPEB **NOTED** that currently this information is not well captured in the data that are mandatory for reporting under Resolution 15/01.

6.3 Review of the minimum standards for safe handling and live release procedures (Annex III of Resolution 25/08) (all)

115. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-35 on New best handling and release practice guide for vulnerable bycatch tropical species in tropical tuna purse seiners, including the following abstract provided by the authors:

“Novel research has led to improvements in best handling and release practices (BHRP) for tuna purse seiners, some of which have not yet been incorporated in conservation measures of tuna regional fisheries management organization (tRFMO). The new tools and techniques are aimed at increasing crew safety and post-release survival rates of endangered, protected, and threatened (ETP) species, which can complement or improve existing recommended practices. Because most BHRP recommended by RMFOs are based on scientific work conducted a decade ago, we suggest updating BHRP by including these new bycatch release devices (BRDs) that include hoppers with ramps, shark velcros, lower deck gutters for sharks or sorting grids for mobulid rays. This equipment reduces direct contact between crew and dangerous species and simultaneously foments bycatch survival opportunities due to faster release times. Most described BDRs in the new guide are suitable for use in a variety of purse seiners, but larger devices might require specific vessel characteristics for their implementation (e.g., large free space on deck). Several fleets operating in all oceanic regions are actively participating in the refinement of BRD prototypes and employing them regularly during their commercial fishing operations. As BHRP evolve with new solutions and technologies, recommended guidelines should also be regularly updated to provide state-of-the-art bycatch mitigation advice to managers and industry.”

116. The WPEB **NOTED** the updated best handling and release practices for vulnerable bycatch species in tropical tuna purse seiners, based on the recent developments over the past five years.

117. The WPEB **RECOGNIZED** the usefulness of these practices and **ENCOURAGED** their application in purse seine fisheries operating in the IOTC area. However, the WPEB **NOTED** that some tools, such as shark velcro devices, are prohibited in other RFMOs (e.g. ICCAT, IATTC) and **AGREED** that further testing is required before recommending their adoption in IOTC. The WPEB **ACKNOWLEDGED** that preliminary survival results are encouraging, but **AGREED** that additional studies are needed to validate their effectiveness.

118. The WPEB **AGREED** on the importance of updating and streamlining best practices in Annex 3 of the relevant CMM (25/08) to reflect the latest scientific evidence.

119. The WPEB **NOTED** paragraph 24 of Resolution 25/08:

“With the aim to reduce post-release mortality, CPCs shall ensure that their flag vessels, when a shark is released, release the shark as soon as practically possible, taking into consideration the safety of the crew and observer, in accordance with the Minimum Standards for Safe Handling And Live Release Procedures set out in Annex III. The IOTC Scientific Committee shall review these Minimum Standards by 31 December 2025 and provide recommendations to the Commission on further improvements of the Minimum Standards for consideration and adoption at its annual Session in 2026.”

120. The WPEB **REVIEWED** the minimum standards set out in Annex III of this Resolution and **ADOPTED** the revisions made by members of the group which can be found in Annex XVVII. The WPEB **RECOMMENDED** that the SC **ENDORSE** these handling guidelines for consideration by the Commission in 2026. The WPEB further **NOTED** that work on best practice handling guidelines is ongoing and frequently evolves. The WPEB therefore **RECOMMENDED** that the SC suggest that the Commission consider adopting a master document containing handling guidelines for all taxa, rather than requiring Resolutions containing such guidelines to be updated when new information becomes available. Future Resolutions could then refer back to this master document adopted by the SC. The WPEB **AGREED** that a small working group will work on compiling these intersessionally for review by the SC.

7. Stock assessment for blue shark

7.1 Review of indicators for blue shark

121. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-16 on CPUE and catch distribution for blue shark in the Tanzanian EEZ.

122. The author was unavailable to present.

123. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-27 on Updated on CPUE standardization of blue shark (*Prionace glauca*) from Indonesian tuna longline fleets 2006-2024, including the following abstract provided by the authors:

"*The blue shark (Prionace glauca) is a main of shark by-catch in tuna longline fisheries, but its status is uncertain due to recent catch increases and conflicting data, particularly in the abundance index. this study aimed to update the CPUE of blue shark (BSH) to provide abundance indices in the eastern Indian Ocean utilising data obtained through scientific observer program. Catch and effort data from more than 172 trips and 4163 sets were obtained from the Indonesian scientific observer program, spanning the years 2006 to 2024. These data were spatially disaggregated into one-degree blocks and were collected alongside commercial longline fleets. To analyse the dataset, Nominal annual CPUEs were calculated as number (N)/1000 hook. Standardized CPUEs were estimated with Generalized Linear Models (GLMs) using Year, Quarter, nbf, Hooks and Area. Model goodness of-fit and model comparison was carried out with the Akaike Information Criteria (AIC) and the pseudo coefficient of determination (R^2) and model validation with a residual analysis. The final estimated indexes of abundance were calculated by least square means (LSMeans). The results showed that, no clear long-term pattern was detected, although relatively higher CPUE were observed in the more recent years but exhibited a decline trend in the past five years.*"

124. The WPEB **NOTED** the development of the CPUE index and praised the author for bringing this to the WPEB, however the WPEB **NOTED** that for inclusion in the stock assessment, the index needs to be presented at the WPEB(DP) meeting to allow for a full discussion of the methods used, and potentially for improvement of the index.

125. The WPEB **NOTED** that the index was an update of the Indonesian longline CPUE, mostly from Benoa (Bali) and was based on a total of 192 trips, mostly in the southeast Indian Ocean. The methods included using GLM and GLMM models. Data contained many zeros, so a Tweedie model was used with log-link function. Significant variables in the standardisation were area, year, hooks, HBF, quarter.

126. The WPEB **DISCUSSED** various aspects of the CPUE index. The low CPUE value in 2011 was **HIGHLIGHTED** as it was unusually low and biologically implausible (in terms of a drop in abundance) even though the percentage of positive sets (e.g. sets with blue shark catch) was higher than other years. The authors explained that higher catches are generally seen around 30°S when targeting

albacore, and in 2011, there were only 3 trips in the data with low observer coverage (only 5 blue shark individuals were caught).

127. The WPEB **NOTED** that differences in total hooks and trips (increasing trip numbers but decreasing mean hook numbers) were due to observer coverage and/or budgeting issues: earlier observers were scientifically trained, however since 2023, official fisheries observers have been used, and their skill level may not be as high as before. Additionally, these differences in hooks and trips could be due to variations in target species (e.g. bluefin tuna vs. Inshore species) which is related to the number of hooks (and hooks between floats).

128. The WPEB **DISCUSSED** how the CPUE index was obtained from the fitted values, and what standardisation method was used, **NOTING** that using "hooks" as both an explanatory variable and within the CPUE itself was an issue.

129. The WPEB **DISCUSSED** their concerns regarding the small CVs presented in the index and **NOTED** that wire leaders / shark line effects were not significant in previous iterations of the standardisation process and so they were not included in this year's index.

130. The WPEB **AGREED** that there was no time before the assessment to reconfigure the model, so the Indonesian CPUE will not be included in the assessment this year. However, the effort to produce the index was recognised as excellent, and it was **AGREED** that the index could be considered for inclusion in future assessments if presented at the Data Preparatory meeting.

131. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-10 on Spatio-temporal dynamics through standardized CPUE for blue shark caught by the Taiwanese large-scale tuna longline fishery in the Indian Ocean from 2005 to 2023, including the following abstract provided by the authors:

"Understanding spatiotemporal variability is crucial for accurate stock assessments and effective fishery management. This study examines the relative abundance of blue sharks (Prionace glauca) in the Indian Ocean using observer-based catch per unit effort (CPUE) data from the Taiwanese large-scale longline fishery collected between 2005 and 2023. We applied a spatiotemporal modeling approach (sdmTMB) to standardize the CPUE index. The nominal CPUE series displayed significant interannual variability, particularly a sharp decline in 2015. In contrast, the standardized CPUE exhibited a clearer trend: it increased steadily from 2005 to 2013, then fluctuated moderately but remained relatively stable through 2023. The coefficient of variation of standardized estimates decreased significantly from 28.0% to 12.0% during 2005–2013, indicating enhanced model precision, and stayed consistently below 25% thereafter. Spatial analyses identified recurring hotspots of blue shark abundance in the southwestern and southeastern Indian Ocean, especially during specific years and quarters, along with notable seasonal and interannual shifts in distribution. These findings highlight the importance of spatiotemporal standardization and suggest that blue shark abundance has remained relatively stable over the past two decades, potentially indicating optimal utilization. Future assessments should integrate environmental covariates to improve inference and support ecosystem-based management."

132. The WPEB **NOTED** the presentation used observer data, and fitted a sdmTMB model to the data, using quarter, depth, vessel size and gear as explanatory variables. A spatial mesh was fitted over the Indian Ocean using 212 knots. Two CPUE hotspots were identified (southern Africa, and southwest Western Australia). The CPUE rose between 2005-2013, declined post-2015, and then was stable through 2023.

133. The WPEB **DISCUSSED** the inclusion of spatio-temporal effects in the CPUE model and the potential effects that this may have on the index. Additionally, there were suggestions that the mesh size could be improved as it overlaps with landmasses. The WPEB **NOTED** that the authors will include some improvements to the index in time for future WPEB Data Preparatory meetings.

134. The WPEB **DISCUSSED** the inclusion of this index in the stock assessments for blue shark, **NOTING** that the index should have been presented at the WPEB(DP) meeting to allow all meeting participants sufficient time to review the methods. The WPEB also **NOTED** that during the data preparatory meeting, it was agreed that the assessment should consider CPUE data from Japan, Spain, Reunion, Portugal, South Africa and Taiwan,China. Notwithstanding this, the WPEB **AGREED** that the index should be included in the JABBA and SS3 assessments, due to the large spatial coverage, good methodology, and the temporal extent of the index.

135. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-28 on Catch estimates of blue shark (*Prionace glauca*) in the IOTC area, including the following abstract provided by the authors:

"*Catch histories form an important component of stock assessments and so having a reliable and believable catch series is a key part in gauging the level of stock depletion. In data-limited situations, reported nominal catches are often not considered reliable and so reconstruction of catch histories plays an important role. The first Indian Ocean stock assessment of blue shark took place in 2015, however, due to the amount of uncertainty in the assessments, the conclusion regarding stock status remained as uncertain. The historic catch series was considered to be one of the key sources of uncertainty and the Working Party requested that participants develop approaches to reconstructing historic catches to be used as alternate series for assessment. Nominal catch of blue shark was revised in 2025 by some CPCs and this has altered the historical reported catch.*

This paper uses the available nominal catch data held by the IOTC and two methods to reconstruct historic blue shark catches in the Indian Ocean, the first a generalized additive model (GAM) and the second a ratio-based estimator approach. Both estimates based on based on the reported data as of 2024 with data for 2023 supplied by the 2025 nominal catch,

The procedure used to estimate catch for both the ratio and GAM based models assumes that target catches can be used to predict the unreported catches in the case where there are zero reported catches. The accuracy of all of these methods is entirely dependent on the quality of the original data on which they are based. The underlying dataset that was used was a combination of the 2024 nominal catch and the final year from the 2025 nominal catch data. The working party is encouraged to discuss this combination of the data as well as any preferred alternatives."

136. The WPEB **NOTED** the presentation which described and presented seven different potential catch series' that were reconstructed using both ratio-based and GAM methods. The WPEB **NOTED** that there were scale issues (e.g. very different estimates of the scale of the catch), and continuity issues with the catch estimates used in the previous stock assessment. The WPEB **ACKNOWLEDGED** that these issues with the scale of the catch will influence both the MSY values and any catch recommendations.

137. The WPEB **DISCUSSED** their concerns around comparability and continuity between previous catch estimates. The WPEB **DISCUSSED** the methods used in the ratio-based methods and issues where there are time periods with insufficient catch, which may introduce breaks into indices. The WPEB **NOTED** that no catch was assumed prior to 1964, and that ratio-based estimates were based on average scales and not annually.

138. The WPEB **DISCUSSED** the use of swordfish catches to provide comparative scaling **NOTING** that swordfish and blue shark catch trends are correlated in longliners in some fleets, but in others (ZAF) the ratios were impacted by moratoria and permit restrictions relating to blue shark.

139. The WPEB **DISCUSSED** the catch scenarios to be included in the stock assessments. The base case originally agreed at the WPEB(DP) meeting was to use the "GAM-low" estimates, with a sensitivity run using the higher catch estimates. However, since then, the uncertainty in the catches has grown,

and the WPEB **SUGGESTED** running three different scenarios of catch, with a suggestion to integrate models with weighted scenarios.

140. The WPEB **RECALLED** that the Indonesian endorsed catches must take precedence, and therefore that the high scenario should not have equal weight when deciding which catch scenarios to use in the assessment. Notwithstanding the fact that the Indonesian revised catches are the endorsed catches, the WPEB **NOTED** that there was some flexibility in what could be used in the stock assessment. Additionally, the WPEB **RECALLED** the need to archive all scripts used to produce the catch scenarios so that these estimations could be re-run in the future.

141. The WPEB **NOTED** the uncertainties surrounding the catch scenarios and **AGREED** to use two reconstructed catch histories in the stock assessments, namely the "D1-GAM-low" scenario as the base-case, and the "D1-GAM-high" as a sensitivity.

142. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-29 on Comparison of indices of abundance for blue shark (*Prionace glauca*) in the IOTC area, including the following abstract provided by the authors:

"This document presents a comparison of the six catch per unit of effort (CPUE) series submitted for consideration in the 2025 IOTC blue shark assessment in the Indian Ocean. The goal of this analysis is to investigate any relative differences between model inputs so that data conflict is not introduced into the model via indices of abundance (CPUE series) that imply different, conflicting states of nature (i.e. do alternative indices of abundance indicate that the stock is increasing or the stock is decreasing). Results show potential groupings of the CPUE series which may indicate similar spatiotemporal dynamics or operational practices. Several pairings show low or near-zero correlations, suggesting these indices may be relatively independent or reflect uncorrelated processes. This could be due to differences in gear type, target species, region, or aggregation scale. The reader is cautioned that a single influential point may cause a strong spurious correlation, and care in interpreting the results is recommended."

143. The WPEB **NOTED** the presentation that compared the trends of CPUE indices submitted for consideration within the stock assessment, namely those from JPN, TWN-CHN, EU-ESP, EU-REU, ZAF, and EU-PRT. Overall, the trends were mostly flat, although EU-PRT, and ZAF showed declining trends in CPUE in recent years. As these two indices were the only ones to display a significant change in trend (e.g. either increasing or decreasing overall), there were conflicts in the information being provided by each CPUE index. The WPEB **DISCUSSED** the implications of including all indices in the assessment, given the results of this analysis.

144. The WPEB **AGREED** that the last datapoint (2023) in the JPN index was biologically implausible in terms of an abundance estimate as it was a significant increase compared to the average trend, and that it should be removed when used in the assessment models.

145. The WPEB **AGREED** that the indices from ZAF and EU-REU were not representative of the stock abundance, due to them being derived from data at the edge of the stock (ZAF), or from a highly localised fleet (EU-REU).

146. The WPEB **ACKNOWLEDGED** that although the ZAF and EU-REU indices were not representative of the adult biomass, they may provide important information on the juvenile portion of the stock.

147. The WPEB **DISCUSSED** the reliance within IOTC on longline indices from fleets that have a shrinking spatial footprint (JPN, EU-ESP, EU-PRT) without comparable standardisation methods in the CPUE indices. Additionally, the WPEB **NOTED** that in other fleets, gear modifications could be increasing swordfish CPUE and therefore lowering the number of sharks being caught (which may not be captured appropriately in the standardised CPUEs).

148. The WPEB **NOTED** in its discussions of CPUEs, two additional issues:

149. Firstly, that the changing spatial distribution of the fleets which regularly provide CPUE series can make it challenging to determine which CPUE series are consistent and appropriate for use in assessments. The WPEB **NOTED** that it might be useful to consider a wider research project (or workshop) that attempts to compare CPUEs, by isolating sub-regions where fishing effort has been fairly consistent such as the South-West Indian Ocean. The WPEB **NOTED** that such a project/workshop would help to determine the similarities and conflicts between the various CPUE series and how well they are explaining the population trends. The WPEB **NOTED** that comparing and identifying which CPUE series are the most appropriate to include in assessments is a consistent challenge across all species, not just bycatch species so this type of analyses would benefit the work of all IOTC's Working Parties

150. Secondly, the need to homogenise CPUE standardization methods, as a diverse range of methods are used that calculate results in different ways, that might not always be comparable. One way in which this might be addressed, alongside other issues with CPUE data, is to undertake work to develop a joint longline index of blue shark abundance built from operational fleet data.

151. Subsequently, the WPEB **RECOMMENDED** that to progress work towards resolving the issues above, the SC either a) commission a dedicated project; b) request such analyses to be undertaken as a standard part of developing standardised CPUEs for assessments; or c) build this work into a future CPUE workshop.

152. The WPEB **NOTED** that CPUE series are being presented in a range of formats which makes it challenging to directly compare between different series and further **NOTED** that this is a problem for all species for which CPUE series are being produced, not just for bycatch species. The WPEB **NOTED** that guidelines for presenting CPUE series have been developed in the past both by the IOTC and other RFMOs but these do not appear to be consistently followed and may be outdated. Therefore, the WPEB **RECOMMENDED** that the SC review these guidelines and **REQUEST** CPCs to follow the guidelines when reviewed.

153. The WPEB **DISCUSSED** the issues around representative and high spatial coverage – that a high spatial coverage does not necessarily predicate greater representativeness unless the spatial and temporal coverage is maintained in the time series, especially for migratory species.

154. The WPEB **NOTED** that CPUE indices should be derived from the core distribution of the stock, not in marginal fleet dynamics and **AGREED** that the base case for the stock assessments in JABBA and SS3 would use TWN-CHN, EU-ESP, and JPN indices. The WPEB **SUGGESTED** including two other sensitivities – one with the EU-REU, EU-PRT, ZAF; and another with all indices together, except ZAF.

7.2 Stock assessment models

155. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-30 on Stock assessment of blue shark (*Prionace glauca*) in the IOTC area using SS3, including the following abstract provided by the authors:

"This paper presents a stock assessment of blue shark in the Indian Ocean using Stock Synthesis (version 3.30.23.2 https://nmfs-ost.github.io/ss3-website/). The blue shark assessment model is an age structured (25 years), spatially aggregated (1 region) and two sex model. The catch, effort, and size composition of catch, are grouped into 8 fisheries covering the time period from 1950 through 2023. Six indices of abundance, all from longline fisheries were considered for this analysis. This assessment considered two alternative time series of total catch. The diagnostic case model is parameterized using indices of abundance all indices of abundance with the exception of the index from South Africa which showed a divergent trend from the other indices of abundance. The historical catch series used is considered to be one of the key sources of uncertainty and the Working Party

requested that participants develop approaches to reconstructing historical catches to account for non reporting and reporting to an aggregate level (i.e. 'sharks-nei') to be used as potential input for this assessment. Nominal reported catch of blue shark was revised in 2025 by some CPCs and this has altered the historical reported catch, which forms the basis for any estimation of any blue shark catch that is unreported or reported to an aggregate level. Estimates of catch generated via a generalized additive model were used based on the reported data as of 2024 with data for 2023 supplied by the 2025 nominal catch, as well as the 2025 nominal catch data."

156. The WPEB **NOTED** the presentation and all the work that was completed prior to the assessment meeting that included exploring various different CPUE and catch scenarios, a range of steepness values (*h* = 0.6, 0.7, 0.8, 0.9), variation in L_{50}, and scenarios that re-weighted the length-frequency data.

157. The WPEB **NOTED** that in all scenarios, the results were consistent and estimated that the stock was **not subject to overfishing** and was **not overfished**. The WPEB **NOTED** that the CPUE indices included in the base case assessment were flat, and do not provide information on any trends in biomass, therefore the length frequency data provide some information on depletion signals.

158. The WPEB **DISCUSSED** the lack of information provided by the CPUE indices: the lower bounds of the population carrying capacity (k) are estimated, but there are no reliable estimates for the upper bounds of k. There was significant discussion around the selectivity assumptions and whether these could include logistic (or asymptotic) forms to avoid cryptic biomass (that is possible if all selectivity estimates are "double-normal" shapes). The WPEB **NOTED** that the main fleet had a fixed logistic selectivity assumption, but **AGREED** to also test, as a sensitivity, fixing the selectivity of another fleet to logistic that also had requisite length frequency information associated with it, **NOTING** also that there were few large animals in the catch anyway, perhaps due to catchability / biological reasons. The WPEB **NOTED** that this additional scenario was not presented to the group.

159. The WPEB **DISCUSSED** the biological parameters used in the model which were fixed and treated as known rather than estimated, including sigmaR, steepness (h), and natural mortality (M), **ACKNOWLEDGING** that normally these parameters are agreed at the WPEB(DP) meeting to allow the modeller sufficient time to complete scenarios and examine diagnostic plots appropriately.

160. The WPEB **NOTED** the CVs used on the CPUE indices and **AGREED** to reduce the CVs from 0.3 to 0.2, and there was some discussion on using the EU-PRT fleet as a reference fleet (with a lower CV) as that CPUE has a trend and may provide information on the biomass trends.

161. The WPEB **AGREED** that CVs would be centred around 0.2. The WPEB had a wider discussion on the CPUE CVs, and how what was done in SS3 differs from JABBA. The WPEB **NOTED** that in JABBA the CVs from the standardization models (calculated and presented in the respective CPUE papers), were used with the following constraints: If those original CVs are lower than 0.2, then they were raised to 0.2; if the CVs are originally higher than 0.2, then they are left as they were. This option solves the issue of very low CVs in some years for some fleets but also changes inter-annual variability. In SS3 the author rescaled the original CPUEs CVs to be centred at 0.2, meaning they will be higher in some years and lower in others, but will keep the inter-annual variability from the original standardization models.

162. The WPEB **REQUESTED** the modeller to make those changes agreed for the base cases, including the decisions on the catch data and CPUES, and come back to present those to the group, which was done.

163. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-51 on Indian Ocean blue shark stock assessment using Bayesian surplus production models (JABBA): model development, validation,

sensitivity analysis and large grid model ensembles, including the following abstract provided by the authors:

"This paper provides the stock assessment for Indian Ocean blue shark using JABBA, a Bayesian surplus production models. Four base models were constructed with combinations of two productivities and two options for catch series. Models were checked for goodness of fit and validated, and sensitivity analysis was conducted. A large model grid (600 models) was run, by randomly selecting priors from distributions built from the plausible for their values, and using alternatively each of the two-catch series. Stock status for the main base models ranged from not overfished and not undergoing overfishing (B>Bmsy & F<Fmsy), to not overfished but currently undergoing overfishing (B>Bmsy & F>Fmsy). The stock status for the large grid ensemble was weighed in 2 alternative ways (equal-weighting and DIC-weighting), and resulted in a stock status not overfished and not subject to overfishing (B>Bmsy & F<Fmsy)."

164. The WPEB **NOTED** the presentation on the Bayesian surplus production model, implemented in JABBA which was an ensemble of 600 scenarios (300 with priors that centred on an estimate of r = 0.29; 300 with priors that centred on an estimate of r = 0.33).

165. The WPEB **NOTED** that the JABBA models produced similar trends in results to the SS3 model, despite different underlying production models, and overall methodology. However, the WPEB **NOTED** that the JABBA results were less optimistic than those of SS3.

166. The WPEB **DISCUSSED** the starting values for carrying capacity (k), and there was general concern that the results were being driven by the initial values of k (which were informed by a weakly informative prior – which was almost non-informative). The author **AGREED** to test an alternative flat prior, although it was not thought that this was functionally possible in JABBA.

167. The WPEB **DISCUSSED** similar concerns with the JABBA model as there were with the SS3 model, that with no upper bounds on the carrying capacity (k), the model may be estimating a much higher k than is biologically possible. The WPEB **NOTED** that the K prior used as the JABBA default, uses a lognormal distribution centred at 8 times maximum catch and a very wide CV of 100%. This is in practice a very weakly informative prior, that should not constrain the estimation of the K posterior that much. The WPEBs **NOTED** that completely removing the K prior is not possible in JABBA, but it is possible to make the CV even wider and change the point it is centred.

168. The WPEB **SUPPORTED** the ensemble approach used by the authors with JABBA and N**OTED** that the JPN CPUE index should be incorporated as a continuous variable (not split time blocks which was introduced as an error).

169. The WPEB **AGREED** that the historical USSR data should not be used and to start with the EU-REU CPUE index only from 2011. The author agreed to update the models with these details.

170. The WPEB **AGREED** that the base case and sensitivities to be run during the meeting were:

- Base case models:
  - Catches: Use D1 GAM LOW
  - Start year: 1950
  - CPUEs: Japan (single block, remove 2023), Spain, Taiwan,China
  - R priors: continue to run 2 models with the 2 r prior options (0.29, 0.33)
- Sensitivities:
  - Catches: D1 GAM HIGH and D3
  - CPUEs:
  - Others (Reunion from 2011, Portugal, South Africa);

- All CPUEs;
- All except ZAF
- K prior: wider (even less informative)

171. The WPEB **NOTED** these changes to the models when they were presented later in the meeting. The WPEB **NOTED** that the model when using only the base CPUEs had some added difficulties in estimating K, which might be related to the similar difficulties found in SS3 with regards to R0. When using all CPUEs, i.e., Japan, Spain, Taiwan,China, France and Portugal, this estimation improved. As a whole and in terms of the diagnostics, the model using all those CPUEs had slightly better diagnostics.

172. The WPEB **AGREED** on the final model, and **NOTED** the results presented in the tables below, with the Kobe plots from two base case models (with differing estimates of r). The WPEB **NOTED** that although these models would not be used for management advice, that they estimated that the stock status for blue shark in 2025 was **not overfished** and **not subject to overfishing** (green quadrant of the KOBE plot).

173. The WPEB **AGREED** that projections should be carried out for the base models, for a period of 10 years, with TACS: varying between 60-140 % relative to the mean of the previous 3-years of catches (2021-2023). The projections should start in 2026, and for the intermediate years with no catch data (2024-2025) those should assume the mean of the previous 3-year catches.

174. The WPEB **NOTED** the results presented in the table for estimates of the main parameters, the KOBE plot, and the results of the projections in the K2SM table below.

Table 2: Main quantities estimated from the 2 JABBA base case models.

Parameters	**Higher *r* (0.33)**			**Lower *r* (0.29)**		
	mu	**lci**	**uci**	**mu**	**lci**	**uci**
K	288049	220468	342059	257703	219905	438190
r	0.355	0.289	0.434	0.310	0.255	0.379
psi	0.924	0.656	0.997	0.924	0.662	0.997
Sigma. proc	0.091	0.048	0.151	0.101	0.047	0.166
Fmsy	0.177	0.144	0.217	0.155	0.127	0.190
Bmsy	144025	110234	171029	128852	109952	219095
MSY	25043	18642	32446	20999	15889	36352
Bmsy/k	0.500	0.500	0.500	0.500	0.500	0.500
B/Bmsy (2023)	1.595	1.240	2.046	1.610	1.174	2.103
F/Fmsy (2023)	0.675	0.397	1.222	0.779	0.377	1.494

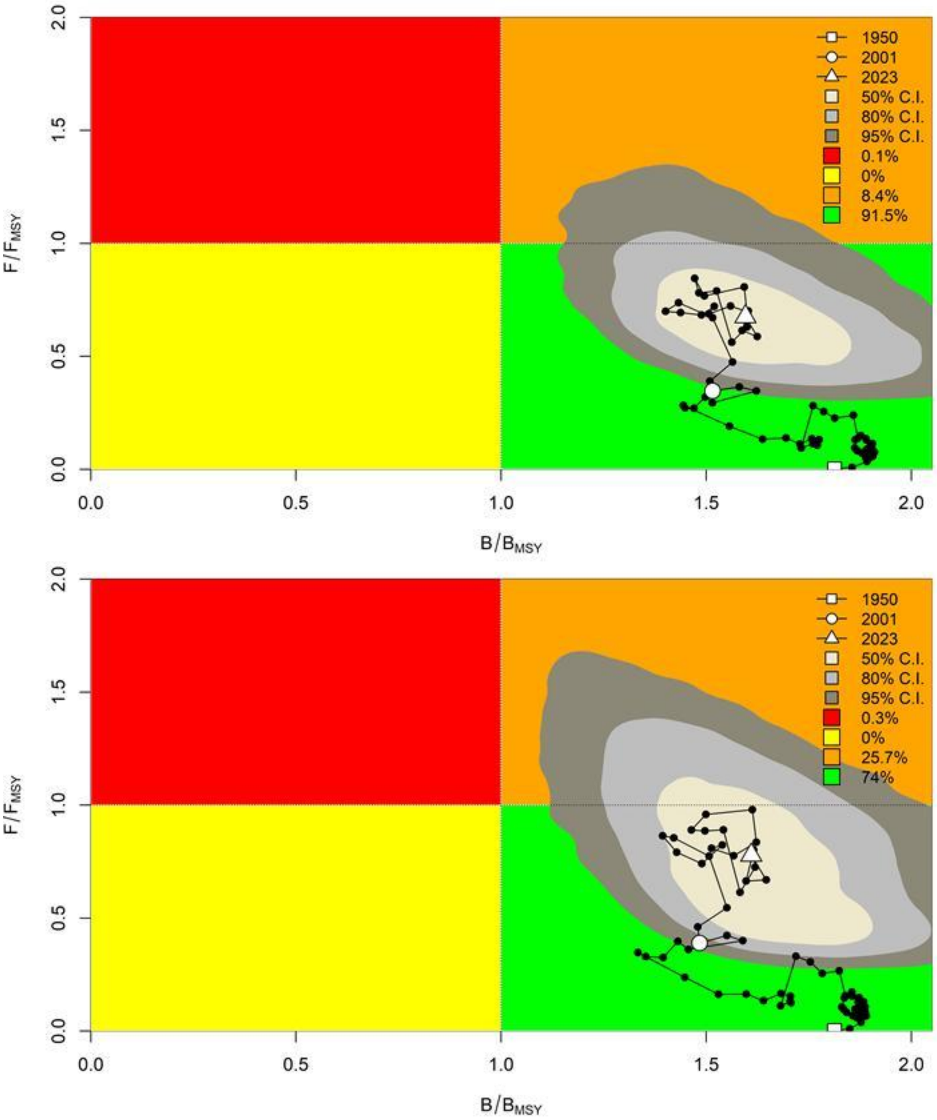

Figure 1. Kobe plots of the 2 JABBA base case models (top: higher r option = 0.33; low; bottom: lower r option = 0.29).

Table 3: K2SM from the JABBA base models (2 model ensemble combined)

Reference point and projection time	**Catch projections (relative to 2021-2023 catch) and probability (%) of exceeding MSY-based reference points**									
Catch relative to 2021-2023 (%)	**0%**	**60%**	**70%**	**80%**	**90%**	**100%**	**110%**	**120%**	**130%**	**140%**
3 year projection (2028)										
B2028 < BMSY	0.0	7.1	8.7	10.7	12.9	15.4	18.2	21.1	24.6	28.2
F2028 > FMSY	1.8	2.9	6.6	13.1	21.9	32.1	43.2	53.9	63.6	72.5
10 year projection (2035)										
B2035 < BMSY	0.0	7.2	12.4	19.7	29.1	39.5	50.4	61.1	70.9	82.2
F2035 > FMSY	0.1	3.8	9.9	20.7	34.1	48.1	61.1	72.9	78.8	89.4

7.3 Review of proposed stock assessment of blue shark

175. The WPEB **NOTED** the results of the final reference case assessment, and the projections. The WPEB **NOTED** that although a “worst-case” scenario had been proposed, there was insufficient time to present the results and examine the diagnostics during the meeting. The WPEB **DISCUSSED** this omission and **REQUESTED** that the results, code, and model specifications be archived with the Secretariat so that they could be fully explored in the next iteration of the assessment process.

176. The WPEB **NOTED** that the CPUE from JPN was initially incorporated into the JABBA assessment as two separate series. However, this was later corrected as the index was standardised as one continuous series so finally one continuous index was incorporated into the final assessment model.

177. The WPEB **NOTED** that the 2025 SS3 indicated that Indian Ocean BSH are **not overfished nor subject to overfishing (Figure 1**).

178. All models (from SS3 and JABBA) produced similar results with small differences resulting from the different model structures. The WPEB **AGREED** that the stock status and management advice should be given using the SS3 reference case. The WPEB **NOTED** that the SS3 assessment indicates that current catches are near MSY, and significant increases could result in decreasing biomass and the stock becoming subject to overfishing in the future, although the likelihood is very low (in most cases 0%) (**Table 4**). The stock should be closely monitored, especially with respect to overall catch and discard reporting. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 16/06), these need to be further implemented by the Commission, so as to better inform scientific advice in the future.

179. The WPEB **DISCUSSED** and **NOTED** the following key points which are also detailed in the Executive Summary for blue shark:

- **Maximum Sustainable Yield (MSY)**: The MSY estimate generated from SS3 for the Indian Ocean blue shark stock is approximately 31,000 t (95% C.I. = 21,790 – 39,840 t).
- The current stock assessment suggests that catch amounts near the estimated MSY values are likely supportable currently. However, the current MSY catch estimates from the assessment model are based on nominal reported catch (which are currently under revision and likely under-reported based on sharks not reported to species), and due to uncertainties in other model inputs and parameters, it is recommended that there is no increase in fishing pressure until such uncertainties are resolved.
- It is expected that as the nominal reported catch is revised, estimates of MSY and other parameters will change.
- The upcoming blue shark MSE process will seek to address the uncertainties in the stock assessment.

180. The WPEB **NOTED** that the Commission has not adopted reference points or harvest control rules for any shark species.

181. The WPEB **RECOMMENDED** based on the SS3 assessment results, that the SC advise the Commission that the current recommended catch for blue shark remain close to current catches, and below the MSY estimated by the SS3 assessment model for 2025 (< 31,000 t).

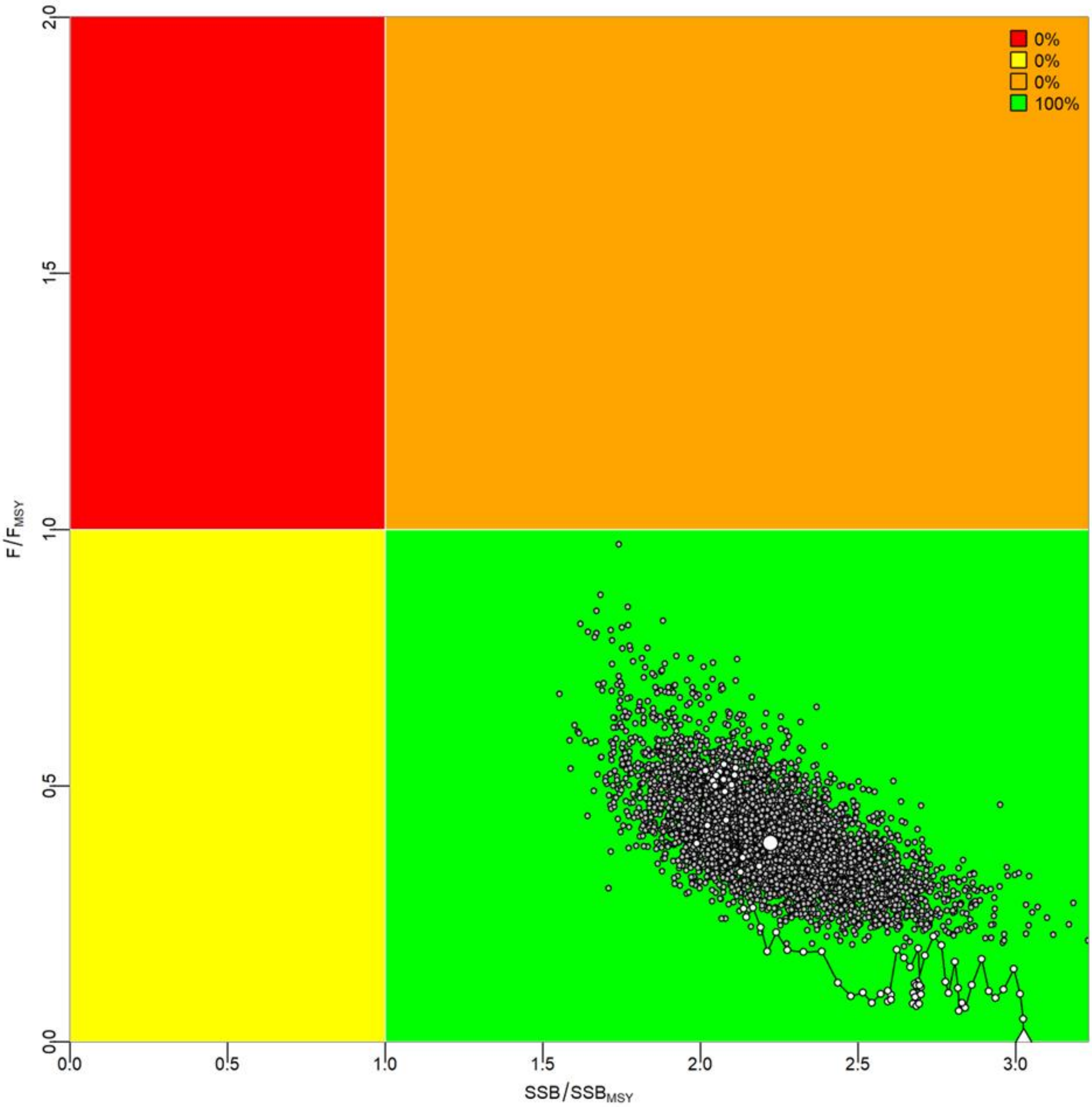

Figure 2. Blue shark: Aggregated Indian Ocean stock assessment Kobe plot for the estimate based on 2025 assessment base case model. (base case model with trajectory and uncertainty in the terminal year).

Table 4. Blue shark: Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based reference points for nine constant catch projections using the base case model (average catch level from 2021-2023)* (25,877MT), ± 10%, ± 20%, ± 30% and ± 40%) projected for 3 and 10 years

Kobe II Strategy Matrix: Probability (%) of violating MSY-based reference points									
	Alternative TAC projections								
Reference point and projection timeframe	**60% (15,526 t)**	**70% (18,113 t)**	**80% (20,701 t)**	**90% (23289 t)**	**100% (25877 t)**	**110% (28464 t)**	**120% (31052 t)**	**130% (33640 t)**	**140% (36227 t)**
B2028<BMSY	0	0	0	0	0	0	0	0	0
F2028>FMSY	0	0	0	0	0	0	0	0	1
B2035<BMSY	0	0	0	0	0	0	0	0	1
F2035>FMSY	0	0	0	0	0	0	2	5	12

*Average catch level and respective % changes refer to the estimated catch series used in the final base case model (IOTC-2025-WPEB21(AS)-30)

7.4 Recommendation and executive summaries (all)

182. The WPEB **ADOPTED** the management advice developed for blue shark, as provided in the draft status summary in Appendix VII and **REQUESTED** that the IOTC Secretariat update the draft stock status summary with the latest catch data and the results from the projections in the Kobe II Strategy Matrix, and for the summary to be provided to the SC as part of the draft Executive Summary, for its consideration.

183. The WPEB **NOTED** that the author of the assessment has committed to writing up all the additional analyses and runs undertaken during the WPEB, into an updated assessment paper to be made available online prior to the Scientific Committee

8. New information on biology, ecology, fisheries and environmental data relating to ecosystems and bycatch species

8.1 Review new information on the environment and ecosystem interactions and modelling, including climate change issues affecting pelagic ecosystems in the IOTC area of responsibility

184. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-31 on Abundance, visiting frequency, interactions, fishery connectivity and economics of exploitation of pelagic species by Réunion's artisanal fishery on anchored FADs (AFICHE): a research project implying tagging of dolphinfish, wahoo and tuna, including the following abstract provided by the authors:

"This note present a synthetic description of the project AFICHE: Abundance, visiting frequency, interactions, fishery connectivity and economics of exploitation of pelagic species by Réunion's artisanal fishery on anchored FADs: a research project implying tagging of dolphinfish, wahoo and tuna. This project is funded by the EU under the European Funds for Maritime Affairs, Fishery and Aquaculture (EFMAFA). We provide the project objectives, means, and technics, which will be carried out including a publicity posters and tag return rewards."

185. The WPEB **NOTED** that visual posters have been developed to promote awareness of the tagging programme and facilitate tag returns, and that the authors requested collaboration from CPCs to inform skippers and encourage tag recovery. The WPEB **ENCOURAGED** wide distribution of the posters among CPCs, vessels and canneries.

186. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-32 on Mitigating the Ecological Impacts of Drifting Fish Aggregating Devices in Seychelles Waters – A Review of the FADWatch Programme, including the following abstract provided by the authors:

"The conservation and management measures of the Indian Ocean Tuna Commission have evolved over the past decade to strengthen regulations on the widespread use of Drifting Fish Aggregating Devices (dFADs) in tropical tuna purse-seine fisheries. Recognising the importance of sustainable fishing practices and the potential risks to marine ecosystems, especially when these devices are abandoned, lost, or discarded (ALD, the Seychelles Fisheries Authority (SFA), in collaboration with Asociación de Grandes Atuneros Congeladores (AGAC) and the Sustainable Indian Ocean Tuna Initiative (SIOTI), initiated the FADWatch Project. This initiative, formalised through a Memorandum of Understanding (MoU), is a proactive effort to monitor, recover, and mitigate dFAD strandings across the Seychelles' Exclusive Economic Zone (EEZ). The project's recovery missions are conducted by the SCGV Saya de Malha. Using the ShoreManager dFAD tracking software, dFADs entering designated buffer zones around 15 monitored islands were identified and recovered. Since 2022, over

150 dFADs and over 170 instrumented buoys have been recovered. While the assessment of materials and conditions was limited to a small sample of dFADs, most dFADs consisted of synthetic and metallic components, although some biodegradable elements were also observed. Key challenges include logistical constraints, a limited number of scientific personnel, and monsoonal weather conditions. Enhanced stakeholder collaboration, expanded monitoring, and improved vessel capabilities are vital for the project's ongoing development. Data collected from FADWatch will inform national dFAD management strategies and support marine conservation efforts in Seychelles."

187. The WPEB **ACKNOWLEDGED** the effort made by the Seychelles Fishing Authority to run the FAD watch programme to recover lost and abandoned FADs and, hence, reduce their impacts in the ecosystem and habitats.

188. The WPEB **DISCUSSED** the financial sustainability of the programme relative to the number of FADs recovered per campaign (80-90 FADs have been retrieved per year of the project), and **NOTED** the high operational costs and logistical difficulties of recovering dFADs across a large area, particularly in the absence of near real-time instrumented buoy position data. The WPEB **SUGGESTED** that cost-effectiveness could be improved through greater engagement of stakeholders, including NGOs, the fishing community and other partners to support the clean-ups.

189. The WPEB further **NOTED** that responses from fishers have been limited in the outer islands, where fishing activity is low, while most reports of strandings are received from local communities. The WPEB **NOTED** that the programme remains a work in progress, with ongoing efforts to improve efficiency.

190. The WPEB **HIGHLIGHTED** the importance of obtaining real-time buoy tracking data, or potentially transferring buoy ownership to the programme, to facilitate recovery before beaching. The WPEB **NOTED** that the programme currently works with the three main buoy providers but only has access to hourly rather than real-time buoy locations for active buoys. The WPEB **AGREED** that access to deactivated buoy data would be valuable to extend monitoring and improve retrieval.

191. The WPEB **NOTED** that most of the materials recovered appear to be shade cloths, canvas and other materials that look like mesh. **NOTING** that the use of netting materials in the construction of FADs has been banned for many years, the WPEB **NOTED** that few FADs with netting materials are found.

192. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-33 on Have Non-Entangling DFADs Reduced Ghost Fishing in the Indian Ocean?, including the following abstract provided by the authors:

"In the last decade, Drifting Fish Aggregating Devices (DFAD) constructed with open wide mesh panels traditionally used by tropical tuna purse seine fisheries have been replaced by new designs and materials that minimize entanglement. This change was partially driven by a key scientific publication by Filmalter et al. (2013) that revealed a much larger scale of shark ghost fishing in the Indian Ocean by DFAD than previously thought. However, since 2012, when lower-risk entanglement DFAD designs where deployed following industry-based initiatives, and more recently in 2020 when IOTC mandates the exclusive use of non-entangling DFADs in the Indian Ocean, no comparable studies of ghost fishing have been conducted to evaluate their potential ecological impact. Using a similar methodology than the one used by Filmalter et al. (2013), combining underwater DFAD surveys with shark satellite tagging data and adding observer data to the analysis, this study reevaluates shark ghost fishing in the Indian Ocean a decade after. Our study indicates that the DFADs currently deployed in the Indian Ocean exhibit a daily shark entanglement rate of 0.00095. In

contrast, Filmalter et al. (2013) reported a daily entanglement probability of 0.35 ± 0.08 per DFAD, highlighting a substantial reduction in shark ghost fishing associated with the transition to non-entangling DFADs. We estimate a total of 3,830 shark entanglements considering the number of active DFADs of the entire purse seine fleet in 2023, which results in 125 to 250 times lower than that reported in 2013 (i.e. between 480,000 and 960,000 sharks were estimated to be entangled annually in 2012 fishing scenario in the Indian Ocean). The shift to fully non-entangling DFADs, combined with the reduction in the number of active DFADs per vessel in recent years resulting from regulatory limits, has contributed to lowering entanglement levels. Industry-based initiatives and conservation measures, supported by scientific evidence, are helping resolve DFAD ghost fishing issues globally."

193. The WPEB **ACKNOWLEDGED** the presentation providing an update on shark ghost fishing related to FAD entanglement in the context of IOTC Resolution 24/02 prohibiting the use of entangling FADs constructed with netting materials, thereby providing an opportunity to verify the effectiveness of this measure. The WPEB **NOTED** the reported reduction in shark ghost fishing following the transition to non-entangling DFADs, with substantially lower entanglement rates compared to those reported by Filmalter et al. (2013).

194. The WPEB **NOTED** that the current results are based on over 2,000 visual observations and additional underwater camera deployments, with only one shark entanglement observed, and **ENCOURAGED** the authors to account for uncertainty in their estimates, including possible variation in entanglement duration.

195. The WPEB **NOTED** that while the earlier Filmalter et al. (2013) study relied on fewer underwater observations, the present study combines multiple sources of information (DFAD surveys, tagging, and observer data), thereby providing a broader basis for comparison.

196. The WPEB **ENCOURAGED** the continued refinement of methods to quantify uncertainty and to ensure comparability with past studies.

197. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-34 on Review of the proposed form for the collection of data on ALDFG.

198. The WPEB **THANKED** the Secretariat for the updated version of the form for the collection of data on ALDFG, which had already been reviewed by the FAD Working Group which provided some suggested revisions and requested that the form also be reviewed by the WPEB.

199. The WPEB **REQUESTED** that information on FADs currently included in the gear form be removed, given that a specific form exists for FAD ALDFG, and further **REQUESTED** that the list of FAD materials be revised. The WPEB **NOTED** that FAD and buoy IDs could be linked to information in the FAD Register.

200. The WPEB **SUGGESTED** that the dimensions of gear found could be included in the form along with the weight. The WPEB further **SUGGESTED** including information on whether any organisms are found in the gears.

201. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-49 on Influence of drifting FAD immersion time on bycatch rate in the tropical tuna purse seine fishery, including the following abstract provided by the authors:

"The growing use of floating objects (FOBs), and in particular human-made drifting Fish Aggregating Devices (dFADs), by tropical tuna purse seine fisheries has raised concerns about their ecosystem impacts particularly due to higher bycatch rates, including vulnerable and sensitive species. While various hypotheses have been proposed to explain why pelagic

species aggregate around dFADs, the underlying drivers of this behavior remain poorly understood. In particular, the relationship between dFAD soak time and bycatch rates is still unclear, as is the potential for managing soak time to mitigate bycatch. This presentation shows preliminary analyses exploring how dFAD soak time may influence bycatch rates, based on French logbook data collected from the Atlantic and Indian Oceans between 2014 and 2024. A zero-inflated Gamma Generalized Additive Model (GAM) was used to account for the high frequency of zero bycatch events. In the Atlantic, soak time showed a statistically significant but limited influence on bycatch weight. Month and latitude emerged as significant predictors in the Atlantic and Indian Oceans, respectively, possibly reflecting underlying biological patterns such as seasonal migrations or spawning events in specific areas and time periods. Interannual variation was more pronounced, likely reflecting improvements in logbook reporting over recent years. Further analysis linking logbook and observer data is needed to improve species identification and assess bycatch weight more accurately."

202. The WPEB **SUGGESTED** incorporating local FAD density as an explanatory variable as it may impact the aggregation process at the FAD being studied. The WPEB further **SUGGESTED** that the authors consider using FAD design characteristics to explain bycatch rates, while **NOTING** that information on FAD design is not always reliably reported by observers.

203. The WPEB **NOTED** that logbook data may not provide reliable information on bycatch rates and composition and **ENCOURAGED** the authors to explore the use of fishery observer datasets, which allow for more robust analyses and inclusion of FAD-specific attributes.

204. The WPEB **NOTED** clarifications from the authors that FADs not deployed by the vessel were excluded from the analysis and **AGREED** that incorporating observer data will strengthen future work.

205. The WPEB **NOTED** that there are some data reported as 'Unknown' species or species group and **NOTED** that this was usually done when the specimen could not be properly observed or certain species could not be identified to species level. The WPEB **NOTED** that this was often the case when fish caught were non-tuna species but further **NOTED** that there have been improvements in species level reporting in recent years.

206. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-26 on Information about "Ring-shaped branchline (Meka-ring)" in pelagic longline fisheries and research plan, including the following abstract provided by the authors:

"This document provides a preliminary overview of the use of "ring shaped branch lines (meka-ring)" in Japanese longline fisheries. The gear was originally developed by local fishers targeting large squid. Subsequently, it spread to tuna longline fisheries in Japan and other regions. The main capture would be swordfish, with minimal bycatch of tunas, billfishes, sharks, or sea turtles and no seabird captures. Current investigations involve collecting information from fishers, and summarizing observers and logbook data, with further detailed reporting planned as research continues in the relevant areas."

207. The WPEB **NOTED** the new loop gear known as "meka-ring/trap-line" that has been increasingly used in various oceans. Several papers have been recently prepared for ICCAT, including in the Mediterranean Sea where the gear started to be used several years ago, and more recently in the Atlantic Ocean. Currently, the scale of the use of this new gear in the IOTC area is unknown but the WPEB **NOTED** that it will have a potential effect on catch, mostly for swordfish. As such, the group **RECOMMENDED** that the SC takes note and **REQUESTED** CPC scientists to investigate within their fleets if such gear is in use in the Indian Ocean, and consider, taking into account the ongoing work

at ICCAT, starting to include this type of gear in data collection methods in their logbook and/or observer program to collect the corresponding catch and effort data in the future. It is noted from some very preliminary literature that with this new loop gear the catch rates of swordfish are higher, while shark and turtle bycatch is much lower. As such, this new gear can also be further studied as a potential mitigation new measure for vulnerable species.

208. The WPEB **NOTED** that the gear is banned in certain fleets operating in the Indian Ocean but that there are exceptions in the Atlantic Ocean and Mediterranean Sea for vessels that are collaborating with trials being conducted where the effect of the gear on bycatch rates is being examined.

209. The WPEB **REQUESTED** the Secretariat to add a reference code for the new gear so it can be reported through ROS data forms.

8.2 Examining the benefits of retaining non-targeted species catches (all)

210. The WPEB **NOTED** that no papers were presented on this topic and so **REQUESTED** the WPTT and other relevant working parties to discuss this as it is thought to be more relevant to their work.

8.3 Assessment of the impacts of climate change on IOTC fisheries and bycatch species (all)

211. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-37 on Advancing Regional Ecosystem Fisheries Overview with Climate and Environmental Indicators to Enhance Fisheries Management Advice in the Indian Ocean Tuna Commission, including the following abstract provided by the authors:

"Tropical tuna fisheries in the Indian Ocean are central to food security, livelihoods, and economies, yet their dynamics are increasingly influenced by climate and environmental variability. To support the operationalization of the Ecosystem Approach to Fisheries Management (EAFM) within the Indian Ocean Tuna Commission (IOTC), this study analyzes key physical and biochemical indicators that are known to influence ecological processes of tropical tuna species - skipjack (Katsuwonus pelamis), yellowfin (Thunnus albacares), and bigeye tuna (Thunnus obesus). We examine long-term trends and variability in a set of physical and biochemical indicators in two candidate IOTC ecoregions, the Indian Ocean Monsoon Gyre Ecoregion (IOMGE) and the Somali Current Ecoregion (SCE). The results reveal significant spatial and temporal heterogeneity both within and between ecoregions, highlighting the importance of monitoring region-specific environmental indicators to capture differential trends and responses of ecological processes of tuna species. Building on these findings, the study provides a preliminary 'Environment and Climate Change Effects' section of regional Ecosystem Fishery Overviews (EFOs) for the two selected ecoregions, providing an initial framework for integrating climate-informed considerations into fisheries management advice in IOTC."

212. The WPEB **NOTED** the efforts in advancing regional Ecosystem Fisheries Overviews (EFOs) through the development of a draft section incorporating climate and environmental indicators relevant to the biological and ecological processes of tropical tuna species, in support of EAFM implementation in the IOTC.

213. The WPEB **NOTED** that the study presented preliminary results for two pilot ecoregions (the Somali Coastal Ecoregion and the Indian Ocean Monsoon Gyre Ecoregion), including a tentative selection of environmental indicators and options for their visualization. The WPEB **NOTED** that a pilot EFO for one ecoregion will be presented next year and will include multiple sections: 1. Who is fishing including major fleets, 2. What are they catching, 3. Environmental and climate change monitoring, 4. Effect of fisheries on ETP species, and 5. Effect of fishing and climate change on food webs.

214. The WPEB **ENCOURAGED** CPCs to provide feedback on the selection and visualization of climate and environmental indicators to strengthen the development of EFOs.

215. The WPEB **NOTED** suggestions to consider the inclusion of additional ETP species such as sharks in the regional EFOs, and **SUGGESTED** that the choice of species should align with the core species relevant to each ecoregion, based on the main fleets operating in the area and their targeted and bycatch species.

216. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-38 on Hindcasting the food-web dynamics of the tropical Indian Ocean pelagic ecosystem over the last two decades, including the following abstract provided by the authors:

"Tuna species are among the most widely harvested fish stocks globally, contributing approximately 6.8% of the global finfish catches. In the tropical Indian Ocean, tropical tuna fisheries alone account for about 22% of the global tuna catches, however these fisheries also interact with a variety of non-targeted species, including vulnerable taxa. In the ecosystem, fisheries have the same ecological role as a high-trophic level predator, therefore it is important to monitor how their activity may influence the food web-structure and functioning of the oceanic pelagic ecosystem over time. In this study, we build upon the Ecopath model presented at the previous meeting of the IOTC Working Party on Ecosystems and Bycatch (Amate et al., 2024), updating biomass and discards estimates, refining dietary information, and incorporating expert knowledge review. Using this updated Ecopath model, we also developed and fitted a temporally dynamic Ecosim model to time series data from 2003 to 2022. The model reproduced satisfactorily observed trends for several functional groups, particularly those with biomass time series data available. For some vulnerable species and mid- to lower-trophic level groups, data limitations constrain the model's capacity to fully capture the historical ecosystem dynamics. Trophic interactions and fishing pressure emerge as key drivers of ecosystem change. Notably, results indicate a decline in the mean trophic level of the catch and in the biomass of commercially important species in line with those of the stock assessment. This study contributes to a deeper understanding of the dynamics of the tropical Indian Ocean pelagic ecosystem and marks a step forward in advancing the operationalization of the ecosystem approach to fisheries management in the IOTC."

217. The WPEB **ACKNOWLEDGED** the effort made to develop the EwE model to better understand the dynamics of the tropical Indian Ocean pelagic ecosystem and for simulating fishing effects of tropical tuna fisheries on the ecosystem in combination with climate change effects on the ecosystem.

218. The WPEB **NOTED** that trophic relationships in the Ecopath model are static and defined through diet matrices representing mean interactions during the period 2000–2003, while the Ecosim allowed dynamic simulations of biomass and catch trends for the different functional groups in response to fishing.

219. The WPEB **NOTED** that the model fitting aligned well with past historical biomass and catch trends and that the fitted Ecosim model can simulate future fishing scenarios, and project ecosystem responses under different climate change scenarios, once temperature response functions are added for the different functional groups. The WPEB **NOTED** that these will be presented in the next WPEB meeting.

220. The WPEB also **NOTED** interest in comparing EwE-based projections with those from fishery stock assessments.

221. The WPEB **SUGGESTED** that confidence intervals are included for observed data and for stock assessment biomass outputs in the plots.

222. The WPEB **NOTED** comparisons raised between EwE and SEAPODYM modelling approaches, and **CLARIFIED** that SEAPODYM is a spatially explicit, environment-driven mechanistic–statistical hybrid model designed to simulate tuna population dynamics and migrations, while EwE is a mass-balance trophic modelling framework representing energy flows and ecosystem-wide interactions to evaluate management trade-offs under fishing and climate change. The WPEB further **NOTED** plans to compare results from the EwE model developed for the tropical Indian Ocean with the two EwE models developed in the Pacific by IATTC and SPC for the eastern and western tropical Pacific, respectively.

223. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-INF06 on Which processes structure global pelagic ecosystems and control their trophic functioning? Insights from the mechanistic model APECOSM, including the following abstract provided by the authors:

"Pelagic ecosystems are distributed throughout the world's seas and oceans. They are characterised by strong vertical structuring, horizontal heterogeneity and temporal variability, which pose significant challenges for modelling them on a global scale. In this paper, we use the mechanistic high trophic level model APECOSM (Apex Predators ECOSystem Model) to assess how the physical and biogeochemical environment constrains the structure and trophic functioning of pelagic ecosystems worldwide. To this end, we configure the model to represent the three-dimensional and size-structured dynamics of six generic pelagic communities: small and medium epipelagics, tropical tunas, mesopelagic feeding tunas, small coastal pelagics, mesopelagic residents and mesopelagic migrants. We analyse their emergent three-dimensional spatial structuring on a global scale. We first show that the modelled horizontal and vertical distributions are consistent with the observed data. We then analyse the role of key environmental drivers, such as temperature, light, primary production, currents and oxygen on the response of the communities. Finally, we explore the trophic functioning of pelagic ecosystems, focusing on the emergent diets of communities and their variation with organism size. This study demonstrates the ability of a mechanistic ecosystem model to represent the multidimensional structural heterogeneity of marine ecosystems globally (encompassing three-dimensional distribution, size variations, and community composition) from a small set of universal principles and well-defined hypotheses.

This approach helps to understand how the various processes at stake act and interact to shape the structure of global pelagic ecosystems, and eventually elucidate the heterogeneity of their trophic functioning."

224. The WPEB **THANKED** the author for presenting the work on the use of the mechanistic ecosystem model APECOSM to investigate the processes structuring global pelagic ecosystems and their trophic functioning.

225. The WPEB **NOTED** that the "communities" represented in the model comprise species with similar functional characteristics; for example, tropical tunas include yellowfin tuna, skipjack tuna and dolphinfish, while mesopelagic feeding tunas include bigeye tuna, marlins and swordfish. The WPEB further **NOTED** that mesopelagic communities include non-fish organisms such as squid and jellyfish.

226. The WPEB **NOTED** that size plays a central role in structuring community behaviour, influencing diet, swimming speed, vertical distribution and predation mortality.

227. The WPEB **NOTED** that APECOSM differs from SEAPODYM in that it is mechanistic and trait-based, rather than a mechanistic-statistical hybrid and single species-based model, thereby allowing APECOSM to model the evolution of processes such as growth, mortality and predator-prey interactions and these to be projected under different conditions, including climate change. The trait-based approach allows the grouping together of the same community species that share similar physiological, morphological and life history characteristics.

228. **ACKNOWLEDGING** that the APECOSM model has successfully assessed the current situation, the WPEB **NOTED** that the next steps include developing climate projections to evaluate how communities may evolve in terms of both structure (e.g. distribution and total biomass) and function (e.g. trophic interactions, growth and mortality). The WPEB **NOTED** that the model will also incorporate fisheries to assess the impacts of alternative management scenarios. A group of ecosystem modellers (not limited to APECOSM) is working on selecting fisheries scenarios to generate future projections and evaluate the effects of different management strategies.

9. Bycatch, species interactions and ecosystem risk assessments for other shark species, marine mammals, seabirds and sea turtles

9.1 All bycatch species (all)

229. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-INF02 on Deep diving into shark catch and trade mismatches, including the following abstract provided by the authors:

"Since 2003 with the inclusion of the first shark species in the CITES Appendices, the number of sharks, rays, and chimaeras, hereafter 'sharks', in the CITES Appendices have increased significantly. In 2019, at the 18th meeting of the Conference of the Parties (CoP18, Geneva, 2019), CITES Parties adopted Decision 18.211 requesting a mismatch review due to concerns that trade data reported by Parties did not match expert expectations and that international trade in CITES-listed sharks may be going undetected and unreported." – see paper for full abstract.

230. The WPEB **NOTED** that trade regulations for sharks may differ from those for other CITES-listed species. There may be unique regulatory requirements depending on whether catches are taken from Exclusive Economic Zones (EEZ) or the high seas, and whether the catch is intended for domestic markets or export. For example, domestic vessels require CITES certificates to fish for listed shark species on the high seas, but not when fishing within the EEZ.

231. The WPEB **NOTED** that catch reporting for some shark species, such as silky sharks, is consistent between data reported to the FAO and RFMOs, but large discrepancies exist for other species. The study identified several potential sources for these mismatches, including 1. The use of different units for reporting shark and ray trade in the CITES trade database compared to databases managed by RFMOs; 2. Underreporting of exports and introductions from the sea for CITES-listed shark and ray species; 3. Unclear requirements for reporting under various scenarios, such as catches within EEZs versus those in high seas; and 4. Variations in how catches from territories and provinces are reported across different databases.

232. The WPEB **NOTED** that WCPFC was not included in the current study due to the lack of accessible, disaggregated data. The report will be updated as data have become available more recently. Additionally, blue shark was not included as this species was only recently added to the CITES Appendix II.

233. The WPEB **NOTED** that the Shark League conducted a similar study which faced significant challenges analysing trade data for countries with coastlines spanning multiple oceans because it is

not possible to identify from which ocean the catches come from. CITES has already proposed using FAO statistical areas for catch reporting to improve tracking of species in trade from countries with this issue but this approach is waiting for adoption at the next CITES Standing Committee.

234. The WPEB **NOTED** that some shark catches in Sri Lanka are taken on the high seas and landed for domestic use and **NOTED** that to be compliant with CITES regulations, a declaration must be issued before such landings to ensure that the removal of these species from ABNJ is not detrimental to their populations. The WPEB **NOTED** that a proposal will be considered at the CITES 20th meeting of the Conference of Parties in November 2025 to transfer mobulids from Appendix II to I, which would prohibit the commercial trade of manta rays and mobulid species. The WPEB **NOTED** that Sri Lanka has a zero export quota for *Mobula* species since early this year, following an assessment of possible unsustainable international trade of these species which was based on CITES Trade Data from the previous 5 years.

235. The WPEB **NOTED** information about the methodology for comparing trade and RFMO data, given differences in reporting units (e.g., RFMO data in fish weight versus CITES data in various product forms such as fins or meat). The analysis used only data reported in weight, applying conversion factors to standardize measurements. Data were analysed separately for specific species and for aggregated categories such as “shark nei”.

236. The WPEB **NOTED** that sharks from Pakistan’s national fishery are exported, and the WPEB **ENCOURAGED** the sharing of more detailed information on export destinations. The WPEB **NOTED** that while import declarations are not required, certain CITES Parties do issue them, making it possible to retrieve this information from the CITES Trade Database.

9.2 Other sharks and rays (all)

237. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-40 on Conservation of Whale Sharks (*Rhincodon typus*) Bycaught in IOTC: Review of Biology, Interactions with Purse Seine Fisheries and Best Practices on Handling and Release, including the following abstract provided by the authors:

“This document reviews current knowledge on the biology, distribution and conservation status of whale sharks (Rhincodon typus) at global and regional levels. It also provides a detailed analysis of whale shark interactions with purse seine fisheries in the Indian Ocean. Although scientific data about whale sharks remains limited, the available information on their life history characteristics and conservation status suggests that whale sharks in the Indian Ocean is “a taxon of the greatest biological vulnerability and conservation concern for which there are very few data”. Therefore, we suggest the SC recommended, as stated in Resolution 25-08, the application precautionary management measures including a retention ban for this species for IOTC fisheries to address this vulnerability. The document also reviews existing measures aimed at mitigating and minimizing the impacts of purse seine fisheries on whale sharks, including current practices for the safe handling and release of accidentally captured whale sharks.”

238. The WPEB **NOTED** a significant increase in interactions with purse seine fisheries over the past two years as shown in the paper and questioned the reasons behind this trend. The WPEB further **NOTED** that there were years when such interactions were absent and **SUGGESTED** that changes in environmental conditions may have played a role.

239. The WPEB **SUGGESTED** that the authors compare current interaction rates with those from a previous study to evaluate potential changes. However, the WPEB **NOTED** that the current study included vessels from Spain, Seychelles, Kenya, and Tanzania, but did not include French vessels.

240. The WPEB **NOTED** that information on mortality resulting from these interactions could be obtained from observer data. The WPEB **NOTED** that the Spanish fleet reported interactions but did not submit observer data to the IOTC. During the COVID-19 period (2020–2021), observer coverage was low, but it has since increased to above 5% of fishing operations.

241. The WPEB **SUGGESTED** using observer data to assess changes in interaction rates with whale sharks before and after the adoption of the prohibition on purse seiners setting on whale sharks brought in under Resolution 13/05. The WPEB **NOTED** that catch rates appear to have increased following the Resolution, though the reasons for this remain unclear.

242. The WPEB **NOTED** the life-history traits and conservation status of the whale shark, highlighting its large size, slow growth, late reproductive maturity, and long lifespan—all characteristics that increase its biological vulnerability.

243. The WPEB **NOTED** that genetic evidence suggests the existence of at least two distinct populations with limited connectivity between the Atlantic and Indo-Pacific Oceans.

244. The WPEB **NOTED** that whale sharks are currently threatened by ship strikes, marine pollution, and incidental catches in fisheries. Although targeted fishing has become rare, fisheries remain a significant source of mortality. Additional human-induced pressures such as habitat degradation and climate change further contribute to population decline.

245. The WPEB **NOTED** that there is little information on the interactions between whale sharks and multiple IOTC fisheries. The WPEB **NOTED** that due to the species' elusive nature and sporadic sightings, detailed biological and distributional data remain limited.

246. The WPEB **NOTED** that while evidence on post-release survival of whale sharks from purse seine interactions suggests low mortality when best-practices are followed, data on bycatch in other fisheries, particularly gillnets, remains scarce**.** Therefore, the WPEB **RECOMMENDED** that the SC **ENCOURAGE** CPCs to improve data collection and reporting for interactions with whale sharks involving all gear types as well as purse seine.

247. The WPEB **NOTED** that the IUCN will soon publish a new assessment for this species. The WPEB **NOTED** that according to the IUCN 2016 Red List assessment the Indo-Pacific subpopulation is assessed as being Endangered, with an estimated 63% decline. The WPEB **NOTED** that however, this risk assessment was mainly based on literature published over 10 years mostly based on sporadic reports. The WPEB **NOTED** that there are large uncertainties in the estimation of the population size in the recent and future results in the Indian Ocean. The WPEB further **NOTED** that preliminary evidence from a CKMR project being conducted on the species in the Indian Ocean supported population decline.

248. **NOTING** the uncertainties in the IUCN assessment, the WPEB **REQUESTED** that the Secretariat seek further details from the assessors regarding the methodologies applied in their evaluations.

249. The WPEB **NOTED** suggestions that improved handling practices may be more appropriate than a retention ban, as whale sharks entangled in nets are not consumed. However, the WPEB **NOTED** that more information is needed to assess the impact of all fishing gears in the Indian Ocean, particularly gillnets in the northern region and further **NOTED** that it remains unclear whether small coastal purse seine fisheries retain whale sharks. Therefore, the WPEB **CONCLUDED** that a retention ban could provide disincentive to captures.

250. The WPEB **AGREED** that the focus should be on evaluating the biological vulnerability of the species and identifying the associated data requirements to provide informed advice to the Commission for decision-making.

251. The WPEB **RECOMMENDED** that the SC should promote efforts to clarify the extent and nature of whale shark interactions with IOTC fisheries, and to assess the current stock status within the IOTC area of competence, **ACKNOWLEDGING** that the extent of the vulnerability of whale sharks to IOTC fisheries is unknown. Based on the available information presented in paper IOTC-2025-WPEB21(AS)-40, the WPEB **RECOMMENDED** that the SC classify whale sharks in the Indian Ocean as a **"**taxon of the greatest biological vulnerability and conservation concern for which there are very few data**"**, as defined in Resolution 25/08. The WPEB **NOTED** that this classification supports the consideration of precautionary management measures and prioritization of future research and data collection efforts by the Commission.

252. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-41 on Consideration of sampling requirements and logistics for close-kin mark recapture and a reappraisal of potential for stock structure in Indian Ocean shortfin mako shark, including the following abstract provided by the authors:

"Concerns about population declines, combined with a lack of informative data on shortfin mako sharks (Isurus oxyrinchus, SMA), have created a need for new assessment approaches. Close-Kin Mark Recapture (CKMR) is a powerful method for obtaining fisheries independent estimates of spawning stock abundance. It has been applied to both target and bycatch species and for several shark species. The statistical design results given in Patterson and Bessell-Browne (2025) indicates that collection of ~2000 tissue samples annually would provide sufficiently precise abundance estimates to estimate absolute population abundance for shortfin mako in the Indian Ocean (IO). This paper presents an appraisal of potential sampling and data collection opportunities by examining catch records by fleet. Based on recent IOTC catch records, we found that this number of samples could in principle be collected from fisheries operating in the IOTC area and that the target sample range is approximately 4-7% of the recent average annual catch reported by the top 10 SMA catching fleets. We also present an updated appraisal of likelihood of genetic stock structure to be present in IO SMA. This used a mix of previously collected and new samples taken from locations in the Indian Ocean (Sri Lanka, Reunion, Northwest Western Australia), as well as "out group" locations (southern Tasmania, New South Wales and the Atlantic)." – see paper for full abstract.

253. The WPEB **NOTED** that the Close-Kin Mark-Recapture (CKMR) design study for shortfin mako was funded by an EU grant. The project began in 2022 and has now been completed. The WPEB further **NOTED** that CKMR aims to provide fisheries-independent abundance estimates and can also be integrated with traditional fisheries assessments.

254. The WPEB **NOTED** that fisheries primarily catch juvenile shortfin mako, with only a small and relatively stable proportion of adults in the catch, based on length frequency data. As a result, adults are unlikely to be included in the study. Therefore, the CKMR study is based on half-sibling pairs (HSP) rather than parent-offspring pairs (POP). HSPs provide information on both natural mortality and adult abundance using a dynamic model that tracks the population back in time.

255. The WPEB **NOTED** that the study suggests that 2,000 samples are needed to achieve the targeted number of HSPs, representing about 3–5% of the catch. Since CKMR only requires tissue samples, there is no additional cost (i.e., no need to purchase fish from fishers). However, considerable logistical work is still required, such as coordination through observer programs. Nevertheless, trained samplers are expected to successfully collect samples once they have access to the fish.

256. The WPEB **NOTED** that the samples are aged and while aging error was not considered in the design study, it can be incorporated into the CKMR modelling, along with other uncertainties related to growth (as a likelihood component in the model). Previous CKMR studies in the Atlantic Ocean have found aging error to be not influential.

257. The WPEB **NOTED** that the IOTC Secretariat is developing a regional sampling program starting in 2026 to collect length and biological samples for neritic and tropical tuna species. The WPEB **SUGGESTED** that shortfin mako could be added to the list of species for which samples are collected, which could reinforce the CKMR study. The WPEB further **NOTED** that, as shortfin mako is listed in CITES Appendix II, there may be some logistical challenges for sampling.

258. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-42 on Evaluation of potential close-kin mark recapture sampling designs for Indian Ocean shortfin mako shark, including the following abstract provided by the authors:

"This paper presents the results of a statistical design exercise investigating the potential for Close-kin Mark-recapture (CKMR) to provide accurate assessment of population size for Indian Ocean shortfin mako sharks (Isurus oxyrinchus). CKMR uses the prevalence of closely related animals (in this study, those which share a parent) in a collection of genetic samples to estimate adult population size. The method can be combined with more typical fisheries data in order to conduct integrated stock assessments. Prior to committing to a large scale CKMR study, it is prudent to conduct a numerical design exercise to investigate how many sample sizes are likely to be required, assuming current knowledge of a population is informative enough to at least guide planning of real sampling. In this working paper, we provide some introductory desciption of how CKMR operates and then detail a design approach to investigate sampling strategies for SMA. For this, a sex and age-based operating model was constructed that simulated CKMR kinship data and catch-at-age data. These data were fed into a similarly structured statistical estimation model which estimated population parameters and predictions of spawning output (akin to spawning stock biomass) and other quantities. The operating model was tuned to approximate outputs from the 2024 stock assessment. We considered a range of sample sizes, which recent IOTC data would suggest are logistically feasible to obtain - even if there are now complications in retaining samples from current management measures. The design modelling estimated that informative population estimates (i.e. with sufficiently low uncertainty to be useful in management decisions) would be expected from 2000 annual samples over 5 years. Testing of this approach with 1000 tissue samples were predicted to be of a reduced quality, and we advise any future sampling program to aim for at least 2000 samples per year. We outline the results and discuss challenges and opportunities for initiating CKMR at scale to obtain estimates of population size for SMA and other pelagic sharks captured by Indian Ocean fishing operations."

259. The **NOTED** that the study suggests collecting around 2,000 samples over five years, after which a CKMR assessment model can be developed to provide reasonable estimates of abundance and a snapshot of the population. Continued sampling will be necessary for ongoing monitoring and assessment, but both the number of samples and frequency of sampling are likely to decrease over time. These adjustments can be evaluated using the simulation model. Generally, intensive sampling is required initially to build the CKMR model, but sampling needs can be reduced considerably thereafter. Ongoing sampling will help reduce uncertainty in the information provided by the early samples in a CKMR study.

260. The WPEB **NOTED** that both an operating model (OM) and an estimation model (EM) were developed in the design study. The OM is mainly used to simulate population and fishery dynamics

and to evaluate the sample sizes needed to achieve the targeted number of HSPs. The EM is used to assess the bias and precision of population estimates from the CKMR model and can also serve as a preliminary assessment model once actual samples are collected.

261. The WPEB **DISCUSSED** how uncertainty in population dynamics, such as life-history parameters (e.g., reproductive cycle), could affect the evaluation of the required sample size. The WPEB **NOTED** that most uncertainties can be evaluated using the simulation framework, although it is not possible to include all sources of uncertainty. The current design study examined a wide range of population sizes, which typically have a much greater impact on sample size than uncertainties in life-history traits, such as skipped spawning cycles.

262. The WPEB **NOTED** that the EM shares the same dynamics as the OM and **DISCUSSED** whether additional uncertainties, such as the magnitude of catches, could be accounted for. The WPEB **NOTED** that this can be addressed through additional sensitivity analyses and one of the novel features of CKMR is that bias and uncertainty can be reduced through continued sampling, which improves the precision of information on population history.

263. The WPEB **NOTED** that CKMR based on HSPs can estimate natural mortality, which usually requires a longer time series and information on the age of the samples.

264. The WPEB **NOTED** that assessments for IOTC species have been affected by increasing uncertainty, partly due to declining quality in some fishery data. The WPEB **NOTED** that CKMR offers great potential to improve these assessments. CKMR has been successfully applied in numerous cases and has proven effective in providing robust, fishery-independent estimates of abundance. The shortfin mako CKMR design presents an opportunity to implement a stock assessment using this approach. Successful application could provide incentives and pave the way for CKMR studies on tuna species as well. The WPEB therefore **SUPPORTED** the implementation of a proper CKMR study for shortfin mako in line with the design study.

265. The WPEB **NOTED** that the Sharks International conference will be held in Sri Lanka in May 2026 and further **NOTED** that members of the group are organising a side event: 'Bridging the gap: strengthening science-policy links for shark and ray conservation and management in tuna RFMOs.'

266. The WPEB **ENCOURAGED** interested scientists to participate in this side event, **NOTING** that the organisers are seeking panellists.

9.3 Mobulids

267. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-INF04: Proposed Mobulid Executive Summary

268. The WPEB **NOTED** that during the 2024 meeting, the group had agreed that it would be helpful to develop an executive summary document for mobulids. The WPEB **NOTED** that a draft was developed by the Secretariat with assistance from the Manta Trust.

269. The WPEB **REVIEWED** the draft executive summary and **ADOPTED** it after some revisions. This can be found in Appendix XVIV.

270. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-INF03: Revised mobulid handling guidelines which also drew on information in papers IOTC-2025-WPEB21(AS)-INF08 and IOTC-2025-WPEB21(AS)-INF11 which both relate to manta sorting grids – how to construct them and their efficacy in improving survival outcomes after release.

271. The WPEB **NOTED** that sorting grids are inexpensive, easy to use, and can be conveniently stored on board. Currently, all US vessels (12 in total) have adopted sorting grids for handling mobulids. The sorting grid allows mobulids to be removed earlier, preventing them from interfering with fishing operations and offering clear benefits to fishers. Ecuadorian fleets have also adopted sorting grids, although global implementation has not yet occurred. The grids have been well received by skippers in the Indian Ocean.

272. The WPEB **NOTED** that the fast timing of release is crucial for reducing release mortality, making equipment such as sorting grids extremely important. The WPEB **NOTED** that sorting grids are only suitable for use on purse seine vessels at this stage.

273. The WPEB **NOTED** that, while Resolution 15/01 on Mobulids establishes specific reporting requirements for each type of fishing gear, Resolution 19/03 implements a retention ban for all fisheries, except for subsistence fisheries, which are required to report their Mobulid ray catches. Consequently, reporting of Mobula rays has declined for both retained catches and discards, and the available data is generally aggregated.

274. **ACKNOWLEDGING** the additional reporting burden on CPCs but **NOTING** the limited amount of species-specific data reported to the Secretariat for mobulids and the difficulties that this poses for accurately assessing the status of these populations, the WPEB **ENCOURAGED** CPCS to report mobulid catch and discards data to species level.

275. The WPEB **REQUESTED** the Secretariat to work with CPCs to improve their capacity in species identification of these species and reporting of data.

276. The WPEB **RECOMMENDED** that the SC **ADVISE** the Commission to speak with CPCs to determine appropriate ways to improve data reporting from artisanal fisheries.

277. The WPEB **NOTED** that in 2024, the group recommended the adoption of a revised set of handling guidelines for mobulids while **NOTING** that that work was required to further develop the guidelines for gillnets. The WPEB **NOTED** that the Secretariat worked intersessionally with the Manta Trust to further develop these guidelines which were reviewed by the group. After these had been reviewed, the WPEB **ADOPTED** the revised handling guidelines for mobulids and **RECOMMENDED** that the SC **ENDORSE** these handling guidelines for consideration by the Commission in 2026. The details of the suggested revisions to the handling procedures can be found in Appendix XVVI.

9.4 Marine Mammals

278. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-43 on Co-Designing a Trial for reduction of cetacean bycatch: A Proposal for Collaborative Bycatch Mitigation Research, including the following abstract provided by the authors:

"*In accordance with Resolution 23/06 and recommendations from several WPEB meetings, the IWC is proposing three potential projects for cetacean bycatch monitoring and mitigation. These are summarised as follows: 1. Pilot study to further investigate sub-surface gillnets as a mitigation measure 2. Developing a roadmap for reducing cetacean bycatch in the Indian Ocean, and 3. Analysing a new long-term dataset from Pakistan's small-scale fleet. IWC would appreciate any feedback on which of these initiatives would be more valuable in the context of IOTC, as well as suggestions for locations and project partners with which IWC should collaborate.*"

279. The WPEB **NOTED** the three proposed options for a collaborative trial for cetacean bycatch mitigation: 1. Pilot testing sub-surface gillnets in selected CPCs (following the methodology

presented in IOTC-2023-WPEB19-24_rev3); 2. Developing a regional roadmap for bycatch reduction to guide future action across the IOTC area; and 3. Analysing the WWF-Pakistan dataset from crew-based observers on gillnet vessels to assess cetacean bycatch patterns.

280. The WPEB **AGREED** that Option A, a pilot study of sub-surface gillnets in a new location of the IOTC area, was the preferred way forward, as it was considered the most practical and had been previously recommended by the WPEB. Options B and C were **NOTED** as being more academic, with limited direct application. The WPEB **SUGGESTED** that additional CPCs, such as Iran, could be included in the trial sub-surface gillnet trial.

281. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-44 on A Regional Conservation Management Plan for Arabian Sea Humpback Whales: Summary, Status and Timeline, including the following abstract provided by the authors:

"The Arabian Sea humpback whale (Megaptera novaeangliae - ASHW), is one of the most endangered whale populations in the world. Unlike other humpback whale populations, they do not undertake the long seasonal migrations to high-latitude feeding grounds, but instead remain within the Arabian Sea year-round, with seasonal movements to areas such as southwest India, Sri Lanka, and (historically) the Maldives. This unique restricted ecology makes the population particularly vulnerable to regional threats, including fisheries entanglement, vessel strikes, underwater noise, habitat degradation, and climate change. With an estimated population size of fewer than 100 individuals, the ASHW is considered 'Endangered' on the IUCN Red List of Threatened Species. In response to the existing threats, a joint International Whaling Commission (IWC) - Convention on Migratory Species (CMS) initiative is developing a Conservation Management Plan (CMP) to guide coordinated, science-based management across Arabian Sea range states. The CMP prioritizes short, medium, and long-term objectives, emphasising threat mitigation, habitat protection, and stakeholder capacity building. This paper summarises the CMP's background, development process, scientific foundations, and threat prioritisation, and provides a timeline for its anticipated endorsement, adoption and implementation in 2026 and beyond."

282. The WPEB **NOTED** that this paper outlined the development of a Regional Conservation Management Plan for Arabian Sea Humpback Whales (ASHW) under the International Whaling Commission and the Convention on Migratory Species, including its status, timeline, and fisheries-related activities.

283. The WPEB **NOTED** the importance of collaboration between IOTC and the IWC.

284. The WPEB **NOTED** that the Bycatch Risk Assessment (ByRA) tool uses GIS-based processes to overlap fisheries data with cetacean distribution models.

285. The WPEB **NOTED** that, in relation to bycatch mitigation measures for Arabian sea humpback whales, alternative gears (e.g. longlines) were proposed as potentially more effective than sub-surface gillnets or LED lights.

286. The WPEB **AGREED** to endorse the CMP and encouraged CPCs to support it in other fora to strengthen international backing.

9.5 Seabirds

287. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-45 on Developing an IOTC multi-year Seabird Strategy.

288. The WPEB **NOTED** that the development of an IOTC Seabird Strategy was included in the WPEB workplan for 2025 and that the Agreement on the Conservation of Albatrosses (ACAP) developed a draft Seabird Strategy for IOTC which is based on the Seabird Strategy of Commission for the Conservation of Southern Bluefin Tuna (CCSBT).

289. The WPEB **NOTED** that at WPEB18, ACAP and BirdLife International (BLI) proposed the development of a seabird strategy and action plan for longline fisheries under IOTC's mandate. The WPEB **NOTED** that while WPEB18 had supported the proposal, development of an IOTC Seabird Strategy was deferred until after the development of a Multi-year Seabird Strategy by the CCSBT, which could be useful to guide and harmonise the efforts among tuna RFMOs to mitigate seabird bycatch, especially considering the strong overlap between CCSBT and IOTC areas.

290. The WPEB **NOTED** the considerable overlap between the objectives and actions expected under an IOTC Seabird Strategy and those already set out in the CCSBT Multi-year Seabird Strategy. The WPEB **RECALLED** that document IOTC-2023-WPEB19-INF39 had introduced the CCSBT's Multi-year Seabird Strategy adopted in 2019, its action plan was adopted in 2022, along with the associated background work, future plans, and proposals for establishing a regular global risk assessment framework.

291. The WPEB **NOTED** that several actions relevant to an IOTC Seabird Strategy could be achieved through cooperation with CCSBT, and so **REQUESTED** the IOTC Secretariat to liaise with CCSBT on this work. However, the WPEB **NOTED** that some actions would need to be specific to IOTC fisheries, and therefore considered within the IOTC context.

292. The WPEB **DISCUSSED** the recommendations in the draft Seabird Strategy to develop a draft strategy for WPEB in 2026 aimed at identifying options for improved bycatch mitigation, stronger compliance with seabird conservation measures, and enhanced collection and analysis of seabird bycatch data. The WPEB **SUPPORTED** the recommendations and **AGREED** to work intersessionally to develop a draft IOTC Seabird Strategy for 2026, building on the elements already presented.

293. The WPEB **NOTED** that CCSBT plans to conduct a global assessment of seabird bycatch in longline fisheries in the southern hemisphere which would provide useful information to the WPEB due to the large overlap of the CCSBT and IOTC areas and fisheries. The WPEB **ENCOURAGED** CPCs to contribute data and any other useful information to this assessment.

294. The WPEB also **AGREED** to further review, with the support of the IOTC Secretariat, which actions could be advanced in cooperation with CCSBT and which should remain specific to IOTC.

295. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-INF07 on Insights into bycatch reduction based on underwater observations of Yelkouan shearwater (*Puffinus yelkouan*) and Atlantic Puffin (*Fratercula arctica*) interactions with the French pelagic longline fishery in the Western Mediterranean, including the following abstract provided by the authors:

"The Mediterranean Sea is a significant habitat for seabirds, including endemic and endangered species. However, French pelagic longline fisheries overlap with foraging zones of seabirds, posing risks of bycatch. Insufficient monitoring and reporting hinder efforts to understand and mitigate these interactions. To identify effective fisheries bycatch mitigation measures, documenting species-fishing gear interactions and foraging strategies for each species are needed. Seabird underwater interaction processes were investigated in situ on pelagic longline gears. Cameras affixed on branchlines 1–2 m above the hook were deployed between May 2022 and June 2024 to enable a precise description of interactions of various species with baited hooks, including the Yelkouan

Shearwater (Puffinus yelkouan) and the Atlantic Puffin (Fratercula arctica). Foraging strategies are documented for the two pursuit-diving seabirds. The Yelkouan Shearwater foraged in association with conspecifics and competitive events were observed. Videos revealed cryptic events of successful and unsuccessful attemps in consuming the bait during the gear soak at depths to ca 10m. Underwater interactions occurred during the gear soak on unattended gear, while the vessel was away from the site. The Yelkouan Shearwater and the Atlantic Puffin may have developed strategies to feed on pelagic longline bait. These observations suggest that bycatch mitigation approaches are needed during multiple phases of fishing operations, and not just during setting and hauling as is the prevailing paradigm. Technical seabird bycatch management measures tailored to regional fishing practices are proposed and discussed."

296. The WPEB **NOTED** the innovative research, which provides the first known direct evidence of diving seabirds attacking baited hooks during soak time.

297. The WPEB **NOTED** that the study related to a surface fishery, with hooks operating at a depth of around 10 m. The WPEB also **NOTED** that such fisheries are not currently known to operate in the Indian Ocean in the southern areas where interactions between seabirds and pelagic longline tuna fisheries are more prevalent within the IOTC area.

9.6 Sea turtles

298. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-46 on Collaborative approaches to monitor and reduce sea turtle bycatch mortality in the French longline fisheries in the SWIO: latest data and insights, including the following abstract provided by the authors:

"This document presents the latest results on sea turtle bycatch in the French longline fisheries operating from Réunion Island in the Southwest Indian Ocean (SWIO). Longline bycatch is a recognised conservation concern in the region, and the Réunion fleet provides one of the few long-term datasets available for regional assessment. Data were compiled from complementary sources and integrated within the SaveTurtleRun (STR) framework: Kelonia Care Centre admissions (2000–2024), IRD/Ob7 observer and self-reporting programmes (2009–2023), IOTC fishing-effort datasets, and STR field records. Together, these sources document 845 bycatch events over 24 years. Loggerhead turtles (Caretta caretta) were the most affected species, followed by green (Chelonia mydas), olive ridley (Lepidochelys olivacea), and leatherback (Dermochelys coriacea) turtles." – see paper for full abstract.

299. The WPEB **NOTED** that the fleet around Reunion is focused on targeting swordfish, so the depth of hook setting does not really change. The WPEB further **NOTED** that a mix of hook types are used including J, circle, G and tuna hooks and their use depends on fishermen's perceptions of what each type are best able to catch.

300. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-47 on Launching ACTIVE: strengthening collaborative efforts for sea turtle bycatch mitigation and conservation in the SWIO, including the following abstract provided by the authors:

"The ACTIVE project (Atténuation des Captures accidentelles de Tortues marines et Initiatives de Valorisation d'une pêche Écoresponsable) was selected in June 2025 for funding under the European Maritime, Fisheries and Aquaculture Fund (FEAMPA, OS 1.6). Building on more than 20 years of partnership with fishermen and on the SaveTurtleRUN project (2023–2025), ACTIVE will start in July 2025 for three years. Its main objective is to reduce the impact of French longline fisheries operating in the Southwest Indian Ocean (SWIO) on sea turtle bycatch, while promoting sustainable fishing

practices and advancing scientific knowledge on these threatened species." – see paper for full abstract.

301. The WPEB **THANKED** the authors and **ENCOURAGED** others to develop projects like this to better understand the interaction between IOTC fisheries and marine turtles as well as better understanding the genetic structure of the marine turtle species.

302. The WPEB **NOTED** that at this stage, environmental factors and behavioural trends have not been included in the model, but the author does intend to include these in the future.

303. The WPEB **NOTED** that similar analyses are being undertaken in eastern Australia looking at the impacts on nesting sites.

304. The WPEB **ENCOURAGED** the authors to coordinate with the Secretariat so these data can be included in the IOTC databases.

305. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-50 on Insights from the Data of the Crew-Based Observer Program: Identifying Blue Corridors for Marine Turtles in Pakistan's EEZ, including the following abstract provided by the authors:

"Marine turtles undertake basin-scale migrations that create seasonally predictable "blue corridors," where exposure to pelagic and semi-pelagic gillnet fisheries can be acute. We analysed 2012–2019 crew-based observer records from Pakistan's Exclusive Economic Zone (EEZ) to delineate seasonal corridors and assess coherence with existing area-based measures. After QA/QC, the dataset comprised 390 turtle–gillnet interaction events (total turtle weight, TTW = 5,791 kg): Released Alive 95.4% by count (97.6% by TTW), Released Dead 3.6% (2.4%), and Sightings 1.0%. Biomass peaked in October–December (40.1% of period TTW) and was concentrated in the Nesting season (September–February: 67.3% of TTW). We generated TTW-weighted kernel density estimates (KDEs) for Early, Peak, and Late phases and aggregated observations to an H3 hexagonal grid (resolution 7) to stabilise spatial signal. Peak KDEs were most compact (95% area ≈ 2.0×10^3 km²), indicating tightened shelf-parallel movement along the Karachi–Churna/Indus margin; Early was broader (95% ≈ 1.09×10^4 km²), and Late intermediate (95% ≈ 3.35×10^3 km²). ²). Geodesic connections between top-5 seasonal hotspots per side yielded 25 candidates (0–350 km; median 137 km), with selected least-risk links consistently short (≈40–60 km) and recurrent, that are overwhelmingly IMMA-contained while largely outside nearshore MPAs (Churna, Astola). Overlap diagnostics showed ≈80% of TTW and corridor length inside the IMMA, but ≈0–2% within nearshore MPAs. Centroid-shift bearings revealed a consistent WNW→SE seasonal axis, with shorter Early→Peak and longer Peak→Late displacements. Sensitivity analyses (grid resolution, bandwidth, hotspot number, coastline masking, cost objective) did not alter top-rank corridor identity. Evidence supports targeted management during October–April in the delineated blue-corridor areas—shelf-parallel lanes off the Karachi–Indus margin (off Karachi–Churna) and western Balochistan— where an interaction-triggered ≥ 25 nm move-on rule, complemented by time–area advisories and soak-time caps, is expected to reduce turtle-encounter risk."

306. The WPEB **NOTED** that limitations of the study include the fact that the crew did not report the turtles to species level and that turtle weight had to be used as a proxy to estimate the size of the animals involved.

307. The WPEB **NOTED** that information from earlier work has already been shared with the government but not from this updated work. The WPEB **NOTED** that the authors do intend to share the outcomes of this work with the government in order to improve the management of marine turtles through the creation of blue corridors.

308. The WPEB **NOTED** that a subset of the data presented have been submitted to the Secretariat.

10. WPEB Program of Work (Research and Priorities)

10.1 Revision of the WPEB Program of Work 2026-2030

309. The WPEB **NOTED** paper IOTC-2025-WPEB21(AS)-09 on WPEB Program of Work 2024-2028 which provided the WPEB21 with the latest Program of Work (2025-2029) with an opportunity to consider and revise this for 2026-2030 by taking into account the specific requests of the Commission and Scientific Committee, given the current status of resources available to the IOTC Secretariat and CPCs.

310. The WPEB **RECOMMENDED** that the SC consider and endorse the WPEB Program of Work (2026–2030), as provided in Appendix XVV.

10.2 Development of priorities for an Invited Expert at the next WPEB meeting

311. The WPEB **AGREED** to the following core areas of expertise and priority areas for contribution that need to be enhanced for the next meeting of the WPEB in 2026, by the Invited Expert:

- Indicator analysis;
- Data poor methods for assessments.

11. Other Matters

11.1 Date and place of the 22nd and 23rd Working Party on Ecosystems and Bycatch

312. The WPEB **NOTED** the intention to continue to hold the WPEB back-to-back with the WPB in early to mid-September and further **NOTED** that the WPEB will be held second in 2026.

313. The WPEB **REQUESTED** CPCs that may be interested in hosting the 22nd and 23rd Working Party on Ecosystems and Bycatch to contact the Secretariat.

11.2 Nomination of the Chair and Vice-Chair of the Working Party on Ecosystems and Bycatch

Chair

314. The WPEB **NOTED** that the second term of the current Chairperson, Dr Mariana Tolotti (EU, France) expired at the close of the WPEB21 meeting and, as per the IOTC Rules of Procedure (2014), participants are required to elect a new Chairperson of the WPEB for the next biennium. The WPEB **THANKED** the Chair for her hard work over her two terms.

315. **NOTING** the Rules of Procedure (2014), the WPEB **CALLED** for nominations for the position of Chairperson of the IOTC WPEB for the next biennium. Dr Charlene da Silva (South Africa) was nominated, seconded and elected as Chairperson of the WPEB for the next biennium.

Vice-Chairs

316. The WPEB **NOTED** that the second term of the current first Vice-Chairperson, Dr Mohammed Koya (India) expired at the close of the WPEB21 meeting and, as per the IOTC Rules of Procedure (2014), participants are required to elect a new Vice-Chairperson of the WPEB for the next biennium.

317. **NOTING** the Rules of Procedure (2014), the WPEB **CALLED** for nominations for the position of first Vice-Chairperson of the IOTC WPEB for the next biennium. Dr Philippe Sabarros (EU, France) was nominated, seconded and elected as first Vice-Chairperson of the WPEB for the next biennium.

318. The WPEB **NOTED** that the second term of the current second Vice-Chairperson, Dr Charlene da Silva (South Africa) expired at the close of the WPEB21 meeting and, as per the IOTC Rules of

Procedure (2014), participants are required to elect a new Vice-Chairperson of the WPEB for the next biennium.

319. **NOTING** the Rules of Procedure (2014), the WPEB **CALLED** for nominations for the position of second Vice-Chairperson of the IOTC WPEB for the next biennium. Dr Yanan Li (China) was nominated, seconded and elected as second Vice-Chairperson of the WPEB for the next biennium.

11.3 Review of the draft, and adoption of the Report of the 21st Session of the WPEB

320. The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB21, provided at Appendix XVVII, as well as the management advice provided in the draft resource stock status summary for each of the eight shark species, as well of those for marine turtles, seabirds, cetaceans and mobulids:

Sharks

- Blue shark (*Prionace glauca*) – Appendix VII
- Oceanic whitetip shark (*Carcharhinus longimanus*) – Appendix VIII
- Scalloped hammerhead shark (*Sphyrna lewini*) – Appendix IX
- Shortfin mako shark (*Isurus oxyrinchus*) – Appendix X
- Silky shark (*Carcharhinus falciformis*) – Appendix XI
- Bigeye thresher shark (*Alopias superciliosus*) – Appendix XII
- Pelagic thresher shark (*Alopias pelagicus*) – Appendix XIII
- Porbeagle shark (*Lamna nasus*) - Appendix XIV

Other species/groups

- Marine turtles – Appendix XV
- Seabirds – Appendix XVI
- Marine mammals – Appendix XVII
- Mobulids – Appendix XVIV

321. The report of the 21st Session of the Working Party on Ecosystems and Bycatch (IOTC–2025–WPEB21(AS)–R) was **ADOPTED** by correspondence.

APPENDIX I
LIST OF PARTICIPANTS

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APPENDIX II
AGENDA FOR THE 21ST WORKING PARTY ON ECOSYSTEMS AND BYCATCH ASSESSMENT MEETING

Date: 9-13 September 2025

Location: Sète, France

Venue: Station Ifremer

Time: 09:00 – 17:00 (France time, GMT+1)

Chair: Dr Mariana Tolotti (EU, France)

Vice-Chairs: Mr Mohammed Koya (India) and Dr Charlene da Silva (South Africa)

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

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

3. **THE IOTC PROCESS: OUTCOMES, UPDATES AND PROGRESS** (IOTC Secretariat)

   3.1. Outcomes of the 27th Session of the Scientific Committee (IOTC Secretariat)
   3.2. Outcomes of the 28th Session of the Commission (IOTC Secretariat)
   3.3. Review of the Conservation and Management Measures relevant to Ecosystems and Bycatch (IOTC Secretariat)
   3.4. Progress on the recommendations of WPEB20 (IOTC Secretariat)

4. **REVIEW OF THE DATA AVAILABLE AT THE SECRETARIAT FOR BYCATCH SPECIES** (All)

   4.1. Review of data available at the Secretariat for bycatch species (all)
   4.2. Review of the voluntary data collection form for ALDFG recovery proposed by the Secretariat (all)

5. **REVIEW OF NATIONAL BYCATCH ISSUES IN IOTC MANAGED FISHERIES AND NATIONAL PLANS OF ACTION** (sharks; seabirds; marine turtles) (CPCs and IOTC Secretariat)

   5.1. Updated status of development and implementation of NPOA for seabirds and sharks, and the implementation of the FAO guidelines to reduce marine turtle mortality in fishing operations (CPCs)
   5.2. Updated status of national fisheries and bycatch (CPCs)

6. **REVIEW INFORMATION ON BIOLOGY, ECOLOGY, FISHERIES AND ENVIRONMENTAL DATA RELATING TO SHARKS** (all)

   6.1. Presentation of new information available on sharks (all)
   6.2. Development of shark research work plan (all)
   6.3. Review of the minimum standards for safe handling and live release procedures (Annex III of Resolution 25/08) (all)
   6.4. Development of ToRs for a long-term project on sharks (all)

7. **STOCK ASSESSMENT FOR BLUE SHARK** (all)

   7.1. Review of indicators for blue shark (all)
   7.2. Stock assessment models (all)
   7.3. Review of the proposed stock assessment of blue shark (all)
   7.4. Recommendations and executive summaries (all)

8. **NEW INFORMATION ON BIOLOGY, ECOLOGY, FISHERIES AND ENVIRONMENTAL DATA RELATING TO ECOSYSTEMS AND BYCATCH SPECIES** (all)

8.1. Review new information on the environment and ecosystem interactions and modelling, including climate change issues affecting pelagic ecosystems in the IOTC area of responsibility (all)
- Ecosystems and climate
- Impact of gears
- Mitigation devices/techniques

8.2. Examining the benefits of retaining non-targeted species catches (all)

8.3. Assessment of the impacts of climate change on IOTC fisheries and bycatch species (all)

9. **BYCATCH, SPECIES INTERACTIONS, AND ECOSYSTEM RISK ASSESSMENTS FOR OTHER SHARK SPECIES, MARINE MAMMALS, SEABIRDS, AND SEA TURTLES** (all)

9.1. All bycatch species (all)
9.2. Other sharks and rays (all)
- Review existing data and information relating to the life history and conservation status of whale sharks (all)

9.3. Mobulids (all)
- Review new information on mobulid biology, ecology, fisheries interactions and bycatch mitigation measures (all);
- Review of indicators for mobulids (all)
- Review of revised best practice safe release and handling guidelines (all)
- Development of management advice on the status of mobulid species – review of new Executive Summary for rays (all)

9.4. Marine mammals (all)
- Best practice guidelines for safe release and handling of cetaceans (all);
- Review new information on marine mammal biology, ecology, fisheries interactions and bycatch mitigation measures (all);
- Development of management advice on the status of marine mammal species (all)

9.5. Seabirds (all)
- Review new information on seabird biology, ecology, fisheries interactions and bycatch mitigation measures (all)
- Development of draft work plan (all)

9.6. Sea turtles
- Review new information on marine turtle biology, ecology, fisheries interactions and bycatch mitigation measures (all)

10. **WPEB PROGRAM OF WORK (RESEARCH AND PRIORITIES)** (all)

10.1. Revision of the WPEB Program of Work 2026-2030 (Chairperson and IOTC Secretariat)

10.2. Development of priorities for an Invited Expert at the next WPEB meeting (Chairperson)

11. **OTHER MATTERS** (Chair)

11.1. Date and place of the 22nd and 23rd Working Party on Ecosystems and Bycatch (Chair)

11.2. Nomination of the Chair and Vice-Chair of the Working Party on Ecosystems and Bycatch (all)
11.3. Review of the draft, and adoption of the Report of the 21st Session of the Working Party on Ecosystems and Bycatch (Chairperson)

APPENDIX III
LIST OF DOCUMENTS

Document	Title
IOTC-2025-WPEB21(AS)-01a	Agenda of the 21st Working Party on Ecosystems and Bycatch
IOTC-2025-WPEB21(AS)-01b	Annotated agenda of the 21st Working Party on Ecosystems and Bycatch Assessment Meeting
IOTC-2025-WPEB21(AS)-02	List of documents of the 21st Working Party on Ecosystems and Bycatch Assessment Meeting
IOTC-2025-WPEB21(AS)-03	Outcomes of the 27th Session of the Scientific Committee (IOTC Secretariat)
IOTC-2025-WPEB21(AS)-04	Outcomes of the 29th Session of the Commission (IOTC Secretariat)
IOTC-2025-WPEB21(AS)-05	Review of Conservation and Management Measures relevant to ecosystems and bycatch (IOTC Secretariat)
IOTC-2025-WPEB21(AS)-06	Progress made on the recommendations and requests of WPEB20 and SC27 (IOTC Secretariat)
IOTC-2025-WPEB21(AS)-07	Review of the statistical data and fishery trends for ecosystems and bycatch species (IOTC Secretariat)
IOTC-2025-WPEB21(AS)-08	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 (IOTC Secretariat)
IOTC-2025-WPEB21(AS)-09	Revision of the WPEB Program of Work (2026–2030) (IOTC Secretariat & Chairperson)
IOTC-2025-WPEB21(AS)-10	Spatio-temporal dynamics through standardized CPUE for blue shark caught by the Taiwanese large-scale tuna longline fishery in the Indian Ocean from 2005 to 2023 (Huynh H, Tsai W)
IOTC-2025-WPEB21(AS)-12	Blue shark (*Prionace glauca*) bycatch in the tuna longline fishery in Sri Lanka (Balawardana T)
IOTC-2025-WPEB21(AS)-13	Impacts of Industrial Longline Fisheries on Elasmobranch Species Captured in Kenya’s Exclusive Economic Zone (Kiilu B)
IOTC-2025-WPEB21(AS)-14	Bycatch of Thai handline fishery in Western Indian Ocean (Thitipongtrakul W)
IOTC-2025-WPEB21(AS)-15	Status of sharks in India’s artisanal fisheries with a focus on shark conservation in India (Muktha M, Shoba J, Akhilesh K, Surya S, Swatipriyanka S, Najmudeen T, Shikha R, Purushottama G, Subal K, Remya L, Abdul A, Vinothkumar R, Livi W, Mahesh V, Sujitha T, Ajay N, Sanjay P, Koyaa K. George G)
IOTC-2025-WPEB21(AS)-16	CPUE and catch distribution for blue shark in the Tanzanian EEZ (Mbukwah R)
IOTC-2025-WPEB21(AS)-17	An update for 2024-2025 on the development of IOTC BTH PRM Project (Evgeny R)

Document	Title
IOTC-2025-WPEB21(AS)-18	Standardized CPUE of oceanic whitetip shark bycaught by the French Reunion-based pelagic longline fishery (2007-2024) (Tellier C, Sabarros P)
IOTC-2025-WPEB21(AS)-19	Distribution of blue sharks and shortfin mako sharks across the IOTC/ICCAT tRFMO boundary (da Silva C, West W)
IOTC-2025-WPEB21(AS)-20	Updated Insights into the Reproductive Biology of Blue Sharks (Prionace glauca) in the Western Indian Ocean Based on Longline Observer Data from 2010–2023 (Zhu J)
IOTC-2025-WPEB21(AS)-21	Best practices, habitat and survival rate of elasmobranch caught by French tropical tuna purse seiners - BEHAVE project (Wain, Sabarros P, Forget, Tolotti M, Goujon)
IOTC-2025-WPEB21(AS)-22	Comparison of catch rate and mortality of sharks by leader-type based on observer data in the Indian Ocean (Semba Y).
IOTC-2025-WPEB21(AS)-23	Post-release mortality of pelagic sharks caught by longliners – POREMO and ASUR projects (Sabarros P, Massey Y, Romanov E, Tellier C, Bach P)
IOTC-2025-WPEB21(AS)-24	Designing experimental fishing trials to explore the effects of leader material on catch and mortality of sharks: A review of best practice, principles and criteria (Emery T, D'Alberto B, Bromhead D)
IOTC-2025-WPEB21(AS)-25	Resolution 2025-08 as an opportunity to step up science driven conservation and management measure at IOTC for both sharks that are directly targeted and sharks caught as a bycatch in tuna and multi-ispecies fisheries? (Ziegler I)
IOTC-2025-WPEB21(AS)-26	Information about "Ring-shaped branchline (Meka-ring)" in pelagic longline fisheries and research plan (Daisuke O)
IOTC-2025-WPEB21(AS)-27	Updated on CPUE standardization of blue shark (*Prionace glauca*) from Indonesian tuna longline fleets 2006-2024 (Novianto D, Setyadji B, Syadiah L, Dodiet R, Januar S)
IOTC-2025-WPEB21(AS)-28	Catch estimates of blue shark (*Prionace glauca*) in the IOTC area (Rice J)
IOTC-2025-WPEB21(AS)-29	Comparison of indices of abundance for blue shark (*Prionace glauca*) in the IOTC area (Rice J)
IOTC-2025-WPEB21(AS)-30	Stock assessment of blue shark (*Prionace glauca*) in the IOTC area using SS3 (Rice J)
IOTC-2025-WPEB21(AS)-31	Abundance, visiting frequency, interactions, fishery connectivity and economics of exploitation of pelagic species by Réunion's artisanal fishery on anchored FADs (AFICHE): a research project implying tagging of dolphinfish, wahoo and tuna (Romanov E, Poirout T, Bonhommeau S, Cerutti F, Sabarros P, Bach P)
IOTC-2025-WPEB21(AS)-32	Mitigating the Ecological Impacts of Drifting Fish Aggregating Devices in Seychelles Waters – A Review of the FADWatch Programme (Lucas V)
IOTC-2025-WPEB21(AS)-33	Have Non-Entangling DFADs Reduced Ghost Fishing in the Indian Ocean? (Grande M, JMurua J, Cuevas N, Erauskin-Extramiana M, Lopetegui-Eguren L, Onandia I, Ruiz J, Salgado A, Moreno G, Murua H , Santiago J)
IOTC-2025-WPEB21(AS)-34	Review of the proposed form for the collection of data on ALDFG (IOTC Secretariat)

Document	Title
IOTC-2025-WPEB21(AS)-35	New best handling and release practice guide for vulnerable bycatch tropical species in tropical tuna purse seiners (Murua J, Ferarios J, Grande M, Ruiz J, Cuevas N, Krug I, Onandia I, Zudaire I, Salgado A, Erauskin-Extramiana M, Lopetegui-Eguren L, Santiago J)
IOTC-2025-WPEB21(AS)-37	Advancing Regional Ecosystem Fisheries Overview with Climate and Environmental Indicators to Enhance Fisheries Management Advice in the Indian Ocean Tuna Commission (Aron R, Marsac R, Murua H, Andonegi E, Jorda M)
IOTC-2025-WPEB21(AS)-38	Hindcasting the food-web dynamics of the tropical Indian Ocean pelagic ecosystem over the last two decades (Amate R, Jordá M, Corrales X, Zudaire I, Andonegi E)
IOTC-2025-WPEB21(AS)-40	Conservation of Whale Sharks (*Rhincodon typus*) Bycaught in IOTC: Review of Biology, Interactions with Purse Seine Fisheries and Best Practices on Handling and Release (Salgado A)
IOTC-2025-WPEB21(AS)-41	Consideration of sampling requirements and logistics for close-kin mark recapture and a reappraisal of potential for stock structure in Indian Ocean shortfin mako shark (Patterson T)
IOTC-2025-WPEB21(AS)-42	Evaluation of potential close-kin mark recapture sampling designs for Indian Ocean shortfin mako shark (Patterson T)
IOTC-2025-WPEB21(AS)-43	Co-Designing a Trial for reduction of cetacean bycatch: A Proposal for Collaborative Bycatch Mitigation Research (Campbell E)
IOTC-2025-WPEB21(AS)-44	A Regional Conservation Management Plan for Arabian Sea Humpback Whales: Summary, Status and Timeline (Minton G)
IOTC-2025-WPEB21(AS)-45	Developing an IOTC multi-year Seabird Strategy (ACAP)
IOTC-2025-WPEB21(AS)-46	Collaborative approaches to monitor and reduce sea turtle bycatch mortality in the French longline fisheries in the SWIO: latest data and insights (Barret M)
IOTC-2025-WPEB21(AS)-47	Launching ACTIVE: strengthening collaborative efforts for sea turtle bycatch mitigation and conservation in the SWIO (Barret M)
IOTC-2025-WPEB21(AS)-49	Influence of drifting FAD immersion time on bycatch rate in the tropical tuna purse seine fishery (Mollier et al.)
IOTC-2025-WPEB21(AS)-50	Insights from the Data of the Crew-Based Observer Program: Identifying Blue Corridors for Marine Turtles in Pakistan’s EEZ (Razzaque S, Sheikh A, Nawaz R, Shahid U, Afsar N, Abid S, Zafar A, Sheikh M, Hammdan)
IOTC-2025-WPEB21(AS)-51	Indian Ocean blue shark stock assessment using Bayesian surplus production models (JABBA): model development, validation, sensitivity analysis and large grid model ensembles (Coelho R)
Information papers	
IOTC-2025-WPEB21(AS)-INF01	Bycatch trend and its fate of the Spanish-owned tuna purse seiners fleet from the Atlantic and Indian oceans: impacts of the implementation of good practices (Acevedo-Iglesias S)

Document	Title
IOTC-2025-WPEB21(AS)-INF02	Deep diving into shark catch and trade mismatches (CITIES)
IOTC-2025-WPEB21(AS)-INF03	Revised mobulid handling guidelines (Manta Trust)
IOTC-2025-WPEB21(AS)-INF04	Proposed Mobulid Executive Summary ES28
IOTC-2025-WPEB21(AS)-INF05	Best Practices for the disentanglement of free-swimming small cetaceans
IOTC-2025-WPEB21(AS)-INF06	Which processes structure global pelagic ecosystems and control their trophic functioning? Insights from the mechanistic model APECOSM (Dalaut et al)
IOTC-2025-WPEB21(AS)-INF07	Insights into bycatch reduction based on underwater observations of Yelkouan shearwater (*Puffinus yelkouan*) and Atlantic Puffin (*Fratercula arctica*) interactions with the French pelagic longline fishery in the Western Mediterranean (Poisson F, Ochi, D, Gilman E)
IOTC-2025-WPEB21(AS)-INF08	Manta Sorting Grid Construction Instructions for Purse Seine Vessels (Cronin M, Murua J and Moreno G)
IOTC-2025-WPEB21(AS)-INF09	Bycatch survival of shortfin mako sharks (*Isurus oxyrinchus*) in the U.S. Atlantic pelagic longline fishery (Schultz M, Hoffmayer E R, Sulikowski J A and Byrne M E)
IOTC-2025-WPEB21(AS)-INF10	CCSBT Multi-year Seabird Strategy (CCSBT)
IOTC-2025-WPEB21(AS)-INF11	Innovative Solutions for manta and devil ray bycatch: Evidence for rapid release using manta sorting grids in the U.S. tropical tuna purse seine fleet (Cronin, M.)

APPENDIX IV
THE STANDING OF A RANGE OF INFORMATION RECEIVED BY THE IOTC SECRETARIAT FOR BYCATCH SPECIES

Extract from IOTC–2025–WPEB21(AS)–07.
(Appendix references in this Appendix, refer only to those contained in this appendix)

Overall bycatch levels & trends

Overall levels of reported catches of shark and ray species have increased over time due to the development and expansion of tuna and tuna-like fisheries across the Indian Ocean, reaching over 80,000 tonnes in 2016 (Fig. A1). Although the data reported in 2017 showed a reduction of around 10,000 tonnes, it was the period from 2018 to 2022 that saw the most significant impact, with an average catch reduction of 40%, due to Indonesia's catch re-estimation endorsed by SC27).

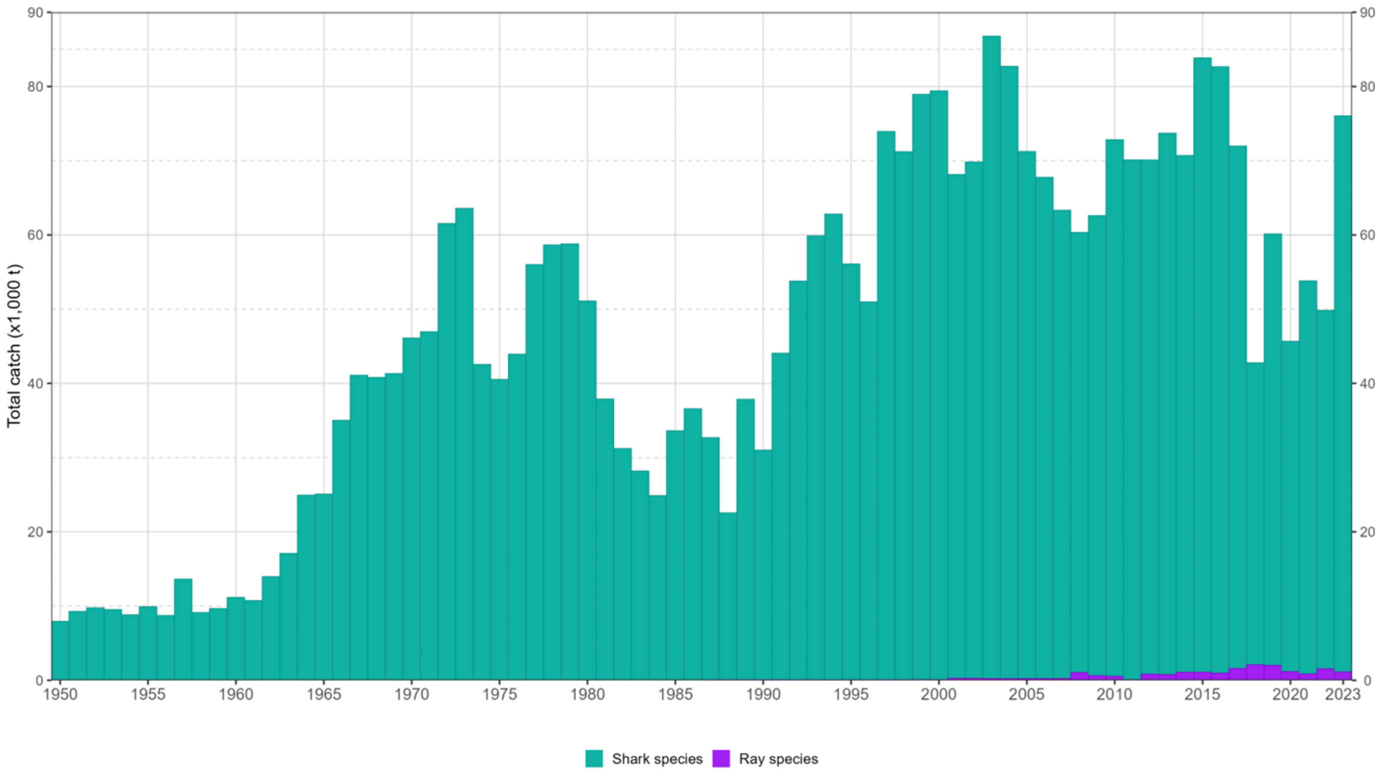

Figure A 1: Annual time series of cumulative nominal absolute catches (metric tons; t) of shark and ray species by species category for the period 1950-2023

Until the mid-1980s, shark catches were almost entirely reported as aggregate species. However, over the years, and as a result of the adoption of CMMs and improvements to monitoring programmes by some CPCs, species-level reporting has accounted for 40% of total shark catches in recent years. Blue sharks account for 55% of reported shark catches at species level, followed by silky sharks (about 12%) and shortfin mako sharks (7%) (**Figure A 2**).

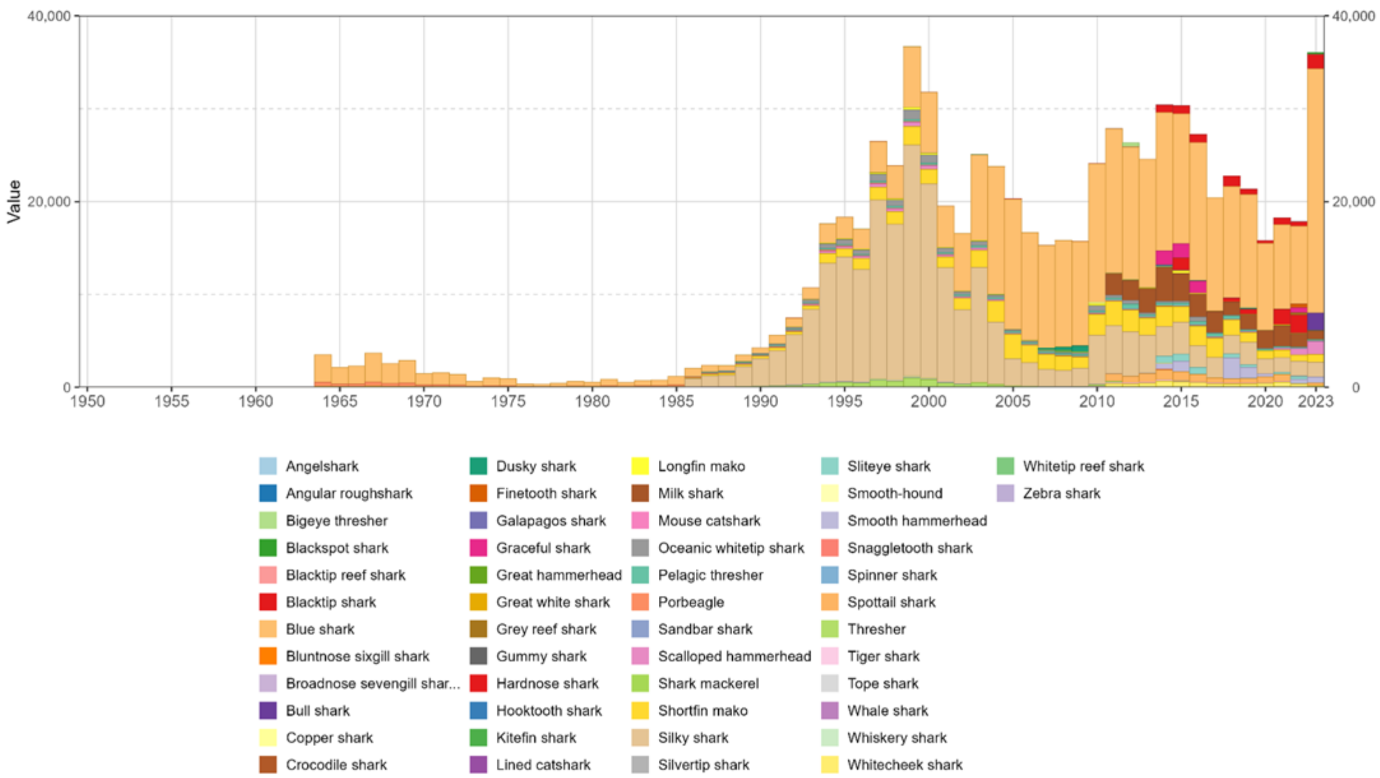

Figure A 2: Annual cumulative absolute time series of retained catches (metric tonnes; t) of sharks reported at species level for the period 1950-2023

Although aggregate shark catches represent around 60% of the total, in some cases the data are obtained from other sources (e.g. FAO) or repeated from year to year (e.g. MDG) due to inconsistency or lack of reporting by some fleets. On the other hand, in recent years, some CPCs have improved their monitoring programmes (KEN, TZA) by significantly reducing the level of reporting of aggregate shark species. Rays' catches accounted for 1,460 tons in recent years (period 2019-2023) and are mostly reported as aggregated species (**Figure A3**).

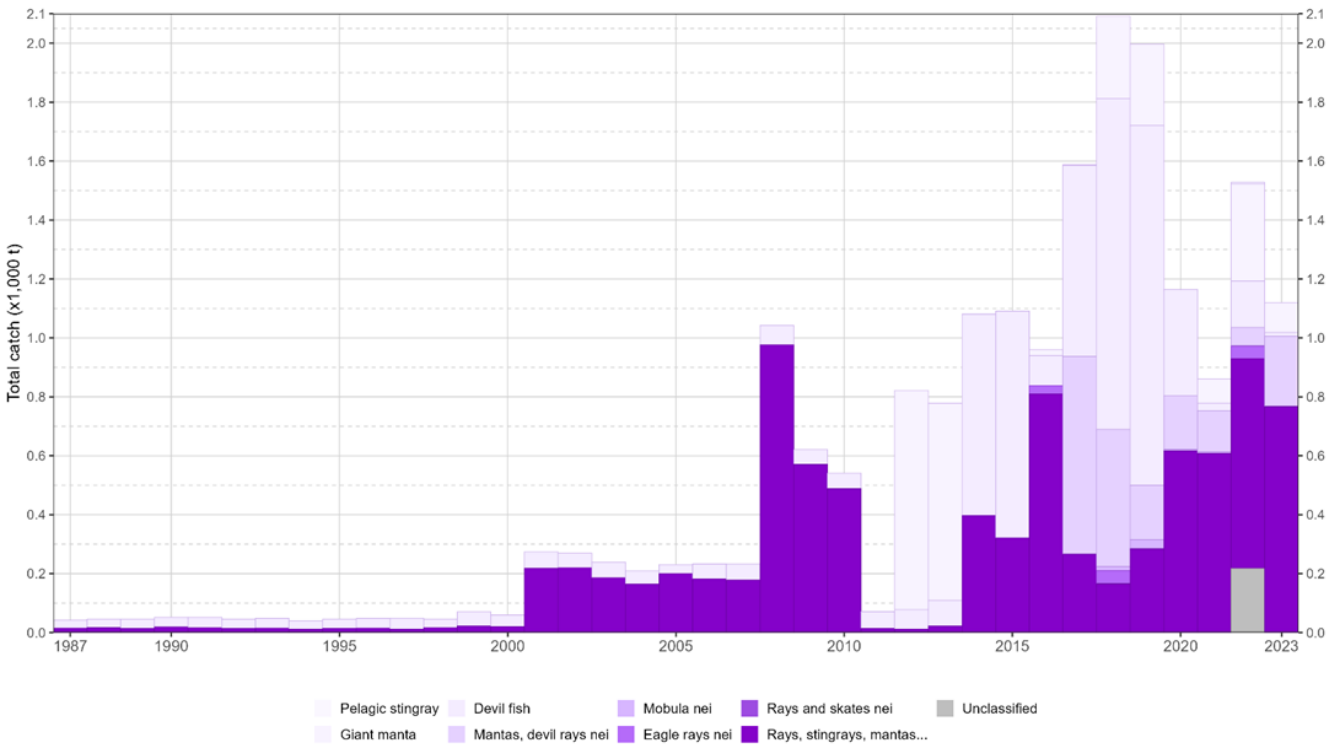

Figure A 3: Annual cumulative absolute time series of retained catches (metric tonnes; t) of rays for the period 1950-2023

Sharks and rays interactions with IOTC fisheries

As the available data on total discards in most fisheries remain sparse and fragmented, therefore discards are inferred from observer data collected through the ROS program. For longline fisheries 70% of the recorded interactions corresponds to blue shark, followed by oceanic whitetip sharks, silky shark and shortfin mako shark. The recorded interactions with rays in longline fisheries are almost entirely for Pelagic stingray.

For purse seine fisheries the recorded interactions are dominated by silky shark (98%) with some interactions recorded for oceanic whitetip sharks (**Fig. 5**). Pelagic stingray is also the main species interacting with purse seine fisheries (47%), followed by Devil fish (24%), mobula nei (16%) and Giant manta (10%).

APPENDIX V
MAIN ISSUES IDENTIFIED CONCERNING DATA ON NON-IOTC SPECIES

Extract from IOTC–2025-WPEB21(AS)–07

Unreported catches

Aggregate catches represent around 60% of the total shark catches reported, in some cases the data are obtained from other sources (e.g. FAO) or repeated from year to year due to inconsistency or lack of reporting by some fleets. In some cases, historical catches have gone unreported as many countries were not collecting fishery statistics in years prior to the 1970s or even do it as total sharks. The implementation of retention bans also has impacted the reporting for some species. Some CPCs are in the process of reviewing historical series and seeking the best approach to reconstruct the data on catches of sharks.

Poor data resolution

Misidentification of shark and ray species is still common and catch processing might introduce further problems related to proper species identification. The available size data are mostly coming from logbooks of industrial fisheries providing the size distribution of a few main species including blue shark, shortfin mako, silky shark and porbeagle. Data from other fisheries are scarce and inconsistent over time.

Catch and effort data

Geo-referenced catch and effort data sets available at the Secretariat for shark and ray species are of poor quality overall, with very little information available to derive time series of abundance indices that are essential for conducting stock assessments.

The main issues with shark data affecting the information sets available to the IOTC Secretariat vary with gear and fleet:

- **Gillnet fisheries**
  - **Driftnet fishery of Taiwan,China (1982–92)**: data not reported to IOTC standards (no species-specific catches);
  - **Gillnet fisheries of Pakistan**: revised nominal catches with species-specific shark data have been provided from 1987 onward (although reports of catches for "various sharks NEI" are still present). Catch levels of shark species decrease dramatically with the revised time series (to levels which are practically negligible compared to years prior to 1987). Furthermore, spatially disaggregated catch-and-effort data have never been provided, if not for a very limited number of years (1987-1991);
  - **Gillnet fisheries of I.R. Iran**: spatially disaggregated catch-and-effort data are now available from 2007 onwards, although not fully reported to IOTC standards as they do not include data for distinct shark species for the years in which these are instead available as nominal catches (2012-2022);
  - **Gillnet fisheries of Oman**: data not reported to IOTC standards, as nominal catches of distinct shark species are only available for a limited period of the recent time-series (2014-2022) for which no spatially disaggregated catch-and-effort data have been provided.
- **Longline fisheries**
  - **Historical catches of sharks from major longline fisheries (Taiwan,China, Indonesia, and Rep. of Korea)**: for years before 2006 data are either unavailable or not reported according to IOTC standards;
  - **Fresh-tuna longline fisheries (Malaysia, Indonesia)**: data not provided or not reported to IOTC standards. Indonesia started reporting catch and effort data since 2018 but the level of coverage is very low, with minor reported blue shark catches;

  - **Deep-freezing longline fisheries (EU-Spain, India, Indonesia, and Oman)**: data not provided or not reported according to IOTC standards for the periods during which these fisheries were known to be active.
- **Coastal fisheries**
  - **Coastal fisheries of Yemen**: data not provided;
  - **Coastal fisheries of India and Oman**: data not reported to IOTC standards;
  - **Coastal fisheries of Madagascar**: data provided since 2018 but with a very low coverage and not reported to IOTC standards;
  - **Coastal fisheries of Indonesia**: data provided since 2018 but subject to revision due the recent estimation methodology.

APPENDIX VI

2025: 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

(*updated September 2025*)

CPC	Sharks	Date of Implementation	Seabirds	Date of implementation	Marine turtles	Date of implementation	Comments
MEMBERS							
Australia		1st: April 2004 2nd: July 2012 3rd: 2021 4th: August 2024		1st: 1998 2nd: 2006 3rd: 2014 NPOA in 2018.		2003	**Sharks:** 3rd NPOA-Sharks (Shark-plan 3) was released in 2021 replacing the previous Shark-plan 2. Australia produced a revised NPOA for the conservation and management of sharks (Revised Shark-plan 2) in 2024. **Seabirds:** Has implemented a Threat Abatement Plan [TAP] for the Incidental Catch (or Bycatch) of Seabirds During Oceanic Longline Fishing Operations since 1998. The present TAP took effect from 2014 and largely fulfilled the role of an NPOA in terms of longline fisheries. http://www.antarctica.gov.au/__data/assets/pdf_file/0017/21509/Threat-Abatement-Plan-2014.pdf. In 2018 Australia finalised an NPOA to address the potential risk posed to seabirds by other fishing methods, including longline fishing in state and territory waters, which are not covered by the current threat abatement plan. **Marine turtles:** Australia's current marine turtle bycatch management and mitigation measures fulfil Australia’s obligations under the FAO-Sea turtles Guidelines.

Bangladesh			n.a.					**Sharks:** Bangladesh has finalised a NPOA for shark and rays which will be in place for 2023-2027. The Wildlife Conservation and Security Act introduced in 2012 lays out rules on requirements for hunting wild animals. It includes provisions for the protection of sharks and rays including the species for which there are active IOTC CMMs (hammerhead, blue, mako, silky, oceanic whitetip, thresher and whale sharks, and mobulid rays). **Seabirds:** Bangladesh currently does not have a NPOA for seabirds. The Wildlife Conservation and Security Act introduced in 2012 lays out rules on permits required to hunt wild animals and includes provisions for the protection of seabirds. Bangladesh does not have any flagged purse seine or longline vessels so do not consider there to be any problems with seabird interactions in their fisheries. **Marine turtles:** Bangladesh currently have no information on their implementation of FAO guidelines on sea turtles. The Wildlife Conservation and Security Act introduced in 2012 lays out rules on requirements for hunting wild animals and includes provisions for the protection of marine turtles. A Marine Fisheries Rules act was finalised in 2023 which requires the use of turtle excluder devices onboard shrimp trawlers. The act also requires live release of marine turtles for all gear and the mandatory use of circle hooks for hook and line fishing.
China		–		–				**Sharks:** China is currently considering developing an NPOA for sharks. Regulations relating to the conservation of sharks managed by RFMOs have been updated. Targeted distant water fisheries for sharks and rays are prohibited and vessels must avoid or reduce catching of sharks. Sharks (species not under a retention ban) caught as bycatch shall be fully utilised and finning is prohibited. Longliners are prohibited from using shark lines and wire tracers. **Seabirds:** China is currently considering developing an NPOA for seabirds. Regulations relating to the conservation of seabirds managed by RFMOs have been updated. Vessels operating in the area south of 25ºS shall use two mitigation measures from: tori lines, night setting and weighted branch lines. They may also use hook-shielding devices to replace the above three measures. **Marine turtles:** Regulations relating to the conservation of turtles managed by RFMOs has been updated. All longlines shall use circle hooks whenever possible. Longline vessels are encouraged to use finfish as bait, not squid.

–Taiwan,China		1st: May 2006 2nd: May 2012		1st: May 2006 2nd: Jul 2014			**Sharks:** No revision currently planned. **Seabirds:** No revision currently planned. **Marine turtles:** Wildlife Protection Act introduced in 2013, Protected Wildlife shall not be disturbed, abused, hunted, killed, traded, exhibited, displayed, owned, imported, exported, raised or bred, unless under special circumstances recognized in this or related legislation. *Cheloniidae spp*., *Caretta Caretta*, *Chelonia mydas*, *Eretmochelys imbricata, Lepidochelys olivacea* and *Dermochelys coriacea* are listed into List of Protected Species. Domestic Fisheries Management Regulation on Far Sea Fisheries request all fishing vessels must carry line cutters, de-hookers and hauling nets in order to facilitate the appropriate handling and prompt release of marine turtles caught or entangled.
Comoros		–		–			**Sharks:** No NPOA has been developed. Shark fishing is prohibited but measures are difficult to enforce due to the artisanal nature of the fisheries. A campaign to raise awareness of measures is being implemented to improve compliance. Shark catches and size frequency data are submitted to IOTC **Seabirds:** No NPOA has been developed. There is no fleet in operation south of 25 degrees south and no long-line fleet. The main fishery is artisanal operating within 24 miles of the coast where there is low risk of interactions with seabirds. **Marine turtles:** According to the Comoros Fisheries Code Article 78, fishing, capture, possession and marketing of turtle and marine mammals or of protected aquatic organisms is strictly forbidden in accordance with national legislation in force and International Conventions applicable to the Comoros.
European Union		5 Feb 2009		16-Nov-2012		2007	Regulation n°2021-47 of 9th of July 2021 legislating tuna and tuna-like species fisheries includes marine species protection measures, especially in its Annex 2, aiming to reduce the impact on marine turtles, sea birds and sharks. **Sharks:** Approved on 05-Feb-2009 and it is currently being implemented. **Seabirds:** The EU adopted on Friday 16 November 2012 an Action Plan to address the problem of incidental catches of seabirds in fishing gears. A specific national plan of action has been published for Albatrosses which runs from 2018-2027. **Marine turtles**: European Union Council Regulation (EC) No 520/2007 of 7 May 2007 lay down technical measures for the conservation of marine turtles including articles and provisions to reduce marine turtle bycatch. The regulation urges Member States to do their utmost to reduce the impact of fishing on sea turtles, in particular by applying the measures provided for in paragraphs 2, 3 and 4 of the resolution.

France (territories)		2009		2009, 2011		2015	**Sharks:** NPOA for sharks was approved on 05-Feb-2009. **Seabirds:** NPOA for seabirds was implemented in 2009 and 2011. 2009 for Barrau's petrel and 2019 for Amsterdam albatross which will be in force from 2018-2027. **Marine turtles:** Implemented in 2015 for the five species of marine turtles that are present in the southwest Indian Ocean for the period 2015-2020. This is still being applied and currently being revised and will be published in 2025.
India							**Sharks:** India published their NPOA sharks in 2024 but this has not yet been made available to the IOTC. **Seabirds:** India has determined that seabird interactions are not a problem for their fleets. However, a formal evaluation has not yet taken place which the WPEB and SC require. **Marine turtles:** India published an action plan for marine turtles in 2021 titled "National Marine Turtle Action Plan".
Indonesia		–		–			**Sharks:** Indonesia first drafted a NPOA in 2010 then later developed a revised NPOA for sharks and rays for the period 2016-2020. Indonesia has also established a national plan of action for whale sharks from 2021-2025 through Ministerial Decree No. 16 of 2021. Indonesia plans to review the NPOA for sharks in 2025. **Seabirds:** An NPOA for seabirds was finalized in 2016 **Marine turtles:** Indonesia has established an NPOA for Marine Turtles in 2022 and this will be reviewed in 2025. Indonesia has also been implementing Ministerial Regulations 12/2012 and 30/2012 regarding capture fishing business on high seas to reduce turtle bycatch. Indonesia is also cooperating with Coral Triangle countries including Malaysia, the Philippines, the Solomon Islands, Papua New Guinea, and Timor Leste through Coral Triangle Initiatives on Coral Reefs, Fish, and Food Security (CTI CFF) platform to protect threatened migratory species, including marine turtles. The CTI CFF is now developing a regional plan of action (RPOA) 2020-2030 and areas of critical habitats, such as migratory corridors, nesting beaches, and Inter-nesting and feeding areas, have been identified.

Iran, Islamic Republic of		–		–		–	**Sharks:** A NPOA for sharks and rays has been developed and is currently under review. Iran has implemented a nationwide ban on the targeted fishing and retention of sharks which has been formally communicated to all fishing operations, fishermen and fishing cooperatives. **Seabirds:** I.R. Iran determined that seabird interactions are not a problem for their fleet as they consist of gillnet vessels only. i.e. no longline vessels. The nets are set 1m below the surface of the water and no bycatch of oceanic seabirds has been reported to date. **Marine turtles:** An Action Plan for the conservation of sea turtles has been fully developed and is now awaiting translation into English for submission to the Secretariat.
Japan		03-Dec-2009, 2016		03-Dec-2009, 2016			**Sharks:** NPOA–Shark assessment implementation report submitted to COFI in July 2012 has since been revised in 2016 and again in 2023. **Seabirds:** NPOA–Seabird implementation report submitted to COFI in July 2012 (Revised in 2016). **Marine turtles:** All Japanese fleets fully implement Resolution 12/04.
Kenya			n.a.	–			**Sharks:** A National Plan of Action for sharks has been finalised and is awaiting cabinet approval. This document shall put in place a framework to ensure the conservation and management of sharks and their long-term sustainable use in Kenya. **Seabirds:** Kenya does not have any flagged longline vessels on its registry fishing south of 25°S latitude. There is no evidence of any gear seabird interaction with the current fishing fleet. Kenya has prepared a NPOA for seabirds which is in the process of being reviewed by relevant stakeholders. **Marine turtles:** The Kenyan fisheries law prohibits retention and landing of turtles caught incidentally in fishing operations. Public awareness efforts are conducted for artisanal gillnet and artisanal longline fishing fleets on the mitigations measures that enhance marine turtle conservation. Kenya has prepared a NPOA for marine turtles which is in the process of being reviewed by relevant stakeholders.
Korea, Republic of		08-Aug-11		2019		–	**Sharks:** NPOA sharks is currently being implemented. **Seabirds:** NPOA seabirds was submitted to FAO in 2019. **Marine turtles:** All Rep. of Korea vessels fully implement Res 12/04.
Madagascar		–		–			**Sharks:** Madagascar has developed a NPOA for sharks which is awaiting final ministerial approval. **Seabirds:** Development on a NPOA for seabirds has not begun. Note: A fisheries monitoring system is in place in order to ensure compliance by vessels with the IOTC's shark and seabird conservation and management measures. **Marine turtles:** There is zero capture of marine turtle recorded in logbooks. All longliners use circle hooks. This has been confirmed by onboard observers and port samplers.

Malaysia		2008 2014		–		2008	**Sharks:** A revised NPOA-sharks was published in 2014. **Seabirds:** A NPOA for seabirds is yet to be developed **Marine turtles:** A NPOA For Conservation and Management of Sea Turtles had been published in 2008. A revision will be published in 2017.
Maldives, Republic of		Apr 2015	n.a.	–			**Sharks:** NPOA Sharks was finalised in 2015 with the assistance of Bay of Bengal Large Marine Ecosystem (BoBLME) Project. On 14th July 2019 the Government of Maldives officially announced the cessation of the Maldives long line fishery in Maldives EEZ and High Seas so consider the NPOA for sharks to now be unnecessary. **Seabirds:** Maldives is in the final stages of developing an action plan on seabird nesting sites. Article 12 of IPOA states that if a 'problem exists' CPCs adopt an NPOA. IOTC Resolution 05/09 suggests CPCs to report on seabirds to the IOTC Scientific Committee if the issue is appropriate'. Maldives considers that seabird entanglement and bycatch is not an issue in Maldives fisheries especially with the cessation of the Maldives long line fishery in 2019. **Marine turtles:** Standards of code and conduct for managing sea turtles have been developed by the Environmental Protection Agency in the drafted national sea turtle management plan under the protected species regulation. Longline regulation has provisions to reduce marine turtle bycatch. The regulation urges longline vessels to have dehookers for removal of hook and a line cutter on board, to release the caught marine turtles as prescribed in Resolution 12/04.
Mauritius		2016					**Sharks:** The NPOA-sharks has been finalised; it focuses on actions needed to exercise influence on foreign fishing through the IOTC process and licence conditions, as well as improving the national legislation and the skills and data handling systems available for managing sharks. **Seabirds:** Mauritius does not have national vessels operating beyond 25^{0}S. However, fishing companies have been requested to implement all mitigation measures as provided in the IOTC Resolutions. There are currently no plans to develop a NPOA for seabirds. **Marine turtles:** Marine turtles are protected by the national law. Fishing companies have been **requested** to carry line cutters and de-hookers in order to facilitate the appropriate handling and prompt release of marine turtles caught or entangled. There are currently no plans to develop a NPOA for marine turtles.

Mozambique		–		–			**Sharks**: Drafting of the NPOA-Shark started in 2016. At this stage, a baseline assessment has been performed and the relevant information of coastal, pelagic and demersal shark species along the Mozambican coast has beengathered. **Seabirds**: Mozambique is regularly briefing the Masters of their fishing vessels on the mandatory requirement to report any seabird interaction with longliner fleet. **Marine turtles**: see above.
Oman, Sultanate of							**Sharks:** The drafting of an NPOA-sharks started in 2017 but has not yet been finalised. **Seabirds:** Not yet initiated. **Marine turtles:** The law does not allow the catch of sea turtles, and the fishermen are requested to release any hooked or entangled turtle. The longline fleet are required to carry out the line cutters and de-hookers.
Pakistan							**Sharks:** A stakeholder consultation workshop was conducted in 2016 to review the actions of the draft NPOA - Sharks. The final version of the NPOA - Sharks has been submitted to the provincial fisheries departments for endorsement but has not yet been finalised. Meanwhile, the provincial fisheries departments have passed notification on catch, trade and/or retention of sharks including Thresher sharks, hammerheads, oceanic whitetip, whale sharks, guitarfishes, sawfishes, wedgefishes and mobulids. Sharks are landed with the fins attached and each and every part of the body of sharks are utilised. **Seabirds:** Pakistan considers that seabird interactions are not a problem for the Pakistani fishing fleet as the tuna fishing operations do not include longline vessels. **Marine turtles:** Pakistan has already framed Regulations regarding the prohibition of catching and retaining marine turtles. As regards to the reduction of marine turtle bycatch by gillnetters; presently Marine Fisheries Department (MFD) in collaboration with International Union for Conservation of Nature (IUCN) Pakistan, is undertaking an assessment. Stakeholder Coordination Committee Meeting was conducted on 10th September 2014. The "Turtle Assessment Report (TAR)" will be finalized by February 2015 and necessary guidelines / action plan will be finalized by June 2015. As per clause-5 (c) of Pakistan Fish Inspection & Quality Control Act, 1997, "Aquatic turtles, tortoises, snakes, mammals including dugongs, dolphins, porpoises and whales etc" are totally forbidden for export and domestic consumption. Pakistan is also in the process of drafting a NPOA for cetaceans.
Philippines		Sept. 2009		–			**Sharks:** A NPOA sharks was published in 2009 and this document is under periodic review. **Seabirds:** Development of a NPOA for seabirds has not begun. **Marine turtles:** No information received by the Secretariat.

Seychelles, Republic of		Apr-2007 2016		–			**Sharks:** Seychelles developed and is implementing a NPOA for Sharks for years 2016-2020 which was extended for 2025. Seychelles are working to review the previous NPOA for sharks which should be complete by early 2026. **Seabirds:** SFA is collaborating with Birdlife South Africa to develop an NPOA for seabirds. Phase one, which addressed the biology, ecology, and population of seabirds potentially impacted by the Seychelles longline fleet, has been completed. Phase two will assess the potential impacts of the fleet on vulnerable seabirds and recommend mitigation measures is expected to be completed in early 2026. The NPOA is expected to be completed in early 2026. **Marine turtles:** The development of a NPOA for turtles is planned to start in 2025 and it should be completed in early 2026.
Somalia							**Sharks:** Somalia is currently revising its fisheries legislation (current one being from 1985) and has completed the necessary steps for required for the consultative process to begin in order to develop these NPOAs. **Seabirds:** See above. **Marine turtles:** The Somali national fisheries law and legislation was reviewed and approved in 2014. This includes Articles on the protection of marine turtles. Further review of the National Law is underway to harmonize this with IOTC Resolutions and is expected to be presented to the new parliament for endorsement in 2017.

South Africa, Republic of		2013 2022		2008			**Sharks**: The NPOA-sharks was first approved and published in 2013. A revised version of the document was finalised in 2022 following extensive review including input from the research community and affected stakeholders. **Seabirds**: The NPOA seabirds was published in August 2008 and fully implemented. An updated NPOA has been drafted and is now awaiting approval. **Marine turtles**: All FAO guidelines to reduce marine turtle mortality have been inserted into permit conditions. A report from 2019 on the implementation of FAO guidelines to reduce marine turtle mortality has been provided to the IOTC. Bycatch in South African fisheries is considered to be very low. The South African permit conditions for the large pelagic longline fishery prohibits landing of turtles. All interactions with turtles are recorded, by species, within logbooks and in observer reports, including data on release condition. Vessels are required to carry a de-hooker on board and instructions on turtle handling and release in line with the FAO guidelines are included in the South African Large Pelagic permit conditions. All turtle interactions in respective areas of competence are reported to the respective RFMOs. Recent South African led studies on impact of marine debris on turtles have been published in the scientific literature (Ryan et al. 2016). Marine turtle nesting sites in South Africa are protected by coastal MPAs since 1963.
Sri Lanka		2013 2018					**Sharks:** The first NPOA-sharks was finalized in 2013 then revised in 2018 which was valid until 2022. This version has now been reviewed but is awaiting final approval. Shark data collection is done through logbooks and a large pelagic data collection programme. NARA has started to collect fisheries and biological data on blue, silky and scalloped hammerhead sharks. **Seabirds:** Sri Lanka has determined that seabird interactions are not a problem for their fleets. However, a formal review has not yet been provided to the WPEB and SC for approval. **Marine turtles:** Implementation of the FAO Guideline to Reduce Sea Turtle Mortality in Fishing Operation in 2015 was submitted to IOTC in January 2016. Marine turtles are legally protected in Sri Lanka. Longliner vessels are required to have dehookers for removal of hooks and a line cutter on board, to release the caught marine turtles. Gillnets longer than 2.5 km are now prohibited in domestic legislation. Reporting of bycatch has made legally mandatory and facilitated via logbooks.
Sudan							**Sharks:** No information received by the Secretariat. **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.

Tanzania, United Republic of		–		–			**Sharks:** A NPOA has been drafted and shared with the Secretariat and is expected to be released in September 2025. **Seabirds:** Initial discussions have commenced. Note: Terms and conditions related to protected sharks and seabirds contained within fishing licenses. **Marine turtles:** Sea turtles are protected by law. However, as there is a national turtle and Dugong conservation committee that oversee all issues related to sea turtles and dugongs. There is no information so far with regards to interaction between sea turtles and long line fishery.
Thailand		2020		–			**Sharks:** An updated NPOA Sharks has been developed for the years 2020-2024 and has been submitted to the Secretariat and FAO. **Seabirds:** The NPOA for seabirds has been finalised and submitted to the Secretariat. Thailand has the Notification of the Department of Fisheries on Requirement and Regulations of Fishing Vessels Operating Outside Thai Water in IOTC Area of Competence (IOTC) B.E. 2565 (2022), Clause 18 and 21 include requirements for line-cutters and dehookers to be carried for releasing marine animals and for any fishing vessel operating south of 25ºS to follow the measures for mitigating capture of seabirds. **Marine turtles:** Thailand reports on progress of the implementation of FAO guidelines on turtles in their National Report to IOTC. Regulations on Fishing Vessels operating outside Thai waters in the IOTC area of competence contains clauses relating to the conservation of marine turtles including: Clause 14 prohibiting purse seines from setting around cetaceans, marine turtles or whale sharks; Clause 18 requiring the release and recording of incidental bycatch of sensitive species including marine turtles; Clause 19 requiring that any bycaught marine turtles that are not healthy should be cared for until it is ready to be released.

United Kingdom	n.a.	–	n.a.	–		–	British Indian Ocean Territory (Chagos Archipelago) waters are a Marine Protected Area closed to fishing except recreational fishing in the 3nm territorial waters around Diego Garcia. Separate NPOAs have not been developed within this context. **Sharks/Seabirds:** For sharks, UK is the 24th signatory to the Convention on Migratory Species 'Memorandum of Understanding on the Conservation of Migratory Sharks' which extends the agreement to UK Overseas Territories including the British Indian Ocean Territory; Section 7 (10) (e) of the *Fisheries (Conservation and Management) Ordinance* refers to recreational fishing and requires sharks to be released alive. No seabirds are caught in the recreational fishery. **Marine turtles:** No marine turtles are captured in the recreational fishery. A monitoring programme is taking place to assess the marine turtle population in UK (OT). In August 2022 the UK Government published the Bycatch Mitigation Initiative which applies to metropolitan UK waters but includes commitments to work with the international community to contribute to the understanding, reduction and elimination of bycatch globally, including by advocating for effective measures through RFMOs.
Yemen							**Sharks:** No information received by the Secretariat. **Seabirds:** No information received by the Secretariat. **Marine turtles:** No information received by the Secretariat.

Colour key	
Completed	
Drafting being finalised	
Drafting commenced	
Not begun	

APPENDIX VII
EXECUTIVE SUMMARY: BLUE SHARK (2025)

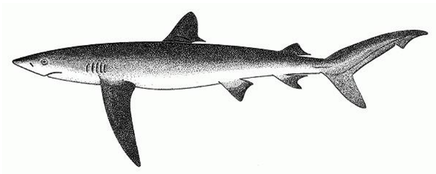

Table A 1. Status of blue shark (*Prionace glauca*) in the Indian Ocean

Area	Indicators		2025 stock status determination
Indian Ocean	Nominal Reported catch 2023 (MT)	26,354	100%
	Estimated catch 2023 (MT)	27,722	
	Not elsewhere included (nei) sharks[2] 2023 (MT)	28,179 t	
	Average reported catch 2019-23 (MT)	13,072	
	Average estimated catch 2019-23 (MT)	26,690	
	Avg. not elsewhere included (nei) sharks[2] 2019-23 (MT)	27,279 t	
	MSY (1,000 t) (80% CI):	0.31 (0.22 - 0.40)	
	F_{MSY} (80% CI):	0.18 (0.18 - 0.18)	
	SSB_{MSY} (1,000 t) (80% CI):	52.87 (37.38 - 68.37)	
	F_{2015}/F_{MSY} (80% CI):	0.39 (0.21 - 0.57)	
	SSB_{2019}/SSB_{MSY} (80% CI):	2.22 (1.76 - 2.68)	
	SSB_{2019}/SSB_0 (80% CI):	0.73 (0.34 - 1.13)	

Boundaries for the Indian Ocean are defined as the IOTC area of competence

[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SHK: sharks various nei; RSK: requiem sharks nei)

[3]Estimates refer to the base case model using estimated catches

[4] Refers to fecund stock biomass

Colour key	Stock overfished (SB_{2019}/SB_{MSY}< 1)	Stock not overfished ($SB_{2019}/SB_{MSY}\geq$ 1)
Stock subject to overfishing(F_{2019}/F_{MSY}> 1)	0%	0%
Stock not subject to overfishing ($F_{2019}/F_{MSY}\leq$ 1)	0%	100%
Not assessed/Uncertain		

Table A 2. Blue shark: IUCN threat status of blue shark (*Prionace glauca*) in the Indian Ocean.

Common name	Scientific name	IUCN threat status[3]		
		Global status	WIO	EIO
Blue shark	*Prionace glauca*	Near Threatened	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean

[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

Sources: IUCN Red List 2020, Rigby et al 2019

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. Two stock assessments were carried out for blue shark (BSH) in 2025: one using a Bayesian state-space surplus production model (JABBA, Winker et al.) and another using an integrated age-structured model (SS3, Methot and Wetzel 2013). Both assessments used data (catch and indices of abundance) from 1950 to 2023, although the model structure was inherently different. The SS3 model included annual length composition data where available.

Uncertainty in data inputs and model configuration were explored through sensitivity analyses. All models produced similar results, suggesting the stock is currently **not overfished** and **not subject to overfishing** with respect to MSY related reference points (although the IOTC has not adopted reference points for this species).

A base case model, using SS3, was selected to provide management advice based on the best available Indian Ocean biological data, parameter estimates, consistency of standardised CPUE relative abundance series, model fits/diagnostics and the spatial extent of the data (**Fig. A** 1, **Table A 1**).

The major sources of uncertainty identified in the current model are based on the estimated and reported catches. Nominal reported catches were considered unrealistic, and several alternative catch series were developed for this assessment (Rice 2025). Recent revisions of reported catch related to large portions of the historical catch have resulted in a wide range of estimates, it is expected that these revisions will continue soon. The WPEB suggests further research regarding the estimation of non-reported and under reported catch.

All of the CPUE indices of abundance accepted for consideration in the assessment are largely consistent except for the CPUEs from South Africa and Portugal which show a declining trend in recent years, compared to more stable trends from the other CPCs.

The base case models used the GAM-based catch history estimates (lower estimates for catch – “D1 GAM LOW”) and CPUE series from EU-Spain, Taiwan,China and Japan, and a starting year of 1950. Model assumptions regarding the parameterization of steepness, natural mortality and the estimated selectivity were considered with respect to their sensitivity to the major axes of uncertainty identified.

The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery by combining the biological productivity of the species and its susceptibility to each fishing gear type. Blue sharks received a medium vulnerability ranking (No. 10) in the ERA rank for longline gear because it was estimated as the most productive shark species, but was also characterized by the second highest susceptibility to longline gear. Blue shark was estimated as not being susceptible thus not vulnerable to purse seine gear.

The current IUCN threat status of ‘Near Threatened’ applies to blue sharks globally (**Table 2**). Information available on this species has been improving in recent years. Blue sharks are commonly taken by a range of fisheries in the Indian Ocean and in some areas they are fished in their nursery grounds. Due to their life history characteristics – they live until at least 25 years, mature at 4–6 years, and have 25–50 pups every year – they are considered to be the most productive of the pelagic sharks. On the weight-of-evidence available in 2025, the stock status is determined to be **not overfished** and **not subject to overfishing** (**Table 1**).

Outlook. Increasing effort could result in declines in biomass. The Kobe II Strategy Matrix (**Table 3**) provides the probability of exceeding reference levels in the short (3 years) and long term (10 years) given a range of percentage changes in catch.

Management advice. Both 2025 stock assessments (JABBA and SS3) indicated that Indian Ocean blue shark are **not overfished nor subject to overfishing**. The SS3 assessment indicates current catches are near MSY, and significant increases could result in decreasing biomass and the stock becoming subject to overfishing in the future (**Table 3**). The stock should be closely monitored, especially with respect to overall catch and discard reporting. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), these need to be further implemented by the Commission, so as to better inform scientific advice in the future. The WPEB **RECOMMENDED** based on the SS3 assessment results, that the SC advise the Commission that the current recommended catch for blue shark remain close to current catches, and below the MSY estimated by the SS3 assessment model for 2025 (< 31,000 t).

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: The MSY estimate for the Indian Ocean blue shark stock is approximately, 31,000t (95% CI is 21.79 - 39.84 thousand tonnes).
    - The current stock assessment suggests that catch amounts near the estimated MSY values are likely supportable in the near future. However, noting that firstly, the current MSY catch

estimates from the assessment model are based on nominal reported catch (which are currently under revision and likely under-reported based on sharks not reported to species) and secondly, key uncertainties in other model inputs and parameters, it is recommended that there is no increase in fishing pressure until such uncertainties are resolved.

- It is expected that as the nominal reported catch is revised, estimates of MSY and other parameters will change.
- The upcoming blue shark MSE process will address the uncertainties in the stock assessment.

- **Reference points**: The Commission has not adopted reference points or harvest control rules for any shark species.
- **Main fishing gear** (2019–2023): Coastal longline; longline (deep-freezing); longline targeting swordfish. (**Fig. A1**).
- **Main fleets** (2019–2023) [1]: Indonesia (38%) Taiwan, China(23%); EU-Spain (20%); EU-Portugal (5%), Seychelles (4%) (**Fig. A2**)

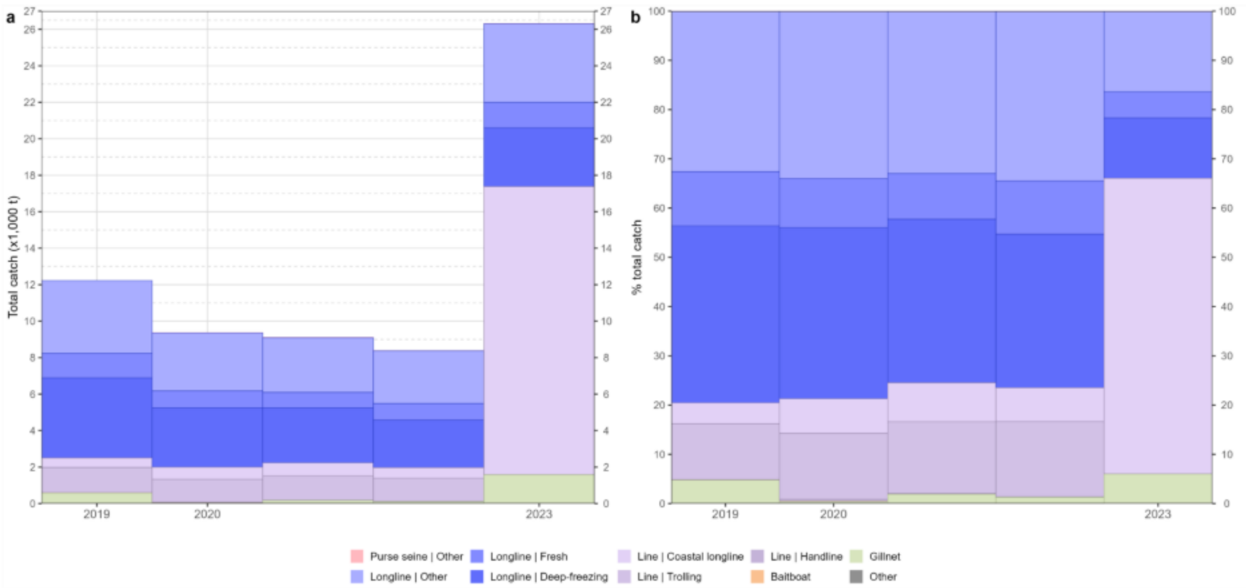

Figure A1 : Annual absolute (a) and relative (b) time series of retained catches (metric tonnes ; t) of blue shark and rays by fishery for the period 2019-2023.

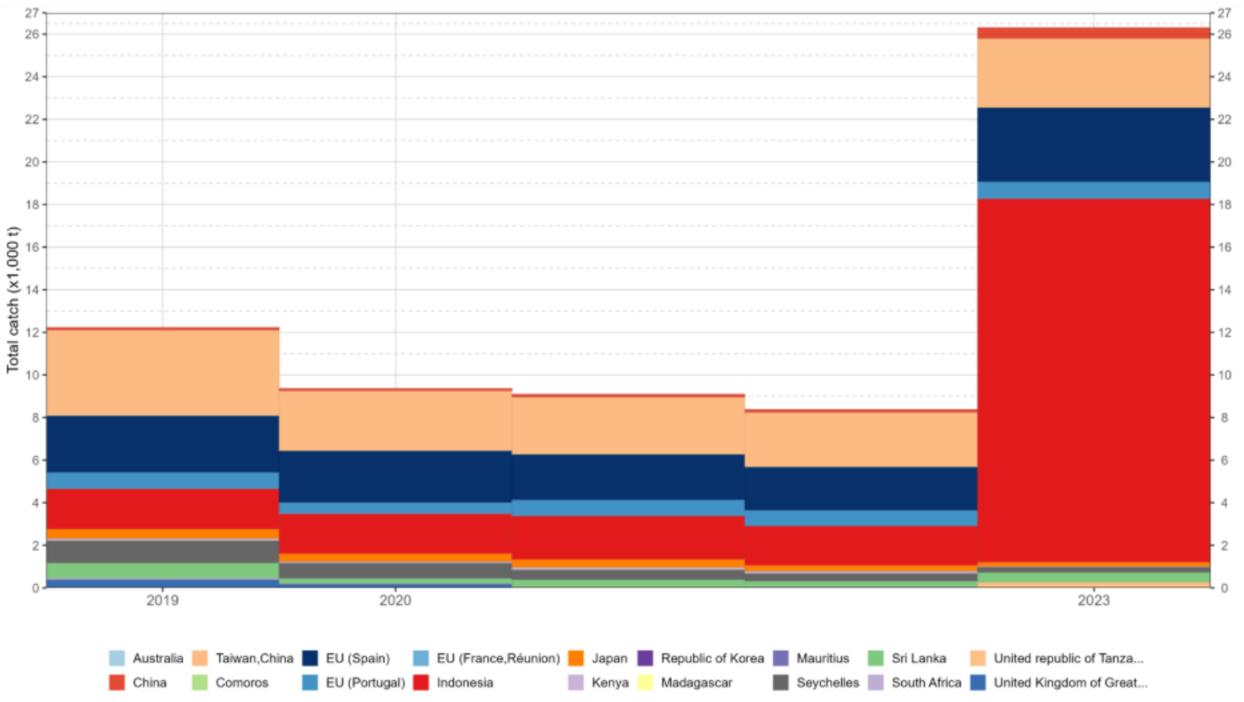

Figure 2: Annual time series of retained catches (metric tonnes; t) of blue shark by fleet during 2019 -2023. There are large uncertainties associated with the estimates of blue shark catches from artisanal Indonesian fisheries. The revision of the catch composition of Indonesian fisheries is ongoing.

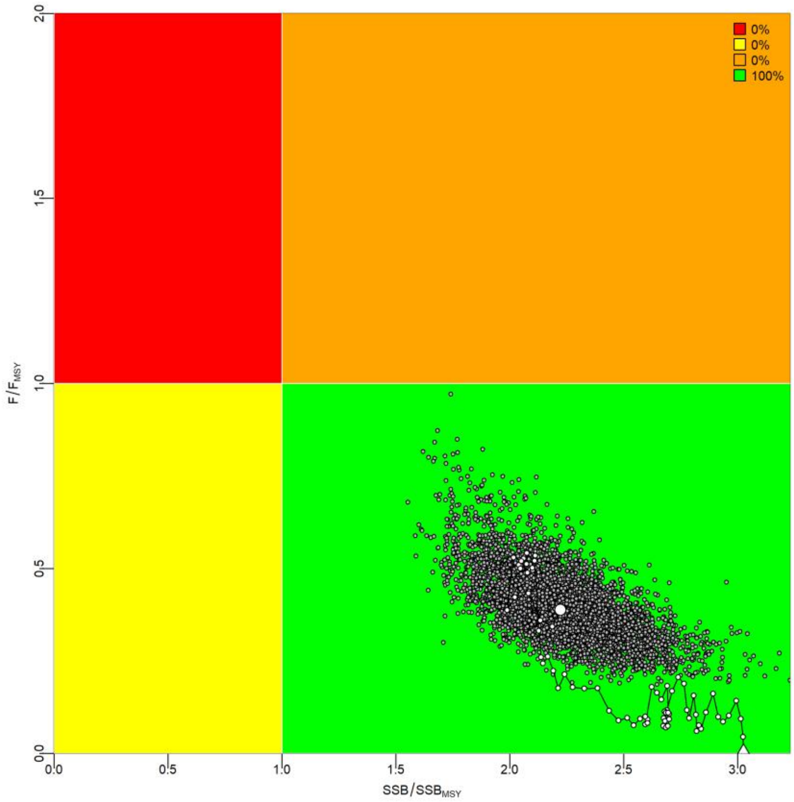

Fig. A 1. Blue shark: Aggregated Indian Ocean stock assessment Kobe plot for the 2025 assessment base case model. (base case model with trajectory and uncertainty in the terminal year.

Table A 3. Blue shark: Aggregated Indian Ocean assessment Kobe II Strategy Matrix. Probability (percentage) of violating the MSY-based reference points for nine constant catch projections using the base case model (average catch level from 2021-2023)* (25,877 MT), ± 10%, ± 20%, ± 30% and ± 40%) projected for 3 and 10 years

Kobe II Strategy Matrix: Probability (%) of violating MSY-based reference points

	Alternative TAC projections								
Reference point and projection timeframe	**60% (15,526 t)**	**70% (18,113 t)**	**80% (20,701 t)**	**90% (23289 t)**	**100% (25877 t)**	**110% (28464 t)**	**120% (31052 t)**	**130% (33640 t)**	**140% (36227 t)**
B2028<BMSY	0	0	0	0	0	0	0	0	0
F2028>FMSY	0	0	0	0	0	0	0	0	1
B2035<BMSY	0	0	0	0	0	0	0	0	1
F2035>FMSY	0	0	0	0	0	0	2	5	12

*: average catch level and respective % changes refer to the estimated catch series used in the final base case model (IOTC-2025-WPEB21(AS)-30)

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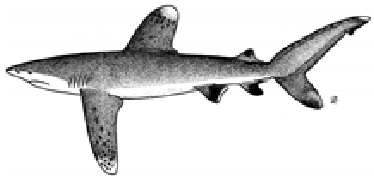
APPENDIX VIII
EXECUTIVE SUMMARY: OCEANIC WHITETIP SHARK (2025)



CITES APPENDIX II species

Table A 1. Status of oceanic whitetip shark (*Carcharhinus longimanus*) in the Indian Ocean.

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2023 (t)[3] Not elsewhere included (nei) sharks[2] 2023 Average reported catch 2019-23 Av. not elsewhere included 2019-2023 (nei) sharks[2]	42 t 28,179 t 36 t 27,279 t	
	MSY (1,000 t) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 t) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $SB_{current}/SB_{MSY}$ (80% CI) $SB_{current}/SB_0$ (80% CI)	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SHK: sharks various nei; RSK: requiem sharks nei)

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		

Table A 2. Oceanic whitetip shark: IUCN threat status of oceanic whitetip shark (*Carcharhinus longimanus*) in the Indian Ocean.

Common name	**Scientific name**	**IUCN threat status[3]**		
		Global status	**WIO**	**EIO**
Oceanic whitetip shark	*Carcharhinus longimanus*	Critically Endangered	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean

[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

Sources: IUCN Red List 2020, Rigby et al 2019
CITES - In March 2013, CITES agreed to include oceanic whitetip shark to Appendix II to provide further protections prohibiting the international trade; which will become effective on September 14, 2014.

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty about the relationship between abundance, standardised CPUE series and total catches over the past decade (**Table A**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type (Murua *et al.* 2018). Oceanic whitetip shark received a medium vulnerability ranking (No. 9) in the ERA rank for longline gear because it was estimated as one of the least productive shark species but was only characterised by a medium susceptibility to longline gear. Oceanic whitetip shark was estimated as being the 11th most vulnerable shark species to purse seine gear, as it was characterised as having a relatively low productive rate, and medium susceptibility to the gear. The current IUCN threat status of 'Critically Endangered' applies to oceanic whitetip sharks globally (**Table A**). There is a paucity of information available on this species in the Indian Ocean and this situation is not expected to improve in the short to medium term. Oceanic whitetip sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived, mature at 4–5 years, and have relatively few offspring (<20 pups every two years), the oceanic whitetip shark is likely vulnerable to overfishing. Despite the limited amount of data, recent studies (Tolotti et al., 2016) suggest that oceanic whitetip shark abundance has declined in recent years (2000-2015) compared with historic years (1986-1999). Available pelagic longline standardised CPUE indices from Japan and EU,Spain indicate conflicting trends as discussed in the IOTC Supporting Information for oceanic whitetip sharks. There is no quantitative stock assessment and limited basic fishery indicators currently available for oceanic whitetip sharks in the Indian Ocean therefore the stock status is **unknown** (**Table A**).

Outlook. Maintaining or increasing effort with associated fishing mortality can result in declines in biomass, productivity and CPUE. Piracy in the western Indian Ocean resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into certain areas in the southern and eastern Indian Ocean. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort on oceanic whitetip sharks declined in the southern and eastern areas and may have resulted in localised depletion there.

Management advice. A cautious approach to the management of oceanic whitetip shark should be considered by the Commission, noting that recent studies suggest that longline mortality at haulback is high (50%) in the Indian Ocean (IOTC-2016-WPEB12-26), while mortality rates for interactions with other gear types such as purse seines and gillnets may be higher.

Mitigation measures should be taken to reduce at-vessel and post release mortality, including consideration of potential gear modifications in longline fleets targeting tuna and swordfish. Noting that a recent study (Bigelow et al. 2021) concluded in WCPFC that banning both shark lines and wire leaders has the potential to reduce fishing mortality by 40.5% for oceanic whitetip shark.

While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), these need to be further implemented by the Commission, so as to better inform scientific advice. IOTC Resolution 13/06 *on a scientific and management framework on the conservation of shark species caught in association with IOTC managed fisheries*, prohibits retention onboard, transhipping, landing or storing any part or whole carcass of oceanic whitetip sharks. Given that some CPCs are still reporting oceanic whitetip shark as landed catch, there is a need to strengthen mechanisms to ensure CPCs comply with Resolution 13/06.

The following key points should be also noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2019-2023): gillnet, line; Longline, purse seine (other).
- **Main fleets** (2019-23): I.R. Iran; Comoros; Mozambique, China, Indonesia, Seychelles, (Reported as discarded/released alive by China, EU-France, Mauritius, Tanzania, Sri Lanka, EU-Spain).
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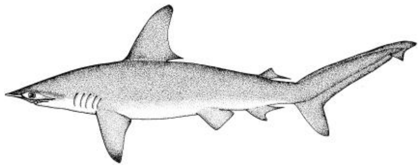
APPENDIX IX
EXECUTIVE SUMMARY: SCALLOPED HAMMERHEAD SHARK (2025)



CITES APPENDIX II species

Table A 1. Status of scalloped hammerhead shark (*Sphyrna lewini*) in the Indian Ocean.

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2023 (t)[3] Not elsewhere included (nei) sharks[2] 2023 (t) Average reported catch 2019-23 (t) Av. not elsewhere included 2019-2023 (nei) sharks[2] (t)	1,397 29,950 470 28,729	
	MSY (1,000 t) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 t) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $SB_{current}/SB_{MSY}$ (80% CI) $SB_{current}/SB_0$ (80% CI)	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SKH: Various sharks nei; SPN: Hammerhead sharks nei).
[3]Proportion of catch fully or partially estimated for 2022: 0% All catches within the database were reported by CPCs.

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		

Table A 4. IUCN threat status of scalloped hammerhead shark (*Sphyrna lewini*) in the Indian Ocean.

Common name	Scientific name	IUCN threat status[3]		
		Global status	WIO	EIO
Scalloped hammerhead shark	*Sphyrna lewini*	Critically Endangered	Critically Endangered	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean

[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

Sources: IUCN Red List 2020, Rigby et al 2019

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. The current IUCN threat status of 'Critically Endangered' applies to scalloped hammerhead sharks globally but specifically for the western Indian Ocean the status is 'Critically Endangered' (**Table A** 4). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type (Murua *et al.* 2018). Scalloped hammerhead shark received a low vulnerability ranking (No. 17) in the ERA rank for longline gear because it was estimated to be one of the least productive shark species but was also characterised by a lower susceptibility to longline gear. Scalloped hammerhead shark was estimated as the twelfth most vulnerable shark species in the ERA ranking for purse seine gear, but with lower levels of vulnerability compared to longline gear, because the susceptibility was lower for purse seine gear. There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. Scalloped hammerhead sharks are commonly taken by a range of fisheries in the Indian Ocean. They are extremely vulnerable to gillnet and prawn trawl fisheries, especially when these occur in and around nursery areas. Scalloped hammerheads are commonly landed in coastal fisheries in the Western Indian Ocean, and have often been recorded among the species with the highest catches numerically. While species-level catch data are limited for the region, there are several sources of published and unpublished data on catches of this species. Furthermore, pups occupy shallow coastal nursery grounds, often heavily exploited by inshore fisheries. Because of their life history characteristics – they are relatively long lived (over 30 years) and have relativity few offspring (<31 pups each year), the scalloped hammerhead shark is vulnerable to overfishing. The stock status is **unknown** due to a lack of data available for quantitative stock assessment or basic fishery indicators (**Table A**).

Outlook. The marked increase in catches over the previous year (200 t) is due to the breakdown by species reporting this year by Kenya and Tanzania, which previously reported sharks aggregated. Piracy in the western Indian Ocean has resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into certain areas in the southern and eastern Indian Ocean. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort from longline fleets on scalloped hammerhead shark declined in the southern and eastern areas during this time period and may have resulted in localised depletion there. Mortality from coastal fisheries remain high and unmonitored.

Management advice. Despite the absence of stock assessment information, the Commission should consider taking a cautious approach by implementing some management actions for scalloped hammerhead sharks. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), these need to be further implemented by the Commission so as to better inform scientific advice.

The following key points should be noted:

- **Maximum Sustainable Yield (MSY)**: Unknown.
- **Reference points**: Not applicable.
- **Main fishing gear** (2019-2023): Gillnet; Handline, longline-coastal; Ringnet; and offshore gillnet, Prawn trawl fisheries
- **Main fleets** (2019-23): Mozambique, Madagascar, Kenya; Tanzania; Sri Lanka; Malaysia, I. R Iran; (report as released alive/discarded by United Kingdom, EU-France, South Africa,) (artisanal fisheries)

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APPENDIX X
EXECUTIVE SUMMARY: SHORTFIN MAKO SHARK (2025)

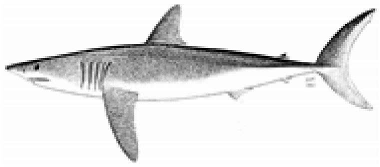

Table A 1. Status of shortfin mako shark (*Isurus oxyrinchus*) in the Indian Ocean.

Area[1]	Indicators		2024 stock status determination
Indian Ocean	Catches (SMA) 2023 (t)[2]	831	49.7%
	Average catches (SMA) 2019-23 (t)	854	
	Catches (SMA, MAK, MSK) in 2023[3]	2021	
	Average catches (SMA, MAK, MSK) 2019-2023	2074	
	Not elsewhere included (nei) sharks[2] 2023 (t)[4]	30202	
	Av. Not elsewhere included (nei) sharks[2] 2019-23(t)	28978	
	MSY (1,000 t) (80% CI)	1.930 (0.985 – 3.313)	
	F_{MSY} (80% CI)	0.03 (0.01 – 0.07)	
	B_{MSY} (1,000 t) (80% CI)	60.0 (35.7 – 103.8)	
	F_{2022}/F_{MSY} (80% CI)	1.53 (0.65 – 3.71)	
	B_{2022}/B_{MSY} (80% CI)	0.96 (0.58 – 1.41)	
	B_{2022}/B_0 (80% CI)	0.45 (0.27- 0.69)	

[1] Boundaries for the Indian Ocean = IOTC area of competence

[2] Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SKH: Various sharks nei; MSK: Mackerel sharks,porbeagles nei; MAK: Mako sharks; AG38: Blue shark, shortfin mako, oceanic whitetip shark).

[3] Proportion of 2022 catch estimated or partially estimated by IOTC Secretariat: 32.2%

[4] Catches of MAK include for all Isurus spp, reported as aggregated MAK.

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)	49.7%	24.0%
Stock not subject to overfishing (F_{year}/F_{MSY}≤ 1)	4.1%	22.2%
Not assessed/Uncertain		

Table A 5. Shortfin mako shark: IUCN threat status of shortfin mako shark (*Isurus oxyrinchus*) in the Indian Ocean.

Common name	**Scientific name**	**IUCN threat status[3]**		
		Global status	**WIO**	**EIO**
Shortfin mako shark	*Isurus oxyrinchus*	Endangered	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean

[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

Sources: IUCN Red List 2020, Rigby et al 2019

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No new assessment was conducted for shortfin mako shark in 2025. In 2024 a stock assessment was carried out for the shortfin mako shark in the IOTC area of competence. The WPEB carried out a data-preparatory meeting earlier in the year followed by the stock assessment meeting. The model applied was a population biomass dynamics model using the platform JABBA. The stock status and projections were based on an ensemble grid of 9 models designed to capture the main uncertainties relating to biology (3 options) and the shape of the production curve used in biomass dynamics models (3 options). A number of additional options and model configurations were explored as sensitivity runs. Median biomass in 2022 was estimated to be at 45% (80% CI: 27-69%) of the unfished levels and below the levels that support MSY (B/BMSY in 2022 = 0.96, 80% CI: 0.58-1.41) (**Table 1**). Median fishing mortality in 2022 was estimated to be higher than the level that supports MSY (F/FMSY in 2022 = 1.53, 80% CI: 0.65-3.71), with the catch in 2022 (2,625 t, combining SMA and MAK codes) above the estimated MSY levels of 1,930 t (80% CI: 985 – 3,313 t (**Table 1**). While in recent years there were a number of CPUE indices to compare, the assessment relied on the Japanese CPUE index which showed a large depletion through the late 1990s and there is no alternative abundance index to compare the extent of this decline during that period. Additionally, although the reported catches of shortfin mako are generally considered to be reliable because this species used to be retained by several fleets, there is still significant uncertainty about the accuracy of reports from earlier years. This uncertainty also applies to more recent years (post-2018) due to discarding or non-retention.

A semi-quantitative ecological risk assessment (ERA) was conducted for the Indian Ocean by the WPEB and SC in 2018 to evaluate the resilience of shark species to the impact of pelagic fisheries (Murua *et al.* 2018). Shortfin mako sharks received the highest vulnerability ranking in the ERA for longline gear (No. 1) because of their low productivity and high susceptibility to longline gear, and were ranked the fourth most vulnerable shark species for purse seine gear. Considering the characterized uncertainty, and on the weight-of-evidence available in 2024, the shortfin mako shark stock is determined to be **overfished** and subject to **overfishing** (**Table 1, Fig 3**).

Outlook. Catches increased mostly from the mid-1980s up to 2016 followed by a decrease until 2022 as it has been under domestic landing restrictions by a number of fleets, and as a result of it having been listed in CITES Appendix II. The CPUE series for several key fleets which have been available since the early 2000s are generally stable or are increasing.

Management advice The Commission should take a cautious approach by implementing management actions that reduce fishing mortality on shortfin mako sharks, and the stock should be closely monitored. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), these need to be further implemented by the Commission so as to better inform future scientific advice. The Kobe II Strategy Matrix (**Table A** 3) provides the probability of exceeding reference levels over 3-, 10-, 20- and 30-year periods, over a range of TAC options established as a percentage of current catches. Current catches are higher than MSY, and the shortfin mako is currently overfished (B/Bmsy < 1) and undergoing overfishing (F/Fmsy > 1). Under those levels of catches, the biomass will continue to decline, and fishing mortality will continue to increase over time. In order to have a lower than 50% probability of exceeding MSY-reference points in 10 years, i.e., to recover the stock to the green quadrant of the Kobe plot with at least 50% probability in 10 years, future catches should not exceed 40% of current catches. This corresponds to an annual TAC of 1,217.2 t (representing all fishing mortality including retention, dead discards and post-release mortality), noting that this TAC level should include and account for the SMA, MAK and MSK species codes as reported to IOTC.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: estimate for the Indian Ocean is approximately 1,930 t
- **Reference points**: The Commission has not adopted reference points or harvest control rules for any shark species.
- **Main fishing gear** (2019-23): Longline targeting swordfish; gillnet, longline (deep-freezing); longline (fresh); gillnet offshore (**Fig 1).**
- **Main fleets** (2019-23): Taiwan, China (21%), Indonesia (20%), EU,Spain (14%), (Reported as discarded/released alive: EU,Spain, Australia, EU,France, Indonesia, Korea, South Africa) **(Fig 2)**.

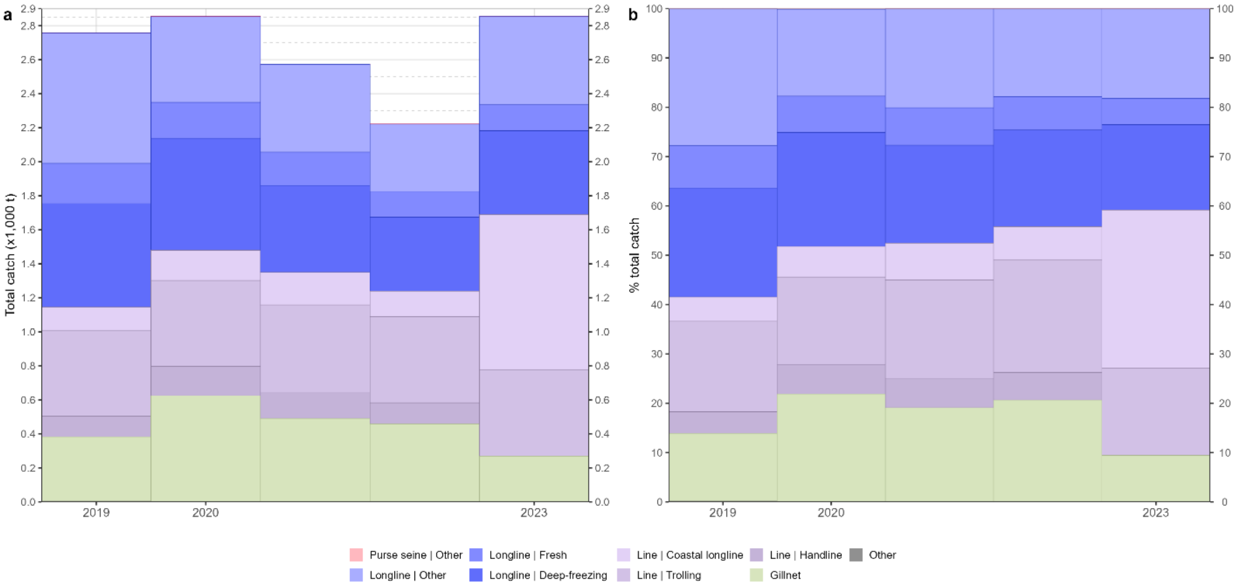

Fig 1: Annual absolute (a) and relative (b) time series of retained catches (metric tonnes; t) of shortfin mako reported at species level or aggregated (SMA, MAK and MSK) by fishery for the period 2019-2023

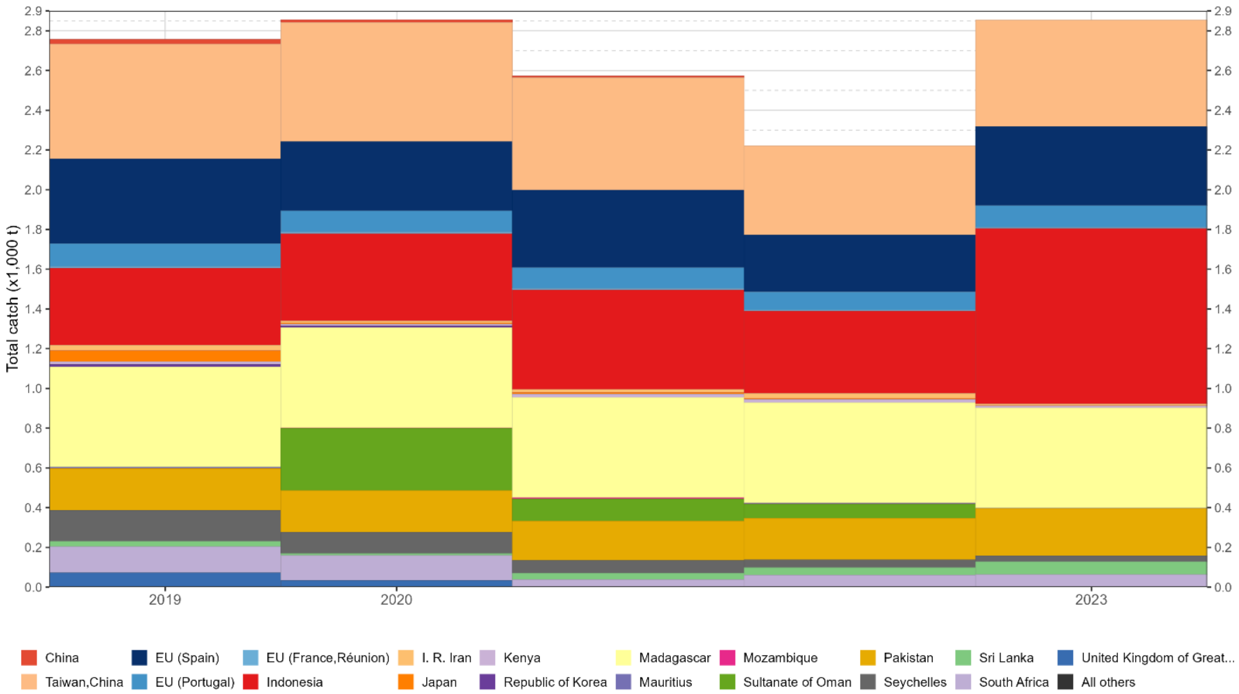

Fig 2: Annual time series of retained catches (metric tonnes; t) of shortfin mako reported at species level or aggregated (SMA, MAK and MSK) by fleet during 2019-2023

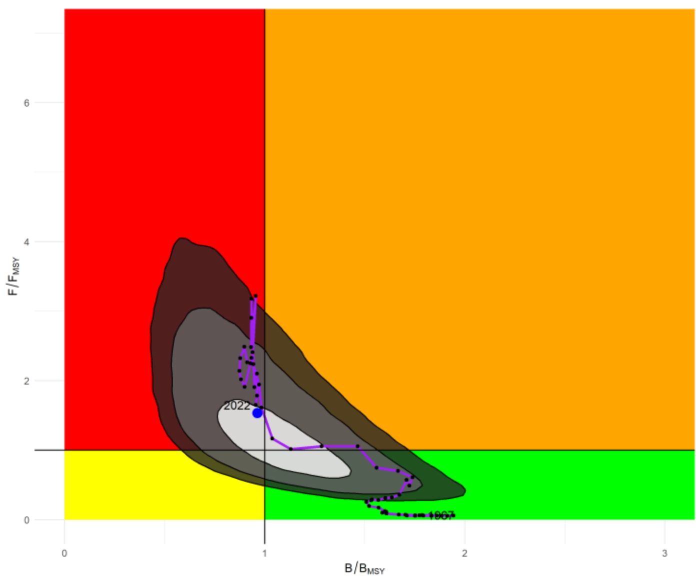

Fig 3: **Shortfin mako**: 2024 stock status, relative to BMSY (x-axis) and FMSY (y-axis) for the final model. The point represents the median of the 9 final models used in the ensemble grid and the shaded areas are the 50%, 80% and 90% contours of the uncertainties in the terminal year. The line represents the time series of the median stock trajectory from the ensemble grid of models.

Table 3. **Shortfin mako**: Final model ensemble aggregated Indian Ocean Kobe II Strategy Matrix. The values represent the probabilities (percentage) of exceeding the MSY-based target reference points, for constant catch projections between 0%-100% (10% intervals) relative to last year catches (average of last 3 years, 2020-2022), and projected for periods of 3, 10, 20 and 30 years.

Reference point and projection time	**Catch projections (relative to the 2020-2022 catches) and probability (%) of exceeding MSY-based reference points**										
Catch relative to 2020-2022 (%)	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**
TAC (t)	**0.0**	**304.3**	**608.6**	**912.9**	**1217.2**	**1521.5**	**1825.7**	**2130.0**	**2434.3**	**2738.6**	**3042.9**
3 year projection											
B2025 < BMSY	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7
F2025 > FMSY	0.0	1.5	9.6	21.7	34.1	45.3	55.1	63.2	70.0	75.7	80.2
10 year projection											
B2032 < BMSY	39.2	41.8	44.5	47.1	49.8	52.5	55.2	57.9	60.6	63.2	65.8
F2032 > FMSY	0.0	2.0	10.0	21.2	32.8	43.8	53.6	62.2	69.5	75.6	80.6
20 year projection											
B2042 < BMSY	26.1	30.0	34.4	39.1	44.0	49.0	54.1	59.1	64.0	68.6	72.9
F2042 > FMSY	0.0	2.4	10.2	20.6	31.9	42.8	52.9	62.0	69.9	76.5	81.8
30 year projection											
B2052 < BMSY	19.3	23.9	29.0	34.9	41.2	47.7	54.3	60.7	66.7	72.3	77.3
F2052 > FMSY	0.0	2.6	10.2	20.4	31.6	42.6	53.1	62.4	70.6	77.5	83.0

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Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019. Isurus oxyrinchus. The IUCN Red List of Threatened Species 2019: e.T39341A2903170. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T39341A2903170.en. Accessed on 06 December 2023.

APPENDIX XI
EXECUTIVE SUMMARY: SILKY SHARK (2025)

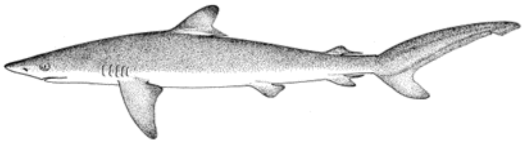

Table A 1. Status of silky shark (*Carcharhinus falciformis*) in the Indian Ocean.

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2023 (t)[3] Not elsewhere included (nei) sharks[2] 2023 (t) Average reported catch 2019-23 (t) Av. Not elsewhere included (nei) sharks[2] 2019-23 (t)	1,579 28,179 1,750 27,279	
	MSY (1,000 t) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 t) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $SB_{current}/SB_{MSY}$ (80% CI) $SB_{current}/SB_0$ (80% CI)	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SKH: Various sharks nei; RSK: requiem sharks nei).
[3]Proportion of 2023 catch estimated or partially estimated by IOTC Secretariat: 7.1%

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		

Table A 2. Silky shark: IUCN threat status of silky shark (*Carcharhinus falciformis*) in the Indian Ocean.

Common name	**Scientific name**	**IUCN threat status[3]**		
		Global status	**WIO**	**EIO**
Silky shark	*Carcharhinus falciformis*	Vulnerable	-	-

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean

[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

Sources IUCN Red List 2020, Rigby 2021

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty about the relationship between abundance and the nominal CPUE series from the main longline fleets, and about the total catches over the past decade (**Table** A **A1**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type (Murua *et al.* 2018). Silky shark received a high vulnerability ranking (No. 2) in the ERA rank for longline gear because it was estimated to be one of the least productive shark species, and with a high susceptibility to longline gear. Silky shark was estimated to be the fifth most vulnerable shark species in the ERA ranking for purse seine gear, due to its low productivity and high susceptibility to purse seine gear. The current IUCN threat status of this species globally is 'Vulnerable' (**Table** A **A2**). There is a paucity of information available on this species, but several studies have been carried out for this species in the recent years. CPUE derived from longline fishery observations indicated a decrease from 2009 to 2011 with a stable pattern onward. A preliminary stock assessment was run in 2018 but could not be updated in 2019. This assessment is extremely uncertain, however, and so the population status of silky sharks in the Indian Ocean is considered uncertain. Silky sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (over 20 years), mature relatively late (at 6–12 years), and have relativity few offspring (<20 pups every two years), the silky shark can be vulnerable to overfishing. Despite the lack of data, there is some anecdotal information suggesting that silky shark abundance has declined over recent decades, including from Indian longline research surveys, which are described in the IOTC Supporting Information for silky shark sharks. There is no quantitative stock assessment or basic fishery indicators currently available for silky shark in the Indian Ocean therefore the stock status is **unknown**.

Outlook. The impact of piracy in the western Indian Ocean has resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into certain areas in the southern and eastern Indian Ocean. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort on silky shark has declined in the southern and eastern areas and may have resulted in localised depletion there.

Management advice. Despite the absence of stock assessment information, the Commission should consider taking a cautious approach by implementing some management actions for silky sharks. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), these need to be further implemented by the Commission so as to better inform scientific advice.

Mitigation measures should be taken to reduce at-vessel and post release mortality, including consideration of potential gear modifications in longline fleets targeting tuna and swordfish. Noting that a recent study (Bigelow et al. 2021) concluded in WCPFC that banning both shark lines and wire leaders has the potential to reduce fishing mortality by 30.8% for silky shark.

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Unknown.
- **Reference points**: Not applicable.
- **Main fishing gear** (2019-23): Gillnet; offshore gillnet; longline; longline (fresh), trolling (reported as discard by PS)
- **Main fleets** (2019-23): I.R. Iran; Pakistan, Sri Lanka; Taiwan,China; Kenya (reported as discarded/released alive by: EU-France, Mauritius, EU-Spain, Korea, Seychelles and Tanzania).

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APPENDIX XII
EXECUTIVE SUMMARY: BIGEYE THRESHER SHARK (2025)

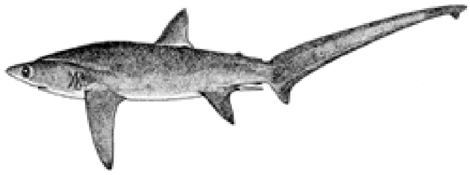

Table A 1. Status bigeye thresher shark (*Alopias superciliosus*) in the Indian Ocean.

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2023 (t) Not elsewhere included (nei) sharks[2] 2023 (t) Thresher sharks nei 2023 (t) Average reported catch 2019-23 (t) Av. Not elsewhere included (nei) sharks[2] 2019-23 (t) Av. Thresher sharks nei 2019-23 (t)	< 1 33,043 4,863 < 1 28,685 1,356	
	MSY (1,000 t) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 t) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $SB_{current}/SB_{MSY}$ (80% CI) $SB_{current}/SB_0$ (80% CI)	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SKH: Various sharks nei;THR: Thresher sharks nei; MSK: Mackerel sharks,porbeagles nei).

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		

Table A 2. Bigeye thresher shark: IUCN threat status of bigeye thresher shark (*Alopias superciliosus*) in the Indian Ocean.

Common name	**Scientific name**	**IUCN threat status[3]**		
		Global status	**WIO**	**EIO**
Bigeye thresher shark	*Alopias superciliosus*	Vulnerable	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean

[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

Sources: IUCN Red List 2020, Rigby et al 2019

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty in the stock status due to lack of information necessary for assessment or for the development of other indicators of the stock (**Table** A **1**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type (Murua *et al.* 2018). Bigeye thresher shark received a high vulnerability ranking (No. 4) in the ERA rank for longline gear because it was characterised as one of the least productive shark species, and highly susceptible to longline gear. Despite its low productivity, bigeye thresher shark has a low vulnerability ranking to purse seine gear due to its low susceptibility to this particular gear. The current IUCN threat status of 'Vulnerable' applies to bigeye thresher shark globally (**Table** A **2**). There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. Bigeye thresher sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (+20 years), mature at 3–9 years, and have few offspring (2–4 pups every year), the bigeye thresher shark is vulnerable to overfishing. There has been no quantitative stock assessment and limited basic fishery indicators are available for bigeye thresher shark in the Indian Ocean. Therefore, the stock status is **unknown**.

Outlook. Current longline fishing effort is directed at other species, however, bigeye thresher sharks are commonly taken as bycatch in these fisheries. Hooking mortality is apparently very high, therefore IOTC Resolution 12/09 prohibiting retaining of any part of thresher sharks onboard and promoting live release of thresher shark may be largely ineffective for species conservation. Maintaining or increasing effort can result in declines in biomass, productivity and CPUE. However, there are few data to estimate CPUE trends and a reluctance of fishing fleets to report information on discards/non-retained catch. Piracy in the western Indian Ocean resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into other areas in the southern and eastern Indian Ocean. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort on bigeye thresher shark declined in the southern and eastern areas over that time period, potentially resulting in localised depletion.

Management advice. The prohibition on retention of bigeye thresher shark should be maintained. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), these need to be further implemented by the Commission, so as to better inform scientific advice. IOTC Resolution 12/09 *On the conservation of thresher sharks (family Alopiidae) caught in association with fisheries in the IOTC area of competence*, prohibits retention onboard, transhipping, landing, storing, selling or offering for sale any part or whole carcass of thresher sharks of all the species of the family *Alopiidae*[1].The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2018–22): No report after 2012. (reported as discard from longline - records from submissions by CHN, IDN, ZAF, Eu FRA, KEN and KOR).
- **Main reporting fleets** (2018–22): India; (reported as discarded/released alive by United Kingdom, South Africa, Indonesia, Korea, EU,France).

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[1] Scientific observers shall be allowed to collect biological samples from thresher sharks that are dead at haulback, provided that the samples are part of the research project approved by the Scientific Committee (or the Working Party on Ecosystems and Bycatch).

APPENDIX XIII
EXECUTIVE SUMMARY: PELAGIC THRESHER SHARK (2025)

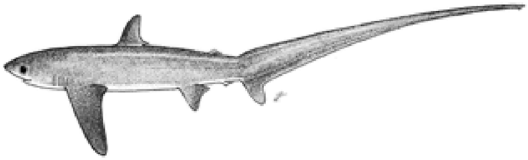

Table A 1. Status pelagic thresher shark (*Alopias pelagicus*) in the Indian Ocean.

Area[1]	Indicators		2018 stock status determination
Indian Ocean	Reported catch 2023 (t)[3]	136	
	Not elsewhere included (nei) sharks[2] 2023 (t)	33,043	
	Thresher sharks nei 2023 (t)	4,863	
	Average reported catch 2019-23 (t)	162	
	Av. Not elsewhere included (nei) sharks[2] 2019-23 (t)	28,635	
	Av. Thresher sharks nei 2019-23 (t)	1,356	
	MSY (1,000 t) (80% CI) F_{MSY} (80% CI) SB_{MSY} (1,000 t) (80% CI) $F_{current}/F_{MSY}$ (80% CI) $SB_{current}/SB_{MSY}$ (80% CI) $SB_{current}/SB_0$ (80% CI)	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SKH: Various sharks nei;THR: Thresher sharks nei; MSK: Mackerel sharks,porbeagles nei).
[3]Proportion of 2022 catch estimated or partially estimated by IOTC Secretariat: 100%

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		

Table A 2. Pelagic thresher shark: IUCN threat status of pelagic thresher shark (*Alopias pelagicus*) in the Indian Ocean.

Common name	**Scientific name**	**IUCN threat status[3]**		
		Global status	**WIO**	**EIO**
Pelagic thresher shark	*Alopias pelagicus*	Endangered	–	–

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean

[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

Sources: IUCN Red List 2020, Rigby et al 2019

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. There remains considerable uncertainty in the stock status due to lack of information necessary for assessment or for the development of other indicators (**Table** A 1**1**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 consisted of a semi-quantitative analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and susceptibility to each fishing gear type (Murua *et al.* 2018). Pelagic thresher shark received a medium vulnerability ranking (No. 12) in the ERA for longline gear because it was characterised as one of the least productive shark species, and with a medium susceptibility to longline gear. Due to its low productivity, pelagic thresher shark has a high vulnerability ranking (No. 2) to purse seine gear due to its high availability for this particular gear. The current IUCN threat status of 'Endangered' applies to pelagic thresher shark globally (**Table** A **2**). There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. Pelagic thresher sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (+ 20 years), mature at 8–9 years, and have few offspring (2 pups every year–) - the pelagic thresher shark is vulnerable to overfishing. There is no quantitative stock assessment and limited basic fishery indicators are currently available for pelagic thresher shark in the Indian Ocean. Therefore, the stock status is **unknown.**

Outlook. Current longline fishing effort is directed at other species, however, pelagic thresher sharks are commonly taken as bycatch in these fisheries. Hooking mortality is apparently very high, therefore IOTC Resolution 12/09 prohibiting retaining of any part of thresher sharks onboard and promoting life release of thresher shark may be largely ineffective for species conservation. Maintaining or increasing effort can result in declines in biomass, productivity and CPUE. However, there are few data to estimate CPUE trends, and a reluctance of fishing fleets to report information on discards/non-retained catch. Piracy in the western Indian Ocean resulted in the displacement and subsequent concentration of a substantial portion of longline fishing effort into other areas in the southern and eastern Indian Ocean. Some longline vessels have returned to their traditional fishing areas in the northwest Indian Ocean, due to the increased security onboard vessels, with the exception of the Japanese fleet which has still not returned to the levels seen before the start of the piracy threat. It is therefore unlikely that catch and effort on pelagic thresher shark declined in the southern and eastern areas over that time period, potentially resulting in localised depletion there.

Management advice. The prohibition on the retention of pelagic thresher shark should be maintained. While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), these need to be further implemented by the Commission, so as to better inform scientific advice. IOTC Resolution 12/09 *On the conservation of thresher sharks (family Alopiidae) caught in association with fisheries in the IOTC area of competence*, prohibits retention onboard, transhipping, landing, storing, selling or offering for sale any part or whole carcass of thresher sharks of all the species of the family *Alopiidae*[2].The following key points should also be noted:

- **Maximum Sustainable Yield (MSY):** Not applicable. Retention prohibited.
- **Reference points**: Not applicable.
- **Main fishing gear** (2019-23): Gillnet, coastal longline, exploratory longline (reported as discard/ released from gillnet and longline).
- **Main fleets** (2019-23): Pakistan; reported as discarded/released alive by Korea, South Africa, Indonesia.

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[2]Scientific observers shall be allowed to collect biological samples from thresher sharks that are dead at haulback, provided that the samples are part of the research project approved by the Scientific Committee (or the Working Party on Ecosystems and Bycatch).

APPENDIX XIV
EXECUTIVE SUMMARY: PORBEAGLE SHARK (2024)

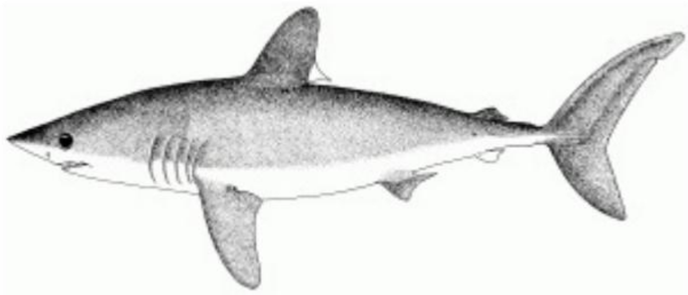

Table 6. Status of porbeagle shark (*Lamna nasus*) in the Indian Ocean

Area	Indicators		2024 stock status determination
Indian Ocean	Reported catch 2023 (t)[4]	28t	Unknown
	Not elsewhere included (nei) sharks[1] 2023 (t)	28,179t	
	Average reported catch 2019-23 (t)	6t	
	Avg. not elsewhere included (nei) sharks[1] 2019-23 (t)	27,279t	
	MSY (1,000 t) (80% CI)[2]		
	F_{MSY} (80% CI)[2]		
	SB_{MSY} (1,000 t) (80% CI)[2,3]		
	F_{2019}/F_{MSY} (80% CI)[2]		
	SB_{2019}/SB_{MSY} (80% CI)[2,3]		
	SB_{2019}/SB_0 (80% CI)[2,3]		

Boundaries for the Indian Ocean are defined as the IOTC area of competence
[1]Includes all other shark catches reported to the IOTC Secretariat, which may contain this species (i.e., SKH: Various sharks nei; MSK: Mackerel sharks, porbeagles nei, AG21: Sharks nei other than oceanic whitetip shark and blue shark)

Colour key	Stock overfished (SB_{2019}/SB_{MSY}< 1)	Stock not overfished (SB_{2019}/SB_{MSY}≥ 1)
Stock subject to overfishing(F/F_{MSY}> 1)		
Stock not subject to overfishing (F/F_{MSY}≤ 1)		
Not assessed/Uncertain		

Table 7. Porbeagle shark: IUCN threat status of porbeagle shark (*Lamna nasus*) in the Indian Ocean.

Common name	Scientific name	IUCN threat status[3]
		Global status
Porbeagle shark	*Lamna nasus*	Vulnerable

IUCN = International Union for Conservation of Nature; WIO = Western Indian Ocean; EIO = Eastern Indian Ocean

[3]The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

Sources: Rigby et al., 2019

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No stock assessment was carried out for porbeagle sharks in 2024. There remains considerable uncertainty in the stock status due to lack of information necessary for assessment or for the development of other indicators of the stock (**Table** A **1**). The ecological risk assessment (ERA) conducted for the Indian Ocean by the WPEB and SC in 2018 consisted of a semi-quantitative risk assessment analysis to evaluate the resilience of shark species to the impact of a given fishery, by combining the biological productivity of the species and its susceptibility to each fishing gear type (Murua *et al.* 2018). Porbeagle shark received a high vulnerability ranking (No. 3) in the ERA rank for longline gear because it was characterised as one of the least productive shark species, and highly susceptible to longline gear. Despite its low productivity, porbeagle shark has a low vulnerability ranking to purse seine gear due to its low susceptibility to this particular gear. The current IUCN threat status of 'Vulnerable' applies to porbeagle shark globally (**Table** A **2**). There is a paucity of information available on this species and this situation is not expected to improve in the short to medium term. Porbeagle sharks are commonly taken by a range of fisheries in the Indian Ocean. Because of their life history characteristics – they are relatively long lived (+30 years), mature at around 15 years, and have few offspring (around 4 pups every one or two years), the porbeagle shark is vulnerable to overfishing. There has been no quantitative stock assessment and limited basic fishery indicators are available for porbeagle shark in the Indian Ocean. Therefore, the stock status is **unknown**.

Outlook. Current longline fishing effort is directed at other species, however, porbeagle sharks are taken as bycatch in these fisheries but it may be released by some fleets. Maintaining or increasing effort can result in declines in biomass, productivity and CPUE. However, there are few data to estimate CPUE trends and a reluctance of fishing fleets to report information on discards/non-retained catch. Preliminary analysis of IOTC catch and effort data from the Japanese and Korean fleets found catchability to have declined from 2009 through 2018 (IOTC-2023-WPEB19-20). The Japanese fleet releases porbeagle sharks caught by longline vessels which may be a reason for the decline in catches of this species.

Management advice.

While mechanisms exist for encouraging CPCs to comply with their recording and reporting requirements (Resolution 18/07), these need to be further implemented by the Commission so as to better inform scientific advice. This is considered to be a vulnerable species

The following key points should also be noted:

- **Maximum Sustainable Yield (MSY)**: Unknown
- **Reference points**: The Commission has not adopted reference points or harvest control rules for any shark species.
- **Main fishing gear** (2019–23): coastal longline; Longline (deep-freezing),
- **Main fleets** (2019–23): IDN (96%), JPN, Catches by JPN are discarded.

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APPENDIX XIVI
EXECUTIVE SUMMARY: MARINE TURTLES (2025)

Table A 1. Marine turtles: IUCN threat status for all marine turtle species reported as caught in fisheries within the IOTC area of competence.

Common name	Scientific name	IUCN threat status[3]
Flatback turtle	*Natator depressus*	Data deficient
Green turtle	*Chelonia mydas*	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Critically Endangered
Leatherback turtle	*Dermochelys coriacea*	Vulnerable (Globally)
	(N. East Indian Ocean subpopulation)	Data deficient
	(S. West Indian Ocean subpopulation)	Critically Endangered
Loggerhead turtle	*Caretta caretta*	Vulnerable (Globally)
	(N. West Indian Ocean subpopulation)	Critically Endangered
	(S. East Indian Ocean subpopulation)	Near Threatened
Olive Ridley turtle	*Lepidochelys olivacea*	Vulnerable

Sources: Marine Turtle Specialist Group 1996, Red List Standards & Petitions Subcommittee 1996, Sarti Martinez (Marine Turtle Specialist Group) 2000, Seminoff 2004, Abreu-Grobois & Plotkin 2008, Mortimer et al. 2008, IUCN 2020, The IUCN Red List of Threatened species. <www.iucnredlist.org>. Downloaded on 16 September 2020

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. No assessment has been undertaken by the IOTC WPEB for marine turtles due to the lack of data being submitted by CPCs. However, the current International Union for Conservation of Nature (IUCN) threat status for each of the marine turtle species reported as caught in IOTC fisheries to date is provided in **Table** A **1**. It is important to note that a number of international global environmental accords (e.g., Convention on Migratory Species (CMS), Convention on Biological Diversity (CBD), as well as numerous fisheries agreements obligate States to provide protection for these species. In particular, there are now 35 Signatories to the Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA MoU). Of the 35 Signatories to the IOSEA MoU, 25 are also members of the IOTC. While the status of marine turtles is affected by a range of factors such as degradation of marine turtle natural habitats and targeted harvesting of eggs and turtles, the level of mortality of marine turtles due to capture by gillnets is likely to be substantial as shown by the Ecological Risk Assessment (ERA) presented in 2018 (Williams et al., 2018). Stock assessments of all species of marine turtles in the Indian Ocean are limited due to data insufficiencies as well as limited data quality (Wallace et al., 2011). Bycatch and mortality from gillnet fisheries have greater population-level impacts on marine turtles relative to other gear types, such as longline, purse seine and trawl fisheries in the Indian Ocean (Wallace et al., 2013). Population levels of impacts of leatherback turtles caught in longline gear in the Southwest Indian Ocean were also identified as a conservation priority.

Outlook. Resolution 12/04 *On the conservation of marine turtles* includes an annual evaluation requirement (para. 17) by the Scientific Committee (SC). However, given the lack of reporting of marine turtle interactions by CPCs to date, such an evaluation cannot be undertaken. Unless IOTC CPCs become compliant with the data collection and reporting requirements for marine turtles, the WPEB and the SC will continue to be unable to address this issue. So far, reporting of sea turtle interactions are not described at the species level. It is recommended that CPCs now declare interactions indicating the sea turtle species. Guides for species identification are available at http://iotc.org/science/species-

[3] IUCN, 2020. The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

identification-cards. Notwithstanding this, it is acknowledged that the impact on marine turtle populations from fishing for tuna and tuna-like species will increase as fishing pressure increases, and that the status of the marine turtle populations will continue to worsen due to other factors such as an increase in fishing pressure from other fisheries or anthropological or climatic impacts.

The following should also be noted:

1. The available evidence indicates considerable risk to marine turtles in the Indian Ocean.
2. Given the high mortality rates associated with marine turtle interactions with gillnet fisheries and the increasing use of gillnets in the Indian Ocean (Aranda, 2017) there is a need to both assess and mitigate impacts on threatened and endangered marine turtle populations.
3. The primary sources of data that drive the ability of the WPEB to determine a status for the Indian Ocean, total interactions by fishing vessels or in net fisheries, are highly uncertain and should be addressed as a matter of priority.
4. Current reported interactions are known to be a severe underestimate.
5. The Ecological Risk Assessment (Nel et al., 2013) estimated that ~3,500 and ~250 marine turtles are caught by longline and purse seine vessels, respectively, per annum, with an estimated 75% of turtles released alive[7]. The ERA set out two separate approaches to estimate gillnet impacts on marine turtles, based on very limited data. The first calculated that 52,425 marine turtles p.a. and the second that 11,400–47,500 turtles p.a. are caught in gillnets (with a mean of the two methods being 29,488 marine turtles p.a.). Anecdotal/published studies reported values of >5000–16,000 marine turtles p.a. for each of India, Sri Lanka and Madagascar. Of these reports, green turtles are under the greatest pressure from gillnet fishing, constituting 50–88% of catches for Madagascar. Loggerhead, hawksbill, leatherback and olive Ridley turtles are caught in varying proportions depending on the region, season and type of fishing gear.
6. Maintaining or increasing fishing effort in the Indian Ocean without appropriate mitigation measures in place, will likely result in further declines in marine turtle populations.
7. Efforts should be undertaken to encourage CPCs to investigate means to reduce marine turtle bycatch and at-vessel and post-release mortality in IOTC fisheries and improve data collection and reporting for marine turtles. This may include alternative data collection mechanisms such as skipper-based reporting, port sampling and cost-effective electronic monitoring systems.

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APPENDIX XVII
EXECUTIVE SUMMARY: SEABIRDS (2025)

Table A 1. IUCN threat status for all seabird species reported as caught in fisheries within the IOTC area of competence.

Common name	**Scientific name**	**IUCN threat status[4]**
Albatross		
Atlantic Yellow-nosed Albatross	*Thalassarche chlororhynchos*	Endangered
Black-browed albatross	*Thalassarche melanophris*	Least Concern
Indian yellow-nosed albatross	*Thalassarche carteri*	Endangered
Shy albatross	*Thalassarche cauta*	Near Threatened
Sooty albatross	*Phoebetria fusca*	Endangered
Light-mantled albatross	*Phoebetria palpebrata*	Near Threatened
Amsterdam albatross	*Diomedea amsterdamensis*	Endangered
Tristan albatross	*Diomedea dabbenena*	Critically Endangered
Wandering albatross	*Diomedea exulans*	Vulnerable
White-capped albatross	*Thalassarche steadi*	Near Threatened
Grey-headed albatross	*Thalassarche chrysostoma*	Endangered
Petrels		
Cape/Pintado petrel	*Daption capense*	Least Concern
Great-winged petrel	*Pterodroma macroptera*	Least Concern
Grey petrel	*Procellaria cinerea*	Near Threatened
Southern giant petrel	*Macronectes giganteus*	Least Concern
Northern giant-petrel	*Macronectes halli*	Least Concern
White-chinned petrel	*Procellaria aequinoctialis*	Vulnerable
Others		
Cape gannet	*Morus capensis*	Endangered
Flesh-footed shearwater	*Puffinus carneipes*	Near Threatened

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Stock status. Following a data call in 2016, the IOTC Secretariat received seabird bycatch data from 6 CPCs, out of the 15 with reported or expected longline effort South of 25ºS (IOTC-2016-SC19-INF02). Due to the lack of data submissions from other CPCs, and the limited information provided on the use of seabird bycatch mitigations, it has not yet been possible to undertake an assessment for seabirds. The current International Union for Conservation of Nature (IUCN) threat status for each of the seabird species reported as caught in IOTC fisheries to date is provided in **Table** A **1**. A number of international global environmental accords (e.g., Convention on Migratory Species (CMS), the Agreement on the Conservation of Albatrosses and Petrels (ACAP), Convention on Biological Diversity (CBD)), as well as numerous fisheries agreements obligate States to provide protection for these species. While the status of seabirds is affected by a range of factors such as degradation of nesting habitats and targeted harvesting of eggs, for albatrosses and large petrels, fisheries bycatch is generally considered to be the primary threat. The level of mortality of seabirds due to fishing gear in the Indian Ocean is poorly known, although where there has been rigorous assessment of impacts

[4] The process of the threat assessment from IUCN is independent from the IOTC and is presented for information purpose only

in areas south of 25 degrees (e.g., in South Africa), very high seabird incidental catches rates have been recorded in the absence of a suite of proven incidental catches mitigation measures.

Outlook. The level of compliance with Resolution 23/07 (*On Reducing the Incidental Bycatch of Seabirds in Longline Fisheries)* and the frequency of use of each of the 4 measures (because vessels can choose two out of three possible options) are still poorly known. Observer reports and logbook data should be analysed to support assessments of the effectiveness of mitigation measures used and relative impacts on seabird mortality rates. Information regarding seabird interactions reported in National Reports should be stratified by season, broad area, and in the form of catch per unit effort. Following the data call in 2016 it was possible to carry out a preliminary and qualitative analysis. The information provided suggests higher sea bird catch rates at higher latitudes, even within the area south of 25°S, and higher catch rates in the coastal areas in the eastern and western parts of the southern Indian Ocean. In terms of mitigation measures, the preliminary information available suggests that those currently in use (Resolution 23/07) may be proving effective in some cases, but there are also some conflicting aspects that need to be explored further. Unless IOTC CPCs become compliant with the data collection, Regional Observer Scheme and reporting requirements for seabirds, the WPEB will continue to be unable to fully address this issue.

The following should also be noted:

- The available evidence indicates considerable risk from longline fishing to the status of seabirds in the Indian Ocean, where the best practice seabird incidental catches mitigation measures outlined in Resolution 23/07 are not implemented.
- CPCs that have not fully implemented the provisions of the IOTC Regional Observer Scheme outlined in paragraph 3 of Resolution 22/04 shall report seabird incidental catches through logbooks, including details of species, if possible.
- Appropriate mechanisms should be developed by the Compliance Committee to assess levels of compliance by CPCs with the Regional Observer Scheme requirements and the mandatory measures described in Res 23/07.

APPENDIX XVIII
EXECUTIVE SUMMARY: CETACEANS (2025)

Table A 1. Cetaceans: IUCN Red List status and records of interaction (including entanglements and, for purse seines, encirclements) with tuna fishery gear types for all cetacean species that occur within the IOTC area of competence.

Family	Common name	Species	IUCN Red List status*	Interactions by Gear Type**
Balaenidae	Southern right whale	*Eubalaena australis*	LC	GN
Neobalaenidae	Pygmy right whale	*Caperea marginata*	LC	-
Balaenopteridae	Common minke whale	*Balaenoptera acutorostrata*	LC	-
	Antarctic minke whale	*Balaenoptera bonaerensis*	NT	-
	Sei whale	*Balaenoptera borealis*	EN	PS
	Bryde's whale	*Balaenoptera edeni*	LC	-
	Blue whale	*Balaenoptera musculus*	EN	-
	Fin whale	*Balaenoptera physalus*	VU	-
	Omura's whale	*Balaenoptera omurai*	DD	-
	Humpback whale	*Megaptera novaeangliae*	LC***	GN, LL
Physeteridae	Sperm whale	*Physeter macrocephalus*	VU	GN
Kogiidae	Pygmy sperm whale	*Kogia breviceps*	LC	GN
	Dwarf sperm whale	*Kogia sima*	LC	GN
Ziphiidae	Arnoux's beaked whale	*Berardius arnuxii*	LC	-
	Southern bottlenose whale	*Hyperoodon planifrons*	LC	-
	Longman's beaked whale	*Indopacetus pacificus*	LC	GN
	Andrew's beaked whale	*Mesoplodon bowdoini*	DD	-
	Blainville's beaked whale	*Mesoplodon densirostris*	LC	-
	Ramari's beaked whale	*Mesoplodon eueu*	DD	-
	Gray's beaked whale	*Mesoplodon grayi*	LC	-
	Hector's beaked whale	*Mesoplodon hectori*	DD	-
	Deraniyagala's beaked whale	*Mesoplodon hotaula*	DD	-
	Strap-toothed whale	*Mesoplodon layardii*	LC	-
	Spade-toothed whale	*Mesoplodon traversii*	DD	-
	Shepherd's beaked Whale	*Tasmacetus shepherdi*	DD	-
	Cuvier's beaked whale	*Ziphius cavirostris*	LC	GN
Delphinidae	Common dolphin	*Delphinus delphis*	LC	GN
	Pygmy killer whale	*Feresa attenuata*	LC	GN

	Short-finned pilot whale	*Globicephala macrorhynchus*	LC	LL, GN
	Long-finned pilot whale	*Globicephala melas*	LC	-
	Risso's dolphin	*Grampus griseus*	LC	LL, GN
	Fraser's dolphin	*Lagenodelphis hosei*	LC	-
	Irrawaddy dolphin	*Orcaella brevirostris*	EN	GN
	Australian snubfin dolphin	*Orcaella heinsohni*	VU	GN
	Killer whale	*Orcinus orca*	DD	LL, GN
	Melon-headed whale	*Peponocephala electra*	LC	LL, GN
	False killer whale	*Pseudorca crassidens*	NT	LL, GN
Delphinidae	Indo-Pacific humpback dolphin	*Sousa chinensis*	VU	GN
	Indian Ocean humpback dolphin	*Sousa plumbea*	EN	GN
	Australian humpback dolphin	*Sousa sahulensis*	VU	GN
	Pantropical spotted dolphin	*Stenella attenuata*	LC	PS, GN, LL
	Striped dolphin	*Stenella coeruleoalba*	LC	-
	Spinner dolphin	*Stenella longirostris*	LC	GN
	Rough-toothed dolphin	*Steno bredanensis*	LC	GN
	Indo-Pacific bottlenose dolphin	*Tursiops aduncus*	NT	GN
	Bottlenose dolphin	*Tursiops truncatus*	LC	LL, GN
Phocoenidae	Indo-Pacific finless porpoise	*Neophocaena phocaenoides*	VU	GN

* The assessment of the status level in IUCN is independent of IOTC processes
** Published bycatch records only (reference at the end of the document)
*** Arabian Sea population: EN
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Indian Ocean stock – Management Advice

Stock status. . The current International Union for Conservation of Nature (IUCN) Red List status for each of the cetacean species reported in the IOTC Area of Competence is provided in Table **A** 1. Information on their interactions with IOTC fisheries is also provided. It is important to note that a number of international global environmental accords (e.g., Convention on Migratory Species (CMS), Convention on Biological Diversity (CBD), International Whaling Commission (IWC)), as well as numerous fisheries agreements obligate States to provide protection for these species. The status of cetaceans is affected by a range of factors such as direct harvesting and habitat degradation, but the level of cetacean mortality due to capture in tuna drift gillnets is likely to be substantial and is also a major cause for concern (Anderson *et al.* 2020, Kiszka *et al.* 2021). Several reports (e.g., Sabarros et al., 2013) also suggest some level of cetacean mortality for species involved in depredation of pelagic longlines, and these interactions need to be further documented throughout the IOTC Area of Competence. Recently published information suggests that the incidental capture of cetaceans in purse seines is low (e.g., Escalle et al., 2015), but should be further monitored.

Outlook. . Resolution 23/06 *On the conservation of cetaceans* highlights the concerns of the IOTC regarding the lack of accurate and complete data collection and reporting to the IOTC Secretariat of interactions and mortalities of cetaceans in association with tuna fisheries in the IOTC Area of Competence. In this resolution, the IOTC have agreed that CPCs shall prohibit their flagged vessels from intentionally setting a purse seine net around a cetacean if the animal is sighted prior to the commencement of the set. The IOTC also agreed that CPCs using other gear types targeting tuna and tuna-like species found in association with cetaceans shall report all interactions with cetaceans to the relevant authority of the flag State and that these will be reported to the IOTC Secretariat by 30 June of the following year. It is acknowledged that the impact on cetacean populations from fishing for tuna and tuna-like species may increase if fishing pressure increases (which is already clear for tuna gillnet fisheries from IOTC data) or if the status of cetacean populations worsens due to other factors such as an increase in external fishing pressure or other anthropogenic or climatic impacts.

The following should be noted:

- The number of fisheries interactions involving cetaceans is highly uncertain and should be addressed as a matter of priority as it is a prerequisite for the WPEB to determine a status for any Indian Ocean cetacean species.
- Available evidence indicates considerable risk to cetaceans in the Indian Ocean, particularly from tuna drift gillnets.
- Current reported interactions and mortalities are scattered but are most likely severely underestimated (Anderson *et al*., 2020, Kiszka *et al*., 2021).
- Maintaining or increasing fishing effort in the Indian Ocean without appropriate mitigation measures in place will likely result in further declines in a number of cetacean species. An increasing effort by tuna drift gillnet fisheries has been reported to the IOTC, which is a major cause of concern for a number of species, particularly in the northern Indian Ocean.
- Efforts should be undertaken to encourage CPCs to investigate means to reduce cetacean bycatch and at-vessel and post-release mortality in IOTC fisheries and improve data collection and reporting for cetaceans. This may include alternative data collection mechanisms such as skipper-based reporting, port sampling and cost-effective electronic monitoring systems.

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APPENDIX XVIV
EXECUTIVE SUMMARY: MOBUIDS (2025)

Table A 1. Mobulids: IUCN Red List status for mobulid ray species that occur within the IOTC area of competence.

Family	Common name	Species	IUCN Red List status*	Interactions by Gear Type**
Mobulidae	Oceanic Manta Ray	*Mobula birostris*	EN	GN, PS, LL
	Reef Manta Ray	*Mobula alfredi*	VU	GN, LL***
	Sicklefin Devilray	*Mobula tarapacana*	EN	GN, PS, LL
	Spinetail Devil Ray	*Mobula mobular*	EN	GN, PS, LL
	Bentfin Devil Ray	*Mobula thurstoni*	EN	GN, PS, LL
	Longhorned Pygmy Devil Ray	*Mobula eregoodoo*	EN	GN, LL***
	Shorthorned Pygmy Devil Ray	*Mobula kuhlii*	EN	GN, LL***

* The assessment of the status level in IUCN is independent of IOTC processes
** Gear types: Gill nets (GN), Purse seines (PS), Longlines (LL)
The IUCN Red List of Threatened species. <www.iucnredlist.org>.
Downloaded on 14 July 2025.

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

Stock status. The current International Union for Conservation of Nature (IUCN) Red List status for each of the mobulid ray species reported in the IOTC Area of Competence is provided in Table **A** 1. Information on their known interactions with IOTC fisheries is also provided. It is important to note that a number of international global environmental accords (e.g., Convention on Migratory Species (CMS), Convention on Biological Diversity (CBD)), as well as numerous fisheries agreements obligate States to provide protection for these species.

The status of mobulids is affected by a range of factors such as direct harvesting, bycatch, and habitat degradation. The level of mobulid mortality due to capture in tuna fisheries is likely to be substantial and is a major cause for concern. Mobulids are primarily caught as bycatch in gillnet fisheries and, to a lesser extent, purse seine and longline fisheries (Croll et al., 2016, Shahid et al., 2018, White et al., 2006, Ardill et al., 2011, Moazamm, 2018; Ruiz et al., 2017; Murua et al., 2021; Acevedo-Iglesias et al., 2025; Laglbauer et al. 2025). Information on catches of these species is poor and often aggregated rather than reported to species level. It is also uncertain as there are difficulties in classifying them at species level, even by scientific observers (Cronin et al., 2024). A recent study comparing mobulid catch across ocean basins shows that globally, an estimated 39,473 mobulids are caught annually in large vessel fisheries (>15 m) (Laglbauer et al. 2025 [In review]). Purse seines accounted for 18.6% of catch and 19.7% of mortality, and together with drift gillnets had the highest rates of dead discards (57.3% and 50% respectively), while longlines had lower at-vessel mortality (6.7%). Gear reporting is often incomplete, but retention and mortality rates vary widely by fleet and country.

The Indian Ocean dominates reported mobulid global catches (72%, n = 191,528) and estimated global mortality (73%, n = 191,010) (Laglbauer et al. 2025 [In review]). However, no holistic evaluation of the vulnerability status of these species exists (Griffiths and Lezama-Ochoa, 2021). These interactions need to be better documented throughout the IOTC Area of Competence. However, information submitted to the WPEB has highlighted declines in the catches of mobulids in the Indian Ocean, which may suggest a decline in the populations (Shahid et al., 2018, Moazzam, 2018, Fernando 2018, Venables et al., 2024, Fernando and Stewart, 2021). Additional catch declines have been reported in coastal India based on landings and effort data where available (Raje and Zacharia 2009; Chopra et al.,2025 [In review]; Thomas et al. 2022); in Indonesia based on landings data (Lewis et al., 2015; FAO 2024); in Kenya based on IOTC publicly available data (IOTC, 2025); and possible local declines have been indicated in Madagascar of *M. alfredi* since 2015 based on citizen science observations (Diamant et al 2025).

Outlook. Resolution 19/03 *On the conservation of mobulid rays caught in association with the IOTC area of competence* highlights the lack of accurate and complete data collection and reporting to the IOTC Secretariat of interactions and mortalities of mobulids in association with tuna fisheries in the IOTC Area of Competence.

This resolution prohibits CPCs flagged vessels from intentionally setting any gear type for targeted fishing of mobulid rays, if an animal is sighted prior to the commencement of the set. CPCs shall also prohibit vessels from retaining any part or whole carcass of mobulid rays. However, these two provisions do not apply to vessels carrying out subsistence fisheries[5] (which should not be selling any part or whole carcass of the rays). CPCs are required to require their vessels to promptly release mobulids as soon as they are seen in the gear following adopted safe handling and release practices. The CPCs shall also report information and data collected on interactions (the number of discards and releases) with mobulids by vessels through logbooks and/or through observer programmes and this data should be provided to the IOTC Secretariat by 30 June of the following year.

The following should be noted:

- The number of mobulid interactions in various fisheries is highly uncertain and most likely underestimated, thus, this information should be collected/reported as a matter of priority for the WPEB to determine a status for any Indian Ocean mobulid species.
- Available evidence indicates considerable risk to mobulids in the Indian Ocean, particularly from tuna drift gillnet fisheries, followed by purse seiners and longline to a lesser extent.
- Maintaining or increasing fishing effort in the Indian Ocean without appropriate mitigation measures in place will likely result in further declines in a number of mobulid species. An increasing effort by tuna drift gillnet fisheries has been reported to the IOTC, which is a major cause of concern for a number of species, particularly in the northern Indian Ocean.
- The adoption of updated safe handling and release best practices, especially for gillnet and purse seine gears, would improve post-release mortality and reduce fisheries impacts on mobulid populations in the Indian Ocean
- Efforts should be undertaken to encourage CPCs to investigate means to reduce mobulid bycatch and at-vessel and post-release mortality in IOTC fisheries and improve data collection and reporting for mobulids. This may include alternative data collection mechanisms such as skipper-based reporting, port sampling and cost-effective electronic monitoring systems.

RELEVANT LITERATURE

[5] A subsistence fishery is a fishery in which the fish caught are consumed directly by the families of the fishers rather than being bought by middle-(wo)men and sold at the next larger market, per the FAO Guidelines for the routine collection of capture fishery data. FAO Fisheries Technical Paper. No. 382. Rome, FAO. 1999. 113p

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APPENDIX XVV
WORKING PARTY ON ECOSYSTEMS AND BYCATCH PROGRAM OF WORK (2026–2030)

The Program of Work consists of the following, noting that a timeline for implementation would be developed by the SC once it has agreed to the priority projects across all of its Working Parties:

Error! Reference source not found.: Priority topics for obtaining the information necessary to develop stock status indicators for bycatch in the Indian Ocean; and
Table A8: Stock assessment schedule.

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

Topic in order of priority	**Sub-topic and project**	Timing				
		2026	2027	2028	2029	2030
Connectivity, movements, habitat use and post release mortality*	Electronic tags (PSATs, SPOT, Splash MiniPAT) to assess the efficiency of management resolutions on non-retention species (BSH in LL, marine turtles and rays in GIL and PS, whale sharks) and to determine connectivity, movement rates, mortality estimates and genetic studies					
1. Fisheries data collection and development of alternative inputs into assessments	1.1 Catch composition reconstruction (initial focus Sri Lanka, Pakistan, India and Indonesia)					
	1.1.1 Historical data mining for the key species and IOTC fleets (e.g., as artisanal gillnet and longline coastal fisheries) including workshops.					
	1.1.2 Historical data mining and development of baseline catch history series for key species, including blue shark and shortfin mako shark, through the collection and integration of information on catch, effort, and spatial distribution of fleets, as well as mining statistics for sharks not reported to species level.					

	1.1.3 CPUE standardisation and review of additional abundance indicators series for each key shark species and fishery in the Indian Ocean 1.2 Investigation of sampling options to explore different indices of abundance for sharks such as CKMR. Identify CPCs who may be able to collaborate.					
2. Shark research and management strategy	2.1 Workshop to update and revise shark research plan with a small working group					
	2.2 Prioritising shark research based on previous work and including analysing gaps in knowledge to address the requests from the Commission contained within Resolution 25/08.					
	2.3 Implementation of work suggested by shark research plan					
3. Studies and training focused on gillnet bycatch mitigation	3.1 Focused GN bycatch mitigation workshop – training, monitoring, determine study design 3.2 Studies trialling gillnet mitigation measures such as: LED lights, sub-surface setting …					

Other Future Research Requirements (not in order of priority)

Topic	Sub-topic and project	2026	2027	2028	2029	2030
1. Review and improve data collection for mobulid rays	1.1 Mobulid ID guide revision and translation. ID guides to be updated with help of CPC scientists					

2. Bycatch mitigation measures	2.1 Gears 2.1.1 Undertake a series of gear specific workshops focusing on multi-taxa bycatch issues					
	2.1.2 Develop studies on bycatch mitigation measures for the main gears using in the IOTC area (operational, technological aspects and best practices)					
	2.2 Sharks a) Harmonise and finalise guidelines and protocols for safe handling and release of sharks and rays caught in IOTC fisheries					
	2.3 Sea turtles 2.3.1 Res. 12/04 (para. 11) Part I. 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; [mostly completed for LL and PS]					
	b) Develop regional standards covering data collection, data exchange and training					
	2.3.2 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.					
	2.3.3 Regional workshop to review the effectiveness of marine turtle mitigation measures 2.3.4 Harmonise and finalise guidelines and protocols for safe handling and release of sea turtles caught in IOTC fisheries					
	2.3 Seabirds 2.3.1 Bycatch assessment for seabirds taking into account the information from the various ongoing initiatives in the IO and adjacent oceans					

	2.3.2 Study on cryptic mortality of seabirds in tuna LL fisheries.					
	2.3.3 Study post release survival rates for seabirds and harmonise and finalise guidelines and protocols for safe handling and release of seabirds caught in IOTC fisheries					
	2.4 Cetaceans 2.4.1 Testing mitigation methods for cetacean bycatch in tuna drift gillnet fisheries					
	2.4.2 Harmonise and finalise guidelines and protocols for safe handling and release of cetaceans caught in IOTC fisheries					
	2.4.3. Intersessional meeting to discuss cetacean guidelines, ERA, Data gaps.					
3. CPUE standardisation / Stock Assessment / Other indicators	3.1 Develop standardised CPUE series for each key shark species and fishery in the Indian Ocean:					
	3.1.1 Development of CPUE guidelines for standardisation of CPC data.					
	3.1.2 Blue shark: Priority fleets: TWN,CHN LL, EU-Spain LL, Japan LL; Indonesia LL; EU-Portugal LL					
	3.1.3 Shortfin mako shark: Priority fleets: Longline and Gillnet fleets					

	3.1.4 Oceanic whitetip shark: Priority fleets: Longline fleets; purse seine fleets					
	3.1.5 Silky shark: Priority fleets: Purse seine fleets					
	3.2 Joint CPUE standardization across the main LL fleets for silky shark, using detailed operational data					
	3.3 Stock assessment and other indicators					
4. Ecosystems	4.1 Develop a plan for Ecosystem Approach to Fisheries (EAF) approaches in the IOTC, in conjunction with the Common Oceans Tuna Project.					
	4.1.2 Workshop for CPCs on continuing efforts to the development of an EAF including delineation of candidate eco regions within IOTC.					
	4.1.3 Practical Implementation of EBFM with the development and testing of ecosystem report cards.					
	4.1.4 Evaluation of EBFM plan in IOTC area of competence by the WPEB to review its elements components and make any corrective measures.					
	4.2 Assessing the impacts of climate change and socio- economic factors on IOTC fisheries					
	4.3 Evaluate alternative approaches to ERAs to assess ecological risk					
	4.4 Progress on Climate webpage on IOTC website and liaise with WPDCS for technical implementation					

Ecoregions development	Support for the development and refinement of ecoregions in the Indian Ocean: Development of a pilot study (focused on two ecoregions: one coastal, the Somali Current ecoregion and one oceanic, the Indian Ocean Gyre ecoregion)					
Development of Indian Ocean Digital Atlas	Facilitate the discussions with WPDCS to consolidate the Indian Ocean Digital Atlas project with stakeholders					

Table A8. Draft: Assessment schedule for the IOTC Working Party on Ecosystems and Bycatch 2026–2030 (adapted from IOTC–2024–SC27–R).

*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.

Working Party on Ecosystems and Bycatch					
Species	**2026**	**2027**	**2028**	**2029**	**2030**
-	Data preparatory meeting	-	-	Data preparatory meeting	Data preparatory meeting
Blue shark	-	–	–	–	Full assessment
Oceanic whitetip shark	Indicator analysis*	-	–		Indicator analysis*
Scalloped hammerhead shark	Indicator analysis*	–	–	–	–
Shortfin mako shark	-			Full assessment	
Silky shark	Indicator analysis*	-	Indicator analysis*	-	–
Bigeye thresher shark	-	Indicator analysis*	-	–	–
Pelagic thresher shark	-	Indicator analysis*	-	–	–
Porbeagle shark	-	Indicator analysis*		–	–
Mobulid Rays	-	Interactions/ Indicators	-	Interactions/ Indicators	–
Marine turtles	-	–	Indicators	–	Indicators
Seabirds	Presentation of the draft Seabird workplan. Review branch line weighting protocols	Review of mitigation measures in Res. 23/07	–	Development of draft workplan	

Marine Mammals	-	–	–	Review of mitigation measures Review of handling guidelines	
Ecosystem Approach to Fisheries Management (EAFM) approaches	Pilot ecosystem fisheries overviews for selected ecoregions				
Series of multi-taxa bycatch mitigation workshops	Focus: tbd	Focus: tbd	Focus: tbd	Focus: gillnets	Focus: tbd
Shark research plan update	Shark research plan update workshop				

APPENDIX XVVI

SUGGESTED REVISION TO THE LIVE RELEASE HANDLING PROCEDURES FOR MOBULIDS

Mobulid ray safe-handling and live release procedures

The primary aim of the following Minimum Standards for Safe Handling and Live Release Procedures is to ensure the highest level of survival of mobulids and that, whenever possible, prompt, and effective action will be taken to return the mobulid to the sea and prioritising that the life and safety of the crew is not compromised and that crew members shall endeavour to avoid hazards in the safe handling and release operations for mobulid.

Safety first: These minimum standards should be considered in light of safety and practicability for crew. Crew safety should always come first. Also minimising manual handling and using appropriate technical release devices instead is preferrable to ensure safety of the crew and the animals at the same time.

<u>**General principles applying to all gears**</u>

- Mobulid rays shall be released as soon as possible. Reducing the release time is the principal factor in determining survival of the released individual – survival is drastically reduced after more than 3 minutes of handling
- Prohibit the use of gaffes, hooks, or ropes to move or lift mobulid rays.
- Prohibit lifting, dragging, carrying or holding mobulid rays by the horns ("cephalic lobes"), tail, gill slits, mouth, wing, eye or spiracle (opening behind the eye) even by hand. Prohibit dragging by the wings but lifting by the wings is allowed when no other option is available.
- Prohibit the punching of holes through the bodies of mobulid rays (e.g. to pass a cable through for lifting the mobulid ray).
- Minimise direct contact with the skin of mobulid rays to prevent damage to their protective mucus layer and epidermis; handling should be avoided where possible and, if necessary, conducted with wet, non-abrasive materials.

<u>***Best Practices for live release from Purse seiners***</u>

- If brought onboard, do not allow the ray to go through the loading chute to the lower deck.
- **Small and medium sized rays** shall be released using stretchers to facilitate release in cases when a stretcher is not available, manual release should include:
    - 2 or 3 crew who carry the animal belly-down. The ray should be held far away from the tail to avoid contact with the barb (one mobulid species has a barb near the base of its tail).
    - Do not lift the animal by the tail
    - Do not drag, carry or hold an animal by its cephalic lobes (“horns”) or in its gill slits.
    - Do not expose the ray for long to air or sun.
    - Do not insert your hands in the mouth or gill slits to carry

- **Large and medium sized rays** shall be, to the extent possible, directly released from the net using the brailer or directly from the brailer (see methods recommended in document IOTC-2012-WPEB08-INF07).

- If a release from the brailer or the net is not possible, it is recommended to either:
  - Release using a purpose-made mobulid sorting grid with a rigid frame that allows the animal to lie flat during release (see document IOTC-2025-WPEB21(AS)-INF08 for construction instructions). The grid can be placed over the unloading hatch or on the hopper. A crane can be used to lift the grid and release the mobulid over the side of the vessel. Instructions for fabricating the grid can be found later in this document**.**
  - release using a cargo net, a canvas sling, or a similar device lifted with the crane. Try not to allow the animal's wings to bend significantly.
  - A seawater hose placed in the animal's mouth is helpful to keep water running over its gills.
- Each vessel must have the following release equipment accessible on deck at all times:
  - Mobulid sorting grid
  - Stretcher
  - Cargo net, canvas sling, or any similar device that can be attached to the crane

Best Practices for live-release for gillnetters

- Mobulids should not intentionally be hauled aboard. Before the net is hauled onboard, maintain the animal in the water and use the body of the net to bring the ray alongside the side of the vessel, disentangle it by manoeuvring the net or using tools e.g. a long-handled line cutter and, if necessary, cut the net. Care should be taken to minimise stress and/or injury to the ray
- For entangled animals, secure excess tangled area in the net with the long-handled gaff while other crew members remove the ray from the entangled areas of the net. The net cutter should be used to remove the animal from the tangled area of the net. Do not use the gaff on the animal.
- Do not let the mobulid pass through or above the net/line hauler, rather heave the net/line from the 'tuna door'/net hauling 'door' or haul by lifting through the gunwale.
- If it is not possible to disentangle the ray while keeping it in the water (such as in larger vessels where deck height doesn't allow it), carefully bring the ray on board, while ensuring that the ray may not pass above or through the net hauler and making every attempt to support the ray's weight by at least two points (i.e., one point of contact being the midsection, the other being the bottom end of the body near the tail), or preferably have 2 or 3 people carry the ray by the sides of each wing. If feasible, use a crane/cargo net/grid/stretcher...
- Disentangle the ray from the net—if the ray is 'badly' entangled, you may have to section some parts of the net (care should be taken to prevent injury to the animal while doing so). Try to minimise handling time and release it as soon as possible.
- A seawater hose placed in the animal's mouth is helpful to keep water running over its gills.

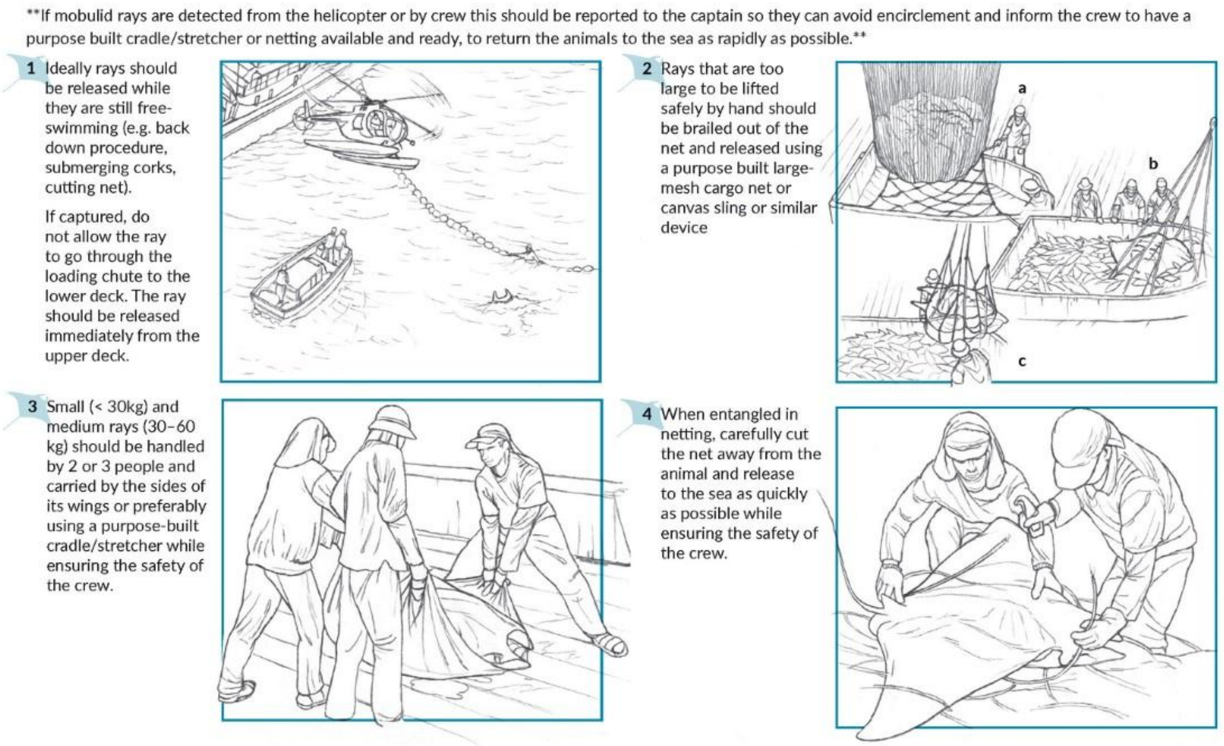
Best practices for live-release from longlines/ hook and line

- If possible stop the vessel to safely remove gear and release large rays.
- Bring the ray alongside the vessel, if possible. Always leave the animal in the water.
- If the animal is not entangled and can be brought close to the boat, consider attaching a flyback prevention device to the branch line to reduce the risk of a lead (or hook) flyback accident.
- For animals that are hooked or have swallowed the hook, use a long-handled line cutter to cut the line as close to the hook as possible leaving as little trailing line as possible.

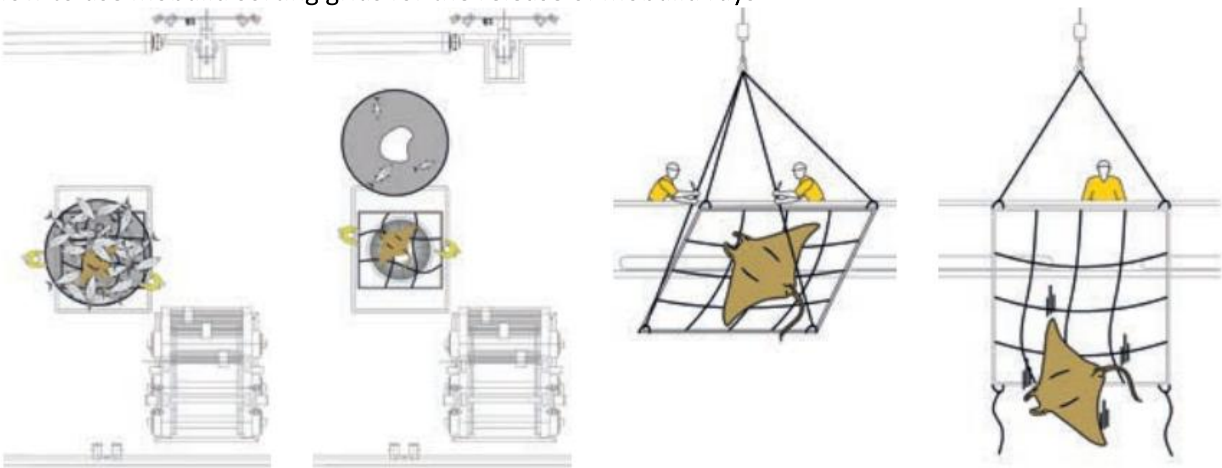
- For entangled animals, secure excess tangled line with the long-handled gaff while another crew member uses a long-handled line cutter to remove as much tangled line as possible. Do not use the gaff on the animal.

Annex I – Illustrations[6]

Purse seine



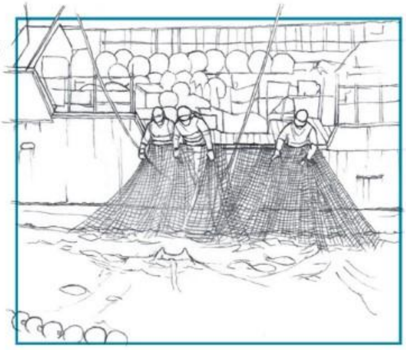
How to use mobulid sorting grids for the release of mobulid rays



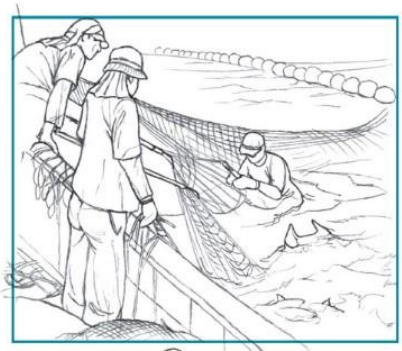
[6] Illustrations provided by Manta Trust

Gillnets

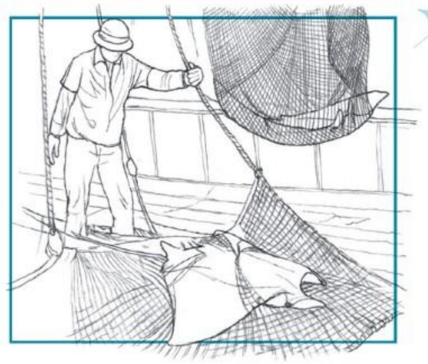
1 Avoid bringing the ray on deck and try to maintain the animal by the side of the boat in the water. Try to disentangle the ray using i.e. a longhandled line cutter.



2 Use the body of the net to manoeuvre the ray alongside the boat; care should be taken to minimise stress and/or injury to the ray.



3 If it is not possible to disentangle the ray while keeping it in the water, carefully bring the ray on board, making every attempt to support the ray's weight by at least two points (i.e., one point of contact being the midsection, the other being the bottom end of the body near the tail), or preferably have 2 or 3 people carry the ray by the sides of each wing; use crane/cargo net/grid if it's as large ray).

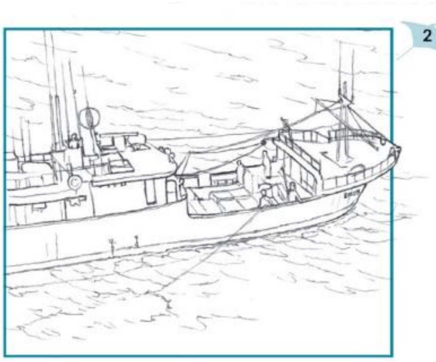


4 Disentangle the ray from the net - you may have to section some parts of the net if the ray is 'badly' entangled (care should be taken to prevent injury to the animal while doing so).

Try to minimise handling time and release ASAP, if possible, get someone to pour water over the animal while you are handling it.

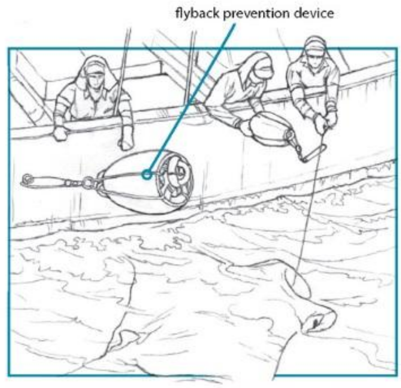
Longline and hook and line

1 Always stop the vessel to safely remove gear and release large rays.

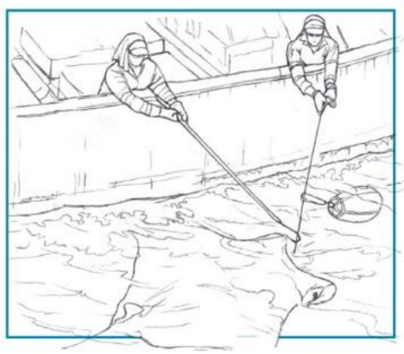


2 Bring the ray alongside the vessel, if possible. Always leave the animal submerged in the water so that its chance of post-release survival will be much higher.

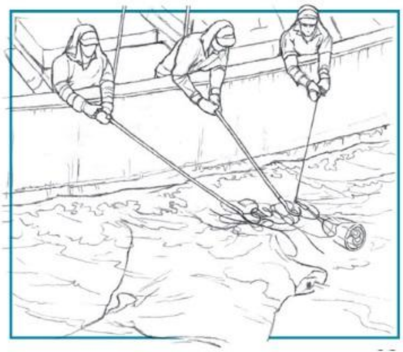
If the animal is not entangled and can be brought close to the boat, consider attaching a flyback prevention device to the branchline to reduce the risk of a lead (or hook) flyback accident.



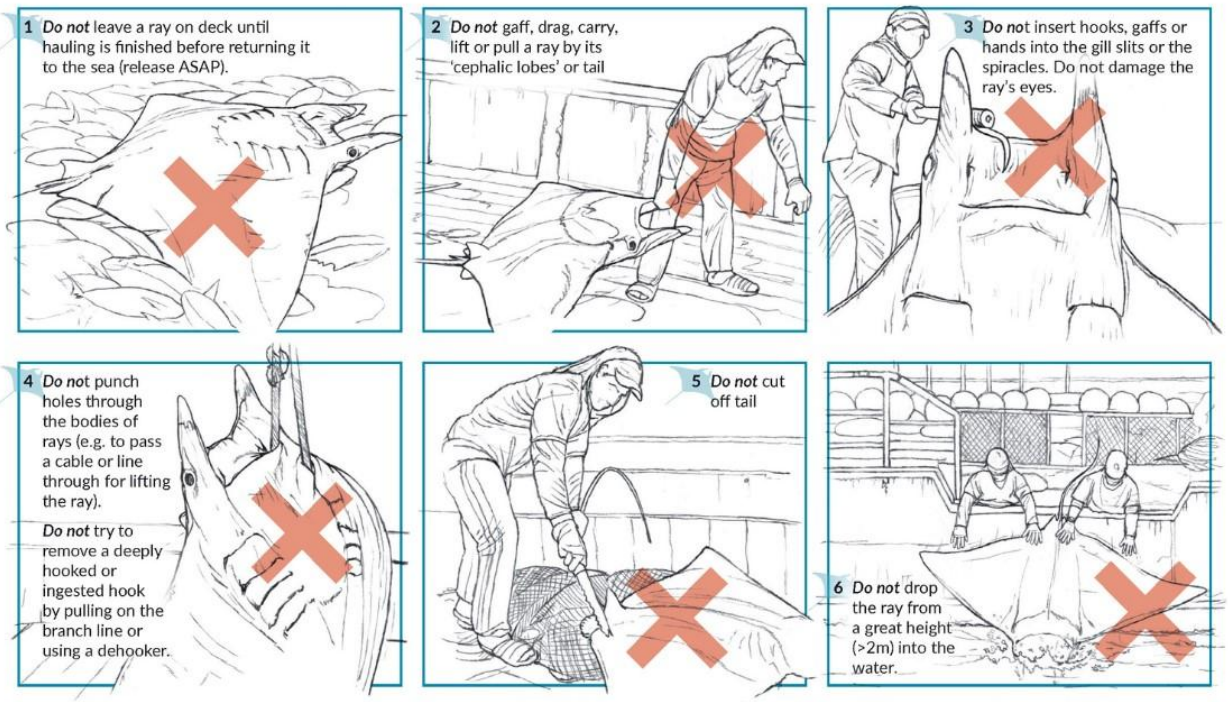
3 For animals that are hooked or have swallowed the hook please use a long-handled line cutter, to cut the line as close to the hook as possible.



4 For animals that are entangled, secure any excess tangled line with the long-handled gaff, while another crew member uses a long-handled line cutter to remove as much tangled line as possible. Do not use the gaff on the animal.



What not to do – all gears



APPENDIX XVVII
SUGGESTED REVISION TO ANNEX III OF RESOLUTION 25/08 (THE LIVE RELEASE HANDLING PROCEDURES FOR SHARKS)

MINIMUM STANDARDS FOR SAFE HANDLING AND LIVE RELEASE PROCEDURES

The primary aim of the following Minimum Standards for Safe Handling and Live Release Procedures is to ensure the highest level of survival of sharks and that, whenever possible, prompt, and effective action will be taken to return the shark to the sea and prioritising that the life and safety of the crew is not compromised and that crew members shall endeavour to avoid hazards in the safe handling and release operations for sharks. The following minimum standards are appropriate for all live sharks when released whether under no-retention policies, or when released voluntarily. These basic guidelines do not replace any stricter safety rules that may have been established by the National Authorities of individual CPCs.

To maximise the efficacy and utility of adopted BHRPs, CPCs should ensure crew are educated and trained on these practices regularly and enough crew members are available to focus on releasing bycaught sharks by applying the adopted BHRP. Illustrated best handling and release practices should be available on the vessels.

Safety first: These minimum standards should be considered in light of safety and practicability for crew. Crew safety should always come first. At a minimum, crew should wear suitable gloves and avoid working around the mouths of sharks. Also minimising manual handling and using appropriate technical release devices instead is preferrable to ensure safety of the crew and the animals at the same time.

Be prepared: Tools should be prepared in advance that are always onboard and ready to be used prior to setting or hauling in fishing gear (listed at the end of this document).

General recommendations for all fisheries

- When entangled (in netting, fishing line, etc.), if safe to do so, carefully cut the net/line free from the animal and release to the sea as quickly as possible with no entanglements attached.
- If, for whatever reason, a shark must be brought on the deck then minimise the time it takes to return it to the water to increase survival and reduce risks to the crew.

Longline fisheries specific safe-handling practices

- If operationally safe to do so, stop the vessel or substantially reduce its speed.
- Bring the shark as close to the vessel as possible without putting too much tension on the branch line to avoid that a released hook or branch line break could shoot hook, weights and other parts toward the vessels and crew at high speed.
- Secure the far side of the longline mainline to the boat to avoid any remaining gear in the water pulling on the line and the animal. Avoid bringing the shark onboard for gear removal whenever possible; bringing sharks onboard should not be attempted for vessels with a high freeboard >1m (i.e. too high for crew members to reach the water).
- If hooked, and the hook is visible in the body or mouth, use a dehooking device or long-handled bolt cutter to remove the hook barb, and then remove the hook as much as possible.
- If attempting to remove hooks, use pliers or dehookers or long-handled de-hookers for vessels with high freeboards (i.e. > 1 meter).
- If it is not possible to remove the hook or the hook cannot be seen, cut the line of the trace (or snood, leader) as close to the hook or mouth as possible leaving no more than 1 meter of gear attached to the animal and with no weights attached to the animal).
- If sharks must be brought on board for gear removal (on vessels with a freeboard height of less than 1 m), if possible:

  – Use a net, lasso or second point of attachment to help lift them onboard

- – Manoeuver shark using manual restraint of the pectoral fins and the caudal peduncle (this may require two crew members depending on the size of the animals)
- – Use a stretcher or cradle for handling and restraint for the safety of the crew and to reduce injury to the animal.
- – Return the animals to the sea as quickly as possible.

Do not:

- Use drag or lazy lines or drag sharks behind the vessel until the hook rips free of the jaw or until the animal is easier to handle.
- Electrocute or stun sharks.
- Lift sharks onboard without a net or second point of attachment to support the weight of the animal, noting it is not recommended to lift sharks onboard the vessel.
- Attempt to remove a hook from a live shark if the hook is not visible.
- Cut into or damage the jaw to remove hooks.
- Lift or maneuver sharks by the gill slits, or spiracles.
- Insert gaffs, hooks, or similar instruments into the bodies of live sharks.
- Lift and drop sharks from the vessel height to rip the hook from the shark's jaw.

Purse seine fisheries specific safe-handling practices

For whale sharks

- Whale sharks should remain in the water when being released.
- The release of whale sharks should be prioritized prior to brailing or when the shark surfaces.
- If a whale shark is encountered the net roll must be immediately stopped to release the whale shark
- If the head of the animal points to the stern of the boat, a crewmember should be available to open the net and/or cut a few meters of net in front of the shark's mouth to release it.
- If the head of the animal points towards the bow of the boat, the crew in charge of the net hauling operation could manoeuver the winch and the capstan to bring the whale shark close to the hull, then stand the animal on the net to roll it outside the sack corkline. If the individual does not swim out of the net by itself, a rope can be placed under the animal and attached to the float line to help rolling the animal out of the net
- Small whale sharks of less than 2 m, 'brailing' may be used to release the animal from the net without bringing it on board

Do not

- Bring the animal on board of the vessel regardless of size.
- Start the brailing process for the catch while the shark is still in the purse seine net
- Attempt brailing sharks of more than 2 m for release
- Pull or tow a whale shark by the tail or caudal peduncle or by a loop hooked around its gills
- Leave towing ropes attached to the trunk of the animal
- Gaff whale sharks or bore holes into a fin

For all sharks

Releasing sharks from a purse seine net

- Scan the net as far ahead as possible to spot the sharks early to react quickly.[7] Avoid lifting them up in the net towards the power block. Allow the entangled animal to be removed from the net. If necessary, use clippers to cut the net.
- The net area containing the entangled shark, should be rolled over the turntable and then the main boom should be moved to starboard or to port (depending on the vessel's orientation) and the net should be rolled back (or 'dropped') so that the shark is lowered to the deck and not thrashing in the air on a rolling vessel.
- Once the net has been dropped and the entangled shark is lowered to the deck the crew should safely cut the net away from the animal.
- Sharks should be manoeuvred by hand following best practices guidelines or into a stretcher/cradle or ramp immediately and take them to the opposite side of the vessel from the net for immediate release.
- If a portable or fixed ramp is available for release this should be wetted and the sharks can be released via this device directly to the sea.[8]

Releasing sharks if in the brailer or on deck:

- Vessels should, whenever possible separate bycatch on the working/main deck before passing the loading hatch.[9]
- When safety conditions are met, sharks may be handled manually, following established best practice guidelines.10
- Use a purpose-built large-mesh cargo net or canvas sling or similar device. If the vessel layout allows, these sharks could also be released by emptying the brail directly on a hopper and release ramp held up at an angle that connects to an opening on the top deck railing, without need to be lifted or handled by the crew.
- Manoeuvre sharks into a stretcher/cradle or ramp immediately and release it on the opposite side of the vessel from the net.
- The crew member should release the shark from the deck whenever possible, avoiding its entry into the lower deck, where the release process becomes longer and potentially more dangerous and complex in the absence of lower deck gutters.
- In cases when the passage of sharks through the loading hatch can't be avoided, sharks should be released as quickly as possible (e.g. via a bycatch waste chute, or via using stretchers).·

Do not

- Roll sharks through the power block.

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[7] Survival rates of sharks entangled in the net during haul back can still be higher than 80% (Poisson et al. 2014a; Hutchinson et al. 2015; Onandia et al. 2021) if the sharks are released early in the net hauling process and returned to the sea immediately.

[8] The use of the ramp can reduce time on board to about 2 minutes showing similar on deck mortality as previously reported by Onandia et al (2021) and an increased chance of post release survival for both silky sharks and oceanic whitetip sharks, thereby providing a cheaper alternative to double conveyor belts although so far sample size for these portable release ramps has been very limited (Murua et al. 2025).

[9] Effective bycatch separation methods and Bycatch Reduction Devices such as double conveyer belts or hoppers with a controlled door and a ramp extension (Murua et al. 2022; Onandia 2021; Poisson et al. 2014b) should be installed on board and mobile devices should be used on smaller vessels. Alternatively mobile devices that can be connected without the need of human handling of the animals such as suggested by Murua et al. (2025) could be used.

10 Best practice guidelines for manual handling of sharks can be found in the following documents: Poisson et al., 2012 (https://www.azti.es/atuneroscongeladores/wp-content/uploads/2017/05/MADE_Practices_to_reduce_shark_mortality_purse_seiners_EN.pdf)

Murua et al., 2025. New best handling and release practice guide for vulnerable bycatch tropical species in tropical tuna purse seiners (IOTC-2025-WPEB21(AS)-35)

- Use gaffs or hooks to manoeuver sharks.
- Leave sharks abandoned on deck.
- Hang sharks by the tail.
- Drag sharks across the deck by the tail.
- Allow visible sharks to pass through the loading hatch

Gillnet fisheries specific safe-handling practices

Existing recommendations for best handling and release of sharks that must not be retained and are unwanted is limited but should at least attempt to:

- Prioritize release of live non-retained sharks.
- Leave sharks in the water for gear removal.
- Carefully cut the net away from the animal, allowing it to swim away from the gear.
- Ensure the weight of the net below the entangled animal is supported during gear removal.

DO NOT (all fisheries)

- To the greatest extent practicable, lift sharks from the water using the branch line, especially if hooked unless it is necessary to lift sharks for species identification.
- Lift sharks using thin wires or cables, or by the tail alone.
- Strike a shark against any surface to remove the animal from the line.
- Attempt to dislodge a hook that is deeply ingested and not visible.
- Try to remove a hook by pulling sharply on the branch line.
- Cut the tail or any other body part.
- Cut or punch holes through the shark.
- Gaff or kick a shark, or insert hands into the gill slits.
- Expose the shark to the sun for extended periods.
- Wrap your fingers, hands or arms in the line when bringing a shark or ray to the boat (may result in serious injury).

Useful tools for safe handling and release

- Gloves (shark skin is rough; ensures safe handling of shark and protects crew’s hands from bites)
- Towel or cloth (a towel or cloth soaked in seawater can be placed on the eyes of the shark; used to calm sharks down)
- Shark harness, stretcher or cradle
- Saltwater hose (If anticipated that it may require more than 5 minutes to release a shark, then place a hose into its mouth so seawater is moderately flowing into it. Make sure deck pump has been running several minutes before placing it in a sharks mouth)

Purse seine

- Portable release ramp that can be attached to a release door and wetted with an attached hose
- Hopper with ramps
- Bycatch sorting devices for work deck/main deck (e.g. hopper with a door, ramp).
- Bycatch/waste chute on lower/well deck
- Stretcher

Longlines

- Net
- Pliers
- Short handled de-hooker
- Long-handled de-hooker (equal or greater in length than the vessel’s freeboard)

- Line cutter- capable of cutting through all lines used in the gear
- Long-handled line cutter (equal or greater in length than the vessel's freeboard)
- Wire/bolt cutter capable of cutting all hooks used on the vessel

Gillnets

- Net cutter – capable of cutting through the net/gear

APPENDIX XVVIII

Note: Appendix references refer to the Report of the 21st Session of the Working Party on Ecosystems and Bycatch (IOTC–2025–WPEB21(AS)–R)

4.3 Review of the statistical data available for ecosystems and bycatch species

WPEB21(AS).01 (para. 25) **NOTING** that data for bycatch species in IOTC fisheries are severely lacking, the WPEB **RECOMMENDED** that the SC ask the Commission and Compliance Committee to **ENCOURAGE** CPCs to provide observer data and work to reach at least the 5% minimum coverage level as required by Resolution 25/04.

6.4 Presentation of new information available on sharks

WPEB21(AS).02 (para. 103) The WPEB **RECOMMENDED** that the Scientific Committee take into account the criteria outlined in the IOTC-2025-WPEB21(AS)-24 (below) and points raised above when discussing the principles for conducting an experimental fishing trial(s) as requested per Resolution 25-08. For reference, the criteria outlined in IOTC-2025-WPEB21(AS)-24 are as follows:

- That the trial is conducted in areas and seasons with known high shark abundance (including of vulnerable shark species), using existing data from Indian Ocean Regional Observer Scheme (ROS) data or surveys to identify suitable hotspots.
- Before the trial, conduct a power analysis (following Watson et al. 2005) informed by historical bycatch data from the Indian Ocean to determine the number of sets required to detect a true effect (for each vulnerable species), thereby avoiding a Type II error.
- That the trial employs a "paired comparison" approach by alternating control (nylon monofilament) and experimental (wire) leaders along each longline section. Also, alternate the leader type on the first branch line for every subsequent fishing set to ensure a balanced design.
- That the trial standardises all gear and operational practices, including, *inter alia*, soak time, setting/hauling times, bait/hook types and branch line/leader lengths and other gear characteristics (e.g. use of lightsticks) to assist the trial in isolating the effect of leader material.
- Use at least one, and preferably two, independent observers or scientific researchers who are trained in longline operations and species identification to minimise human error and observational bias.
- Establish a standardised protocol for collecting data. Key metrics to record are species ID, leader material, fate (retained/discarded), condition at haulback, and the occurrence of bite-offs.
- Ensure the trial vessel skipper and crew are briefed on the trial's objectives and design, and that they support the experimental protocols.
- Develop the statistical analysis plan in collaboration with biostatisticians. Appropriate statistical approaches may include hierarchical or mixed-effect models (e.g., GLMMs) to analyse key response variables, including: CPUE, bite-off rate, and haulback mortality rate.

6.5 *Development of shark research work plan*

WPEB21(AS).03 (para. 113) **NOTING** that Resolution 15/01 includes a list of species for which reporting catch data is mandatory/optional and that varies by gear and by fishery type (i.e. artisanal vs commercial fisheries), the WPEB **NOTED** that many species of interest to the WPEB are not mandatory for reporting for all gears or fishery type. The WPEB therefore **RECOMMENDED** that the SC review the list of species that are mandatory for reporting to species level while considering the feasibility of such data collection, and included the following suggested changes:

- Silky sharks to be added also for gillnets fisheries
- Hammerhead sharks to be reported at species level at least for scalloped, smooth and great hammerhead sharks for all gear types (explicitly including purse seine fisheries)

- Mantas and devil rays to be reported at species level differentiating at least between manta rays (giant manta and reef manta) and other devil rays adding them for mandatory reporting at least for purse seine fisheries and for gillnet fisheries instead of optional
- Great white sharks as mandatory for all gear types
- Oceanic whitetip sharks as mandatory for all gear types

6.6 *Review of the minimum standards for safe handling and live release procedures (Annex III of Resolution 25/08) (all)*

WPEB21(AS).04 (para. 120) The WPEB **REVIEWED** the minimum standards set out in Annex III of this Resolution and **ADOPTED** the revisions made by members of the group which can be found in Annex XVVII. The WPEB **RECOMMENDED** that the SC **ENDORSE** these handling guidelines for consideration by the Commission in 2026. The WPEB further **NOTED** that work on best practice handling guidelines is ongoing and frequently evolves. The WPEB therefore **RECOMMENDED** that the SC suggest that the Commission consider adopting a master document containing handling guidelines for all taxa, rather than requiring Resolutions containing such guidelines to be updated when new information becomes available. Future Resolutions could then refer back to this master document adopted by the SC. The WPEB **AGREED** that a small working group will work on compiling these intersessionally for review by the SC.

7.2 Review of indicators for blue shark

WPEB21(AS).05 (para. 148-151) The WPEB **NOTED** in its discussions of CPUEs, two additional issues.

Firstly, that the changing spatial distribution of the fleets which regularly provide CPUE series can make it challenging to determine which CPUE series are consistent and appropriate for use in assessments. The WPEB **NOTED** that it might be useful to consider a wider research project (or workshop) that attempts to compare CPUEs, by isolating sub-regions where fishing effort has been fairly consistent such as the South-West Indian Ocean. The WPEB **NOTED** that such a project/workshop would help to determine the similarities and conflicts between the various CPUE series and how well they are explaining the population trends. The WPEB **NOTED** that comparing and identifying which CPUE series are the most appropriate to include in assessments is a consistent challenge across all species, not just bycatch species so this type of analyses would benefit the work of all IOTC's Working Parties

Secondly, the need to homogenise CPUE standardization methods, as a diverse range of methods are used that calculate results in different ways, that might not always be comparable. One way in which this might be addressed, alongside other issues with CPUE data, is to undertake work to develop a joint longline index of blue shark abundance built from operational fleet data.

Subsequently, WPEB **RECOMMENDED** that to progress work towards resolving the issues above, the SC either a) commission a dedicated project; b) request such analyses to be undertaken as a standard part of developing standardised CPUEs for assessments; or c) build this work into a future CPUE workshop.

WPEB21(AS).06 (para. 152) The WPEB **NOTED** that CPUE series are being presented in a range of formats which makes it challenging to directly compare between different series and further **NOTED** that this is a problem for all species for which CPUE series are being produced, not just for bycatch species. The WPEB **NOTED** that guidelines for presenting CPUE series have been developed in the past both by the IOTC and other RFMOs but these do not appear to be consistently followed and may be outdated. Therefore, the WPEB **RECOMMENDED** that the SC review these guidelines and **REQUEST** CPCs to follow the guidelines when reviewed.

7.4 Review of proposed stock assessment of blue shark

WPEB21(AS).07 (para. 181) The WPEB **RECOMMENDED** based on the SS3 assessment results, that the SC advise the Commission that the current recommended catch for blue shark remain close to current catches, and below the MSY estimated by the SS3 assessment model for 2025 (< 31,000 t).

8.2 Review new information on the environment and ecosystem interactions and modelling, including climate change issues affecting pelagic ecosystems in the IOTC area of responsibility

WPEB21(AS).08 (para. 207) The WPEB **NOTED** the new loop gear known as "meka-ring/trap-line" that has been increasingly used in various oceans. Several papers have been recently prepared for ICCAT, including in the Mediterranean Sea where the gear started to be used several years ago, and more recently in the Atlantic Ocean. Currently, the scale of the use of this new gear in the IOTC area is unknown but the WPEB **NOTED** that it will have a potential effect on catch, mostly for swordfish. As such, the group **RECOMMENDED** that the SC takes note and **REQUESTED** CPC scientists to investigate within their fleets if such gear is in use in the Indian Ocean, and consider, taking into account the ongoing work at ICCAT, starting to include this type of gear in data collection methods in their logbook and/or observer program to collect the corresponding catch and effort data in the future. It is noted from some very preliminary literature that with this new loop gear the catch rates of swordfish are higher, while shark and turtle bycatch is much lower. As such, this new gear can also be further studied as a potential mitigation new measure for vulnerable species.

9.4 Other sharks and rays (all)

WPEB21(AS).09 (para. 246) The WPEB **NOTED** that while evidence on post-release survival of whale sharks from purse seine interactions suggests low mortality when best-practices are followed, data on bycatch in other fisheries, particularly gillnets, remains scarce**.** Therefore, the WPEB **RECOMMENDED** that the SC **ENCOURAGE** CPCs to improve data collection and reporting for interactions with whale sharks involving all gear types as well as purse seine.

WPEB21(AS).10 (para. 251) The WPEB **RECOMMENDED** that the SC should promote efforts to clarify the extent and nature of whale shark interactions with IOTC fisheries, and to assess the current stock status within the IOTC area of competence, **ACKNOWLEDGING** that the extent of the vulnerability of whale sharks to IOTC fisheries is unknown. Based on the available information presented in paper IOTC-2025-WPEB21(AS)-40, the WPEB **RECOMMENDED** that the SC classify whale sharks in the Indian Ocean as a **"**taxon of the greatest biological vulnerability and conservation concern for which there are very few data**"**, as defined in Resolution 25/08. The WPEB **NOTED** that this classification supports the consideration of precautionary management measures and prioritization of future research and data collection efforts by the Commission.

9.5 Mobulids

WPEB21(AS).11 (para. 276) The WPEB **RECOMMENDED** that the SC **ADVISE** the Commission to speak with CPCs to determine appropriate ways to improve data reporting from artisanal fisheries.

WPEB21(AS).12 (para. 277) The WPEB **NOTED** that in 2024, the group recommended the adoption of a revised set of handling guidelines for mobulids while **NOTING** that that work was required to further develop the guidelines for gillnets. The WPEB **NOTED** that the Secretariat worked intersessionally with the Manta Trust to further develop these guidelines which were reviewed by the group. After these had been reviewed, the WPEB **ADOPTED** the revised handling guidelines for mobulids and **RECOMMENDED** that the SC **ENDORSE** these handling guidelines for consideration by the Commission in 2026. The details of the suggested revisions to the handling procedures can be found in Appendix XVVI.

10.2 Revision of the WPEB Program of Work 2026-2030

WPEB21(AS).13 (para. 310) The WPEB **RECOMMENDED** that the SC consider and endorse the WPEB Program of Work (2026–2030), as provided in Appendix XVIV.

11.3 Review of the draft, and adoption of the Report of the 21st Session of the WPEB

WPEB21(AS).14 (para. 320) The WPEB **RECOMMENDED** that the Scientific Committee consider the consolidated set of recommendations arising from WPEB21, provided at Appendix XVVIII, as well as the management advice provided in the draft resource stock status summary for each of the eight shark species, as well of those for marine turtles, seabirds, cetaceans and mobulids:

Sharks

- Blue shark (*Prionace glauca*) – Appendix VII
- Oceanic whitetip shark (*Carcharhinus longimanus*) – Appendix VIII
- Scalloped hammerhead shark (*Sphyrna lewini*) – Appendix IX
- Shortfin mako shark (*Isurus oxyrinchus*) – Appendix X
- Silky shark (*Carcharhinus falciformis*) – Appendix XI
- Bigeye thresher shark (*Alopias superciliosus*) – Appendix XII
- Pelagic thresher shark (*Alopias pelagicus*) – Appendix XIII
- Porbeagle shark (*Lamna nasus*) - Appendix XIV

Other species/groups

- Marine turtles – Appendix XV
- Seabirds – Appendix XVI
- Marine mammals – Appendix XVII
- Mobulids – Appendix XVIV