Resolution 2025-08, an opportunity to step up science driven conservation and management measures for sharks in tuna and multi-species fisheries at IOTC?

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Abstract

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.

1. Introduction: Resolution 2025-08 and its intent

The Indian Ocean is often referred to as a hotspot of biodiversity, particularly for its unique megafauna. However, it is also an area of significant conservation concern, particularly for sharks and rays. During 2024 ISRA workshop, the western Indian Ocean was found to exhibit "*125 Important Shark and Ray Areas, 1 candidate ISRA, and 45 Areas of Interest*". (Jabado et al., 2023) However, despite this, shark populations in the Indian Ocean have suffered severe declines over the past decades with an increasing number of shark species have been listed as globally threatened by the IUCN. Half of all pelagic elasmobranch species are already classified as endangered or even as critically endangered (Pacoureau et al., 2021), the global abundance of sharks and rays has been halved over the last 50 years and their risk of extinction increased by 19% since 1970 (Dulvy et al., 2021; Dulvy et al 2024).

In the IOTC's Area of Competence, sharks are both a targeted species and bycatch in the fisheries targeting tuna and tuna-like species, yet IOTC has managed elasmobranchs only as a bycatch since its mandate officially only covers species listed in Annex B of the IOTC Agreement, which currently does not include any pelagic sharks or rays. During the 2nd IOTC Performance Review, this has been criticized as resulting in "*incomplete fisheries management and conservation coverage*" for sharks "managed"

only as a bycatch. (IOTC Performance Review 2016). IUCN has also highlighted that two thirds of threatened sharks, rays and chimaeras are at risk of extinction from overfishing alone while most sharks are caught as a "bycatch" yet 99% of them are retained, marketed and traded (Jabado et al. 2024). IOTC has also demonstrated in the past that it can adopt management and conservation measures going beyond pure bycatch management e.g. when adopting Resolution 18/02 *On management measure for the Conservation of blue sharks caught in association with IOTC fisheries* that did call for limiting blue shark mortality and allocating quotas between CPCs based on the stock assessment planned for 2021 and has tasked the Scientific Committee to provide advice for candidate limit, threshold and target reference points for the conservation and management of this species in the IOTC area of competence. However, as experienced often at RFMOs such commitments are easily forgotten if not followed up upon as also in this case when the stock assessment had been postponed to 2023 and no further actions were taken following the stock assessment as the stock was assessed to be in the Green zone of the Kobe plot, which however should not have prevented the agreed action to be pursued as described in the Resolution. Similarly, the Commission has long failed to act for other threatened shark species and possibly overfished stocks in absence of successful stock assessments. Although the Scientific Committee has repeatedly recommended that the Commission should taking a precautionary approach and consider implementation of additional measures to reduce for e.g. shortfin mako, oceanic whitetips, and silky sharks, the Commission failed for many years to adopt any additional measures beyond already existing ones that require reporting of shark catches, full utilization of sharks and retention bans for oceanic whitetip sharks, thresher sharks and mantas and mobulids. Thereby the IOTC was lagging even behind other tuna RFMOs that had started adopting additional measures for threatened shark species and in the case of ICCAT had started acknowledging their obligation to manage targeted sharks similar to other target species, when for the first time adopting Total Mortality Limits for shortfin mako sharks and blue sharks and adopting rebuilding plans for shortfin mako sharks, respectively agreed to start development of MSE tested Management Procedures for blue sharks. (ICCAT Rec 2018, Rec 2021, Rec 2022, Rec 2023)

In 2022 the Maldives started however an important change in the mindset of IOTC CPCs when submitting a comprehensive shark proposal including substantial improvements for the management and conservation of sharks, introducing for the first time a definition of sharks, proposing the introduction of catch limits for blue sharks, bycatch mitigation measures for threatened shark species as well as an update of the IOTC's finning prohibition transitioning to a "Fins Naturally Attached policy (IOTC-2023-S27-PropR[E]). Although no consensus was possible in 2023 the Maldives resubmitted the proposal in 2024 and requested the Scientific Committee to review existing studies and data on the potential of gear modifications to reduce shark mortality in longline fisheries. In 2024 the shark proposal was resubmitted by the Maldives and co-sponsored by Pakistan (IOTC-2024-S28-PropV) receiving broad support on the floor from many other coastal states but failing again to achieve consensus, so that the proponents decided to withdraw the proposal. However, the Commission nevertheless requested in its report that the SC should start MSE for the development of Management Procedures for blue sharks (IOTC Commission report 2024). In 2025 the proposal was resubmitted for the third time, co-sponsored by Pakistan and South Africa, and this time the Commission adopted the proposal in its Revision 1 as Resolution 2025/08, including several compromises to the initial requests but also including several tasks for further assessments and requested suggestions from the WPEB and SC to be provided to the next Commission Meeting in 2026. While this has been a long and sometimes disappointing road the IOTC took on its journey towards improved management and conservation measures for sharks in its Area of Competence, it also outlines the increasing recognition from CPCs that such is urgently needed and that managers finally accept that the past approached are no longer applicable and a more holistic approach informed by science and a precautionary approach are needed to halt the decline of shark populations in the Indian Ocean and the resulting consequences from such a decline for the complete ecosystem.

By adopting this resolution managers have transitioned from perceived "road blockers" to "conservation enablers" but have also handed over the task for further refinement and further improvements needed for implementation to the scientists and Scientific Committee. This might be perceived as both, a blessing and a curse as obviously scientists are best equipped to inform managers on refined or additional measures needed, but they also require appropriate resources to do so which should be committed to by the Commission. However, this provides a unique opportunity to apply best scientific practices and

globally acknowledged mitigation strategies in a systematic way and to step up IOTC from lagging far behind to a leading tuna RFMO in shark and ray conservation.

This paper summarises the defined tasks and mandates addressed to the WPEB and SC by Resolution 25/08 and provides inputs for consideration for each of those, in line with UNCLOS requirements to the sustainable management of species that are retained for their commercial value and a holistic mitigation hierarchy to reduce shark mortality as described in the literature.

The following requests are made to the WPEB and Scientific Committee by Resolution 25/08 and are therefore analysed and discussed as part of this paper.

(1) to establish terms of reference in 2025 for a long-term scientific project for sharks
(2) to review and approve the scientific design of studies proposed for the comparison of shark mortality at IOTC for different leader types
(3) to develop improved safe handling guidelines for all sharks and for whale sharks in particular
(4) to respond to the question whether whale sharks qualify for specific protection as a non-retention species (automatic if recommended by SC in 2025).
(5) to recommend improvements for reporting of shark data
(6) to propose a TAC for blue sharks based on the outcome of the 2025 stock assessment
(7) to define terms of reference for reporting and review of the effectiveness of the allowed alternatives to a "Fins Naturally Attached" (FNA) policy for sharks landed frozen

2. Analysis and Discussion

Regardless, whether sharks are a targeted species or a bycatch and therefore require different approaches for their conservation the actual measures needed to reduce shark mortality are often the same and could ensure sustainable management of both it implemented and enforced consistently. The resolution as adopted by the Commission therefore includes elements for both the sustainable management of stocks targeted for commercial reasons and the conservation of stocks with either unknown or overexploited stock status.

2.1. A long-term shark research and conservation project as an opportunity to define an effective mitigation hierarchy for both, targeted species and incidental bycatch

Resolution 25-08 Para 38 "*The IOTC Scientific Committee shall, through the IOTC Working Party on Ecosystems and Bycatch, continue its work on identifying and monitoring the status of sharks until such time as comprehensive assessments are possible for all relevant sharks, including those listed in paragraph 3, silky sharks, hammerhead sharks and mako sharks. The IOTC Scientific Committee shall establish terms of reference for a long term-project on sharks in the IOTC area of competence to be considered by the Commission at its annual Session in 2026, with the aim to ensure the collection of data required for performing reliable stock assessments for key shark species, including those listed in paragraph 3, silky sharks, hammerhead sharks and mako sharks*."

In the IOTC area of competence sharks are both, a targeted species and a bycatch species. Depending on the respective fleet and the specific shark species, shark "bycatch" is either wanted as commercially valuable or a truly incidental bycatch. Nevertheless, the IOTC Commission has kept calling all sharks to be a "bycatch" and thereby avoided managing them sustainably despite the globally alarming state and the even more dire situation of many stocks in the Indian Ocean (Worm et al 2024). Despite several attempted stock assessments stock status is known only for two stocks in the IOTC area of competence, blue sharks and shortfin mako sharks, the latter being overfished and experiencing overfishing (IOTC SC, 2024). For the other six key shark species the annual Executive Summaries state an unknown stock status and warn that measures should be taken to reduce mortality specifically for silky sharks and oceanic whitetip sharks. Poor compliance with shark data reporting has prevented successful stock assessments for these and other threatened sharks. In the absence of scientific advice effective measures to reduce fishing related mortality have been rejected or delayed calling only for more research and data (Mandelik et al., 2005; Tolotti et al., 2015). This pattern of avoidance of bycatch mitigation measures is well established and has been criticized by many scientists (Cronin et al. 2022, Juan Jorda 2022).

In this context it is therefore important to note that Resolution 25/08 indeed outlines in Para 41 that the Scientific Committee is tasked to develop "*options for candidate limit, threshold and target reference points for the conservation and management of all sharks caught in association with IOTC fisheries, prioritising sharks caught for commercial purposes."* Thereby the Commission recognizes that many shark species at IOTC are not a "bycatch" but a species caught for commercial reasons or a targeted species including the obligation to manage these stocks sustainably via the development of reference points for those. (IOTC TCPM 2025) This should therefore also be part of the long-term project and could be informed by the development of MSE tested MPs for blue sharks that the WPMSE has agreed to start preparations for this already in 2025. (IOTC WPMSE 2025)

Only eight shark species, i.e. blue sharks, silky sharks, oceanic whitetip sharks, mako sharks, porbeagle sharks, scalloped hammerhead sharks, bigeye thresher sharks and pelagic thresher sharks are at all reviewed annually and information summarized in Executive Species Summaries, while at least 20 other shark species also interact with IOTC fisheries on a regular basis (Patterson et al. 2024).

IATTC has adopted a list of 18 sharks, including also additional species such as Galapagos sharks, copper sharks, crocodile sharks and whale sharks as being under the purview of IATTC (IATTC Res-C-24-05) and therefore of specific concern for research and conservation in 2024 and for the 2025 Commission Meeting the IATTC Scientific Staff is also proposing a list of seven rays to the Commission to be included as being under the purview of the IATTC (IATTC SAC-16-08, 2025) including pelagic stingrays, mantas and mobulids. While several of these sharks may not be relevant for IOTC others such as crocodile sharks and whale sharks and additional species with which IOTC fisheries interact certainly are. As IOTC Res 25-08 defines "sharks" as all species belonging to the 8 orders of *Selachimorpha* and all species of the order of *Rhinopristiformes* relevant shark and ray species according to the definition but also other rays interacting with IOTC fisheries should be considered for such a long-term scientific project.

Therefore, also at IOTC an extended list of elasmobranch species interacting with IOTC fisheries should be established as key shark species for which annual Executive Summaries are generated and reviewed, including at least all sharks and rays with regular interactions with IOTC fisheries and prioritizing IUCN threatened or near threatened elasmobranchs.

As part of the planned long-term project however, not only data collection for stock assessments but indeed data collection and investigations on how to reduce mortality of sharks and rays in the most effective and cost efficient way should be included including also the evaluation and comparison of several potential mitigation measures for the various species, including but not limited to the evaluation of retention bans as an initial measure to remove commercial incentives from targeting potentially overfished stocks in the absence of TACs and Management Procedures. For such a review critically endangered and endangered shark species and those shark species that are already subject to retention bans in adjacent tuna RFMOs should be prioritized. Specifically, for all species of hammerhead sharks that are already subject to a retention ban at ICCAT and silky sharks, which are subject to a retention ban at both, WCPFC and ICCAT, protection should be considered being strengthened by banning their retention also at IOTC especially as vessels fishing in the Indian Ocean often also fish in the South Atlantic or Pacific. The threatened state of these species requires immediate action even prior to reviewing outcomes from the planned stock assessments for scalloped hammerheads and silky sharks in 2026, taking a precautionary approach.

Milner-Gulland et al., 2018 defined a globally applicable mitigation hierarchy including five categories of measures listed according to their importance to mitigate impacts of fisheries on bycatch species

(1) **Avoid capturing** of the species e.g. via spatiotemporal management and depth prohibition

(2) **Minimize the likelihood** of capturing it e.g. by requiring the use of certain gear modifications while prohibiting the use of other gear types or modifications in an area; this also could apply to allowing or banning certain set types and requiring certain dFAD designs; furthermore, total allowable catch limits for each (bycatch) species respectively mortality limits could be agreed and enforced

(3) **Remediate the capture** by increasing the chance of survival for the caught animals on board and after having been released by the application of best handling and release procedures or taking away commercial incentives from bycatch by banning the retention and commercialization of bycatch

(4) **Compensate the damage** done to the population by the bycatch mortality via monetary compensations that require e.g. funding of conservation measures at a per capita of bycatch rate

(5) **Stipulate and finance further research** on the impact of occurring bycatch on populations e.g. by improving data collection, increasing observer coverage and performing stock assessments or initiating and funding additional research projects

The 'Avoid' tier has been recognized to have the greatest impact and 'Research' the least impact to reduce immediate bycatch mortality (Booth et al., 2019) and while avoiding and minimisation are effective output controls if enforced, remediation and compensation are input controls that are per definition less effective in reducing mortality even if enforced and therefore should be considered as second tier behind output controls, while further research as such will not reduce mortality on the water. Cronin et al. 2022 analyzed existing policies and requirements as adopted by tuna RFMOs for elasmobranchs concluding that those hardly ever reflect this mitigation hierarchy with all out of 34 assessed measures including further research activities including stock assessments whereas avoidance was only included in one and minimisation measures in 8 policies, while 23 conservation and management measures included remediation measures. The terms of reference for the planned long-term study should therefore consider these apparent gaps and mistakes made in the past and pursue a holistic approach for the reduction of elasmobranch mortality in line with the bycatch mitigation hierarchy emphasizing avoidance over minimisation and both of these over remediation and compensation, while further research activities should be aligned with these needs in particular as supplementary rather than priorities.

A regional IOTC POA Sharks could summarize the outcome of the discussions providing guidance for priorities and how to evaluate outcomes by defining SMART objectives in the respective NOPA Sharks, another shortcoming that has been criticized as lacking in most if not all of the existing NOPAs till today (Gillman et al 2023). Defining deliverable according to the bycatch mitigation hierarchy for unwanted elasmobranch bycatch, while developing proactively sustainable Management Procedures for those species that are of commercial interest and thus actively targeted according to the rules of good project management (SMART = Specific, Measurable, Appropriate, Realistic and Timebound) could also help directing research activities, align these with activities initiated by CPCs in their national waters and to generate scientific justification for NDFs for CITES App II listed species for use by member states taking an IOTC approach to the sustainable removal of sharks as either an incidental bycatch or as a stock of commercial interest managed sustainably by the IOTC.

Further research should focus on minimisation of shark bycatch and particularly the bycatch of threatened sharks by the three most widely used gear types, prioritizing the avoidance or at least minimisation of catch of critically endangered and endangered elasmobranchs.

Purse seine vessels setting on dFADs have large bycatch quantities of juvenile silky sharks and oceanic whitetip sharks due to the specific association of these species with floating objects (Clavareau et al. 2020) Due to the overall low survival rates even when applying best handling and release procedures future research needs to focus on avoidance and minimisation as also supported by the following analysis of data from the National Report 2024 submitted to the Secretariat by the European Union.

EU Member State	No vessels in 2023	Shark species	2021	2022	2023
		Number of animals	Dead discards / live releases	Dead discards / live releases	Dead discards / live releases
Observer coverage %			(44%)	(25%)	(45%)
France	11	FAL	1949 / 1235	3014 / 1987	3360 / 2257
		OCS	6 / 18	9 / 31	25 / 101
		not further specified *Carcharhinidae*			7 / 12
Observer coverage %			(24%)	(40%)	(29%)
Spain	14	FAL	1621 / 3910	894 / 2223	2200 / 2870

EU Member State	No vessels in 2023	Shark species	2021	2022	2023
		Number of animals	Dead discards / live releases	Dead discards / live releases	Dead discards / live releases
		OCS	20 / 7	14 / 5	41 / 145
		not further specified *Carcharhinidae or Carcharhiniformes*	11 / 0	0 / 1	44 /12
Observer coverage %			n/a	n/a	100%
Italy	1	FAL	n/a	n/a	530 / 200
		OCS	n/a	n/a	11 / 12
		not further specified *Carcharhinidae*	n/a	n/a	704

Table 1: Overview on reported discards in EU purse seine fisheries as reported as part of EU National Report 2024

In the Spanish purse seine fleet 60-70% of silky sharks are reported to have been released alive while live releases from French fleet remain only around 40% despite similar observer coverage. For oceanic whitetip sharks the percentage of live releases ranged between 75 and 80% for both fleets and the Italian vessels provides additional differentiation for live releases as either intermediate or alive with a total live release ratio for silky sharks of substantially less than 40% despite the 100% observer coverage, when "intermediate condition" is assumed to add to dead discards assuming these animals will most probably die. Also, using the same approach live releases for oceanic whitetip sharks result in about 50% only on the Italian vessel. Based on the above the following conclusions can be taken.

- Dead discard ratios are known to vary between species and oceanic whitetip sharks being more robust than silky sharks (Sabarros et al. 2023), but substantial differences in dead / live ratios are observed between fleets, further varying within the same fleet between years which might be an indicator for either various efforts handling and release procedures applied or a different catch and age composition of the bycatch between different fleets as younger / smaller silky sharks are well known to be less likely to survive the brailing process and handling on board. (Hutchinson et al. 2015)
- Silky shark bycatch in purse seine fleets remains concerningly high with a projected bycatch rate of 1,000 – 2,000 animals per large purse seine vessel and year, based on data from EU fleets with an observer coverage of 25 – 45% and the only fleet submitting data in its national reports as requested (IOTC SC 2024; EU National Report)
- Other CPCs fishing on purse seine should be expected to have however, at least similar bycatch rates although no silky shark or oceanic whitetip sharks (neither retained nor discarded) have been reported for purse seiners for 2023 based on the submitted national reports of Oman (2 large vessels in 2023), Mauritius (5[1] large vessels in 2023) and Seychelles (13 large vessels in 2023). Korea (2 large vessels in 2023) reported 9 metric tonnes of silky sharks discarded in 2023 but without any indication of the status and Indonesia (205 small to mid-size purse seine vessels in 2023) reported neither silky shark bycatch nor the fate of such bycatch in its National Report. This section of the report is obligatory to complete by all CPCs.
- For those 48 large scale purse seine vessels bycatch rates of juvenile silky sharks should be expected to exceed 100,000 per year even when completely disregarding silky shark bycatch in the Indonesian purse seine fleet in which silky sharks are often retained but very low if any observer coverage applies. Furthermore, these reported numbers don't yet include the percentage of very small silky sharks of less than 100 cm or even less than 85 cm caught when setting on dFADs, that Perez San Juan et al. reported even on-board observers can't reasonably find. These were only detected during an extensive, scientific port sampling program at Port Victoria, Seychelles including sampling of bycatch for sharks in the Spanish purse seine fleet between 2021 and 2022 resulting in an extrapolated 6313 silky sharks from sampling 16 % of all fishing operations. (Perez San Juan et al. 2021 & 2024). Forget et al. also estimated that on-board observer reports may underestimate silky shark bycatch by 50 – 81% (Forget et al. 2021)

[1] One vessel started operation only in December 2023)

- Other ETP species are also a regular bycatch in purse seine fleets especially when vessels are setting on dFADs but have so far not been highlighted or compiled. This includes mantas and devil rays, pelagic stingrays and other vulnerable shark species such as hammerhead sharks, thresher sharks and not further differentiated Carcharhinidae sharks, all showing that species specific bycatch reporting should be also further improved for purse seine. (IOTC SC 2024; EU National Report)

2.2. Gear modifications as an output control to minimize the mortality of endangered, threatened and protected (ETP) sharks

Res 25/08 Para 15 requires that "*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*" and that the design of the study has to be presented to the Scientific Committee for approval in 2025.

Many studies have previously been conducted in other ocean basins, mainly the Western Pacific demonstrating the potential of a ban on wire traces to reduce shark mortality and summarising the outcomes from a workshop conducted by IOTC WPEB in 2024 including global experts from all ocean basins that reviewed available studies on the use of leader material and the use of hook shapes in context of shark mortality (IOTC WPEB(DP) 2024) the *"WPEB NOTED on the basis of its review of global research that a prohibition on the use of wire leaders and shark lines by longline and other* fisheries operating in the IOTC would likely result in a reduction in both the observed catch and the fishing mortality of shark species." Nevertheless, no political consensus could be achieved to accept this conclusion and recommend a ban of wire traces at the 2025 Commission Meeting. Therefore, the adopted Resolution 25/08 includes a compromise by aiming to reassess the superiority of monofilament leaders over wire traces in an IOTC specific study to be conducted in 2026 and results reported to the Scientific Committee in 2027, whereas the study design has to be approved by the Scientific Committee in 2025.

While the design of the study should obviously provide a balanced study design with a sufficiently large sample size and keeping all other variables of the fishing trails identical with representative catches of all shark bycatch species able to be evaluated, it is important to conduct this study over different fleets and fishing regions within the IOTC area of competence in order to ensure fisheries specific differences leading to either higher or lower overall shark mortality for either type of leader are covered as well as all shark species of concern. In this regard the habitat distribution of the respective shark species and areas where the species is typically caught needs to be included in the study. Therefore, the study needs to be conducted over an area not only limited to north of 20° South since main fishing efforts for blue sharks within the IOTC Area of Competence occur south of 20° South, in the area between 20° South and 40° South as outlined by the distribution of fishing efforts depicted in the Figures below. These pictures are taken from the National Reports of the French longliner fleet, the Spanish longliner fleet and the Portuguese longliner fleet in the Indian Ocean highlighting where fishing efforts take place The same should be also done for all other longline fleets to ensure all areas with substantial shark catch are included into the study. Especially fishing efforts for swordfish and blue shark with substantial numbers of endangered shortfin mako sharks being caught are almost exclusively located south of 20° South.

Figure 1 shows the sets of French longliners in the IOTC area for 2023 extending to South of 20° South and Figure 3 shows the nominal catch efforts of the 14 Spanish longline vessels in 2023 and for the years 2019 – 2023, showing a clear shift of fishing efforts and shark catches towards more Southern latitude regions in the last years. At a reported catch of 285 and 397 mt of shortfin mako in 2022 and 2023 respectively, shortfin mako shark catches totaled to more than 10% of the catch weight of blue sharks. Overall catch composition of this fleet consists of 49% blue sharks, 42% swordfish and 6% shortfin mako (IOTC SC 2024; EU National Report Spain). Figure 2 shows blue shark catches from 2 Portuguese longliners in 2023 targeting swordfish and blue sharks in the area South of 20° South with catches of more than 700 mt of blue sharks exceeding swordfish catches since 2021 and shortfin mako accounts for the second biggest shark catch of the fleet but was not retained in 2023. (all graphs as displayed in the National Report of the EU Annexes for IOTC SC 2024)

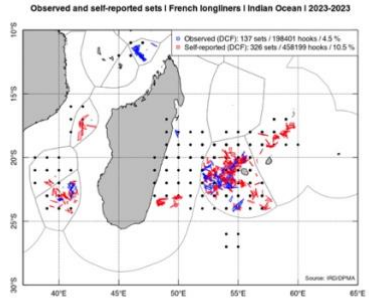


Figure 4b-1. *Carte de la répartition spatiale des opérations de pêche de palangre observées par des observateurs embarqués et l'auto-échantillonnage (programme DCF) pour la Réunion en 2023.*

Figure 1: Fishing effort distribution of French longline fleet in IOTC area of competence in 2023 (IOTC SC 2024, EU National Report, French)

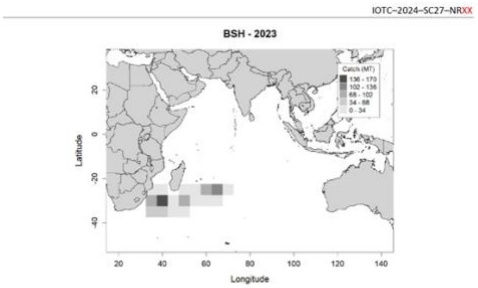


Figure 3a. Map of distribution of the catches (MT) by major species in the IOTC area of competence in 2023: SWO (swordfish) – *Xiphias gladius*; BSH (blue shark) – *Prionace glauca*. Note: different catch scales.

Figure 2: Blue shark catches in 2023 for 2 Portuguese longliners (IOTC SC 2024, EU National Report, Portugal)

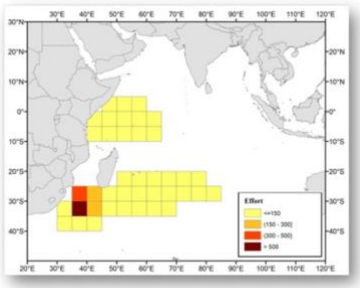


Figure 2.b(ii). Distribution of the nominal fishing effort (thousand hooks) by 5°x5° grid squares carried out by the Spanish surface longline fleet in the Indian Ocean (average of the 5 previous years 2019-2023).

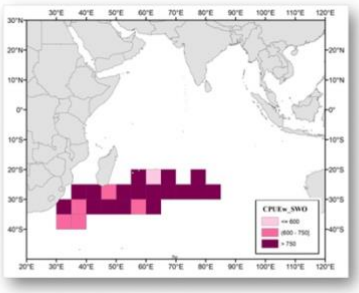


Figure 3.a(v). Map of distribution of the nominal CPUEw in kg (round weight) of SWO landed per thousand hooks set by 5°x5° grid squares, carried out by the Spanish surface longline fleet in 2023, in the IOTC area of competence.

Figure 3: Nominal catch effort distribution of Spanish longline fleet targeting swordfish and blue sharks at IOTC – in 2019 – 2023 and in 2023 (IOTC SC 2024, EU National Report, Spain)

In view of these key areas for catches of shortfin mako the areas and fleets included in the study should reflect the actual longline catch efforts and the catch composition in the Indian Ocean as otherwise statistical significance of outcomes will be lowered or the outcomes even misleading, if important shark areas with longline operations catching sharks are not included into the study region. We therefore suggest to firstly include fishing fleets that have either reported high catch rates of the respective shark species in their fishing areas in previous years or to shift the study region to areas with an expected higher presence of the respective vulnerable sharks. At least oceanic whitetip sharks, silky sharks, mako sharks, and thresher sharks should be covered by the studied fishing area, as well as blue sharks.

Including shortfin mako mortality into this study appears to be especially important as despite the advice from the Scientific Committee the adopted Resolution 25-09 does neither include a TAC to limit mortality nor a quota allocation that could achieve a mortality reduction by at least 60% compared to the mortality that has been reported over the last couple of years. Only then will overfishing stop and rebuild of this overfished stock within a time period of 10 years happen with at least a 50% mortality, being on the low side of risk acceptance for other commercially valuable stocks which are usually required to show at least a 60% probability. The adopted retention ban for animals that are still alive when hauled to the boat allows however to retain all dead animals without limits by all fleets that have either an observer on board or a functioning EMS.

Therefore, assessing the impact of wire leaders on the reduction of mortality of shortfin mako as part of this study has become even more important and will only be possible if including main catch areas for shortfin mako, between 25° South and 35° South, into this study.

2.3. Starting output controls for the ad interim management of blue sharks in preparation of the development of MSE tested Management Procedures

Res 24/08 Para 26 defines for blue sharks that "*based on the review and the results of the stock assessment to be conducted in 2025, updated reported catch information by each CPC and taking into account the IOTC Scientific Committee's advice, the Commission shall consider at its 2026 Session specific conservation and management measures for blue sharks, including a total allowable catch, catch limits for each CPC*".

Therefore, the WPEB should take into consideration that total mortality information remains poor due to poor compliance with shark catch data and discard reporting assess the outcome of the latest stock assessment taking a precautionary approach when recommending a TAC for this species and recommend to ensure at least a 60% probability for this stock to stay in the green quadrant of the Kobe plot for both short term and midterm projections. With NOAA 2023 suggesting that a 70% probability should be required for the management of pelagic shark stocks, IOTC should not accept a lower probability for this stock than generally applied by now e.g. for the management of swordfish and tuna stocks by other major tuna RFMOs.(e.g. ICCAT Rec 23-04)

Catches of blue sharks are mostly reported by Indonesia; Taiwan, China; EU-Spain; EU-Portugal, Seychelles but also by several other CPCs and have clearly increased over the past few years as demonstrated in Figure 4, whereas overall reporting compliance has not significantly improved over that same time as reported by the IOTC Compliance Committee (IOTC CoC 2025)

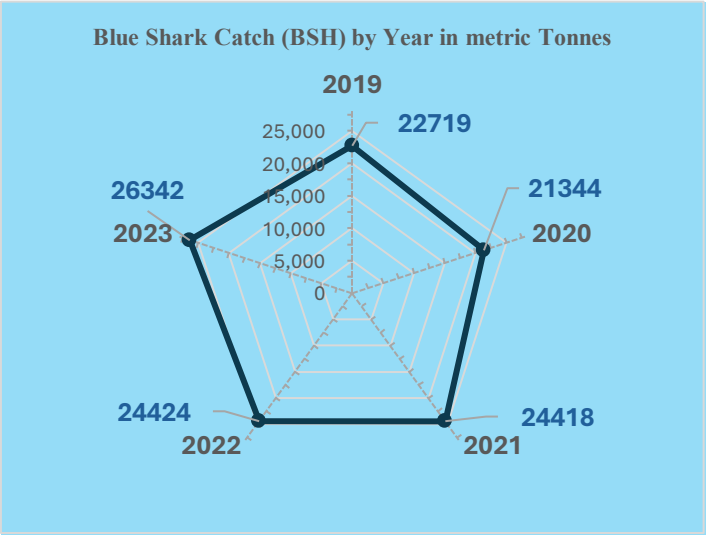


Figure 4: Reported Catches of Blue Sharks for 2019 - 2023 at IOTC in metric tonnes; catch data as reported in IOTC Executive Summaries for blue sharks published as Annex to the SC reports in 2020, 2021, 2022, 2023 and 2024

Therefore, based on the results of the 2025 stock assessment and taking a precautionary approach in line with data uncertainty the WPEB and SC should already propose a Total Mortality Limit (TAC) for blue sharks that will keep the stock in the green quadrant of the Kobe plot with a high probability of at least 60% and this TAC should then be proposed for adoption at the 2026 Commission Meeting including an allocation scheme for quotas of major fishing nations and leaving an unallocated margin for mortality as a bycatch in fisheries not retaining blue sharks. The ICCAT Rec. 23-10 and Rec 23-11 might be used as a blueprint for the structure and terms for an IOTC blue shark resolution but should include a clause requiring reporting of total mortality including discards by all CPCs retaining blue sharks in order to maintain its quota in the following year. While a total limit and quota allocation for blue sharks had already been requested as part of previous IOTC resolutions (e.g. IOTC Res 18/02) the lack of follow up on the defined terms and requirements during subsequent WPEB and SC Meetings and reminding about due task in the next Commission Meeting has been the root cause for a lack of progress in the past despite adopted resolutions. Therefore, WPEB and SC should this time take the lead and follow up on all scientific tasks and providing these to the Commission at the 2026 Meeting accompanied by clear recommendations from science wherever possible while warning managers to take a precautionary

approach in the absence of fully conclusive outcomes and results, e.g. from the blue shark stock assessment.

2.4. Remediation measures in response to conservation needs and international obligations for the conservation of whale sharks and other threatened migratory sharks

Resolution 25/08 Para 3 requires CPCs to "*ensure that their flag vessels do not retain on board, transship, land and store any part or whole carcass of the following sharks: (1) oceanic whitetip sharks; (2) thresher sharks; and (3) whale sharks*" but the new retention ban for whale sharks will only come into effect on 1 July 2026, "*and only if the IOTC Scientific Committee explicitly and unambiguously recommends, in accordance with paragraph 43 of this Resolution, a retention ban for whale sharks*".

The SC needs to explicitly confirm that this retention ban should be adopted, following the example of ICCAT that had adopted a retention ban for whale sharks in its 2023 Commission Meeting (ICCAT Rec 23-12) provided that its Scientific Committee SCRS would confirm in its 2024 Meeting that whale sharks qualify as "a taxon of the greatest biological vulnerability and conservation concern for which there are very few data".

Whale sharks (*Rhincodon typus*) are one of only six elasmobranch taxa listed on CMS App I which lists migratory species that are thought to be threatened with extinction, and CMS Parties that are Range States to such Appendix I-listed species shall "prohibit the taking" of such species, while according to CMS flag vessels that fish outside national jurisdictional waters but interact with listed migratory species are also considered to be a Range State. Whale sharks are also listed on the MOU Sharks and are currently listed on CITES App II therefore requiring an NDF to determine that the removals from the wild are not threatening the survival of a population in the wild and/or performing its function in the ecosystem. Whale sharks are highly vulnerable to overfishing due to their slow growth, late reproductive maturation, and extended longevity, which leads to an increased likelihood of population decline.

Two populations are known to exist that rarely mix between the Atlantic Ocean and Indo-Pacific Ocean and 75% of the global whale shark population is believed to occur in the Indo-Pacific, with only 25% estimated to occur in the Atlantic. Detailed data on its biology and global distribution remains however limited. (Ellis et al 2024)

The population of whale sharks has been subject to an overall decline of 63% in the Indo-Pacific over the last 75 years (three generations), resulting in a subpopulation assessment of Endangered. Therefore, Rhincodon typus is globally listed as Endangered under criteria A2bd+4bd with a decreasing population trend due to decreasing numbers of mature animals. Major contemporary threats to Whale Sharks include fisheries catches, bycatch in nets, and vessel strikes. (Pierce et al 2016). The 2021 IUCN green list assessment rates the species as 'largely depleted' requiring concerted and sustained conservation efforts to allow the population to recover within the next 100 years. (Pierce et al. 2021)

Although whale shark has been one of the first elasmobranchs listed on CITES App II in 2003 the global situation of the species has continued deteriorating and therefore whale shark is now proposed to be transferred from App II to App I at the CITES COP in Uzbekistan in 2025 as NDFs issued for introduction from the sea and exporting nations have not been based on sound scientific evidence that these extractions from the wild do not impact the survival of the species in the wild and the ability of the stocks fulfilling their ecosystem role in the respective area of removal (CITES). The proposed listing also demonstrates concerns that international trade is the main driver for the declining populations of this species.

While the Atlantic subpopulation appears to be less threatened than the Indo-Pacific subpopulation, with an overall population decline of ≥30%, resulting in a subpopulation assessment of Vulnerable A2b+4b the SCRS has unanimously concluded at its September 2024 meeting: "*The available information on whale shark life-history characteristics, conservation status, and paucity of scientific data on whale sharks indicate that whale sharks in the Atlantic Ocean can be considered a taxon of the greatest biological vulnerability and conservation concern for which there are very few data. For the above reasons, the Committee recommends that the Commission give full effect to Rec. 23-12. Given the dearth of data on whale shark interactions in ICCAT fisheries, the Committee considers that it is particularly important to comply with the reporting provisions in paragraph 5 of Rec. 23-12.*"

WCPFC had already adopted a retention ban for whale sharks in 2012 (WCPFC CMM 2012-04) which came into effect in 2014 prohibiting the retention of whale sharks and requiring their safe release from the net if encircled accidentally and requiring the reporting of the animal's condition at release.

Therefore, the IOTC WPEB and SC could not possibly come to a different solution especially as whale sharks are already protected by national regulations of many CPCs at IOTC although IOTC has so far not generated a species summary for this species, an omission that should also be corrected to monitor the status of this endangered species which interacts especially with purse seine and gill net fisheries in the Indian Ocean.

In addition, Res 25/08 calls to the Scientific Committee to review annually which other shark species might be in need of specific protection through a prohibition of their retention, mentioning explicitly silky sharks, mako sharks and hammerhead sharks.

Silky sharks have no recent stock assessment as an attempt to perform an assessment in 2018 failed. A new attempt is planned for 2026. At IOTC most catches of IUCN vulnerable silky sharks are taken by Iran and Pakistan, each reporting several hundred tonnes, followed by Taiwan, Sri Lanka and Madagascar.

At IOTC critically endangered great hammerhead catches of about 10 tonnes per year are reported by Comoros and critically endangered scalloped hammerhead sharks are taken by a series of fisheries with both, Sri Lanka and Kenya reporting several hundred tonnes per year (almost 500 tonnes by Kenya in 2022. Oman reports about 200 tonnes of IUCN vulnerable smooth hammerheads per year and Indonesia reports between 1,600 and 2,000 tonnes of unspecified hammerhead catches per year by its coastal but also by its industrial fleets. The stock status of hammerheads at IOTC is unknown and although an assessment of scalloped hammerheads is planned for 2026 the outcome is highly uncertain in view of the lack of reported mortality in the past and the absence of species-specific data in most fisheries (Ziegler 2024). ICCAT has banned the retention of all but one species of hammerhead sharks and also the retention of silky sharks already.

Other sharks listed on both CMS App I and CITES App II include endangered Basking sharks (*Cetorhinus maximus*) and vulnerable Great White sharks (*Carcharodon carcharias*), whereas the range of Great White sharks spans all oceans Basking sharks are reported in the Indian Ocean only for southern Australia, Indonesia, and South Africa (Ebert et al. 2013, Fahmi and White 2015), but all can reasonably be expected to interact with IOTC fisheries and should therefore also be assessed in the future, whether potentially benefiting from a retention ban. Furthermore, critically endangered Sand Tiger sharks (*Carcharias taurus*) have been listed on CMS App I in 2024 requiring range states to prohibit their take and as Sand Tiger shark has a circumglobal distribution and has been reported to interact with IOTC fisheries. Therefore, also these species protected by international conventions should be added to the IOTC list of which a retention is prohibited after assessment by the Scientific Committee.

2.5. Remediation of shark mortality by improving best handling and release practices for sharks – a review of existing state of the art

Resolution 25-08 Para 11 requires that "*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*."

Over the years many practices have been developed and tested to release unwanted shark bycatch as unharmed as possible, noting that the effectiveness of applied measures always depends on the specific gear, species and how well trained crew members are in applying the respective measures but mostly how much effort they are able and willing to dedicate towards the release of the animals while release efforts are certainly competing with other tasks performed during hauling of the catch and processing it once on board.

However, as an overarching rule releasing the sharks while still in the water as quickly as possible and if brough on board making release as fast and gentle as possible are key factors for increasing probabilities for post release survival. As such sufficient crew members able to focus on releasing

bycaught sharks, having adequate tools or even better technical features readily available for release and of course the number of animals requiring release at a time are decisive for this. Therefore, avoidance of catching them in the first place should always be given priority to release of unwanted sharks following the well-established hierarchy of bycatch mitigation.

However, once as shark has been caught limiting the time prior to release and ensuring the application of best handling practices for release are imperative for reducing on board and post release mortality. While some guidance has been adopted by most RFMOs and included in specific or overarching shark CMMs, existing guidance remains mostly vague, fully voluntary and does in most cases not even provide gear or species-specific advice that can be pursued by the crew respectively has to be considered when commissioning vessels and equipping them for operation. Often measures are even contradictory between RFMOs and maintain a purely suggestive tone that might be applied if desired and always on the condition that safety of the crew and procedures on board are permitting to perform any of these. However, more detailed guidance has recently be summarized by several scientists including Melanie Hutchinson (IATTC SAC-15-11 2024) based on decades of field work and experience in fisheries and can be considered as a compendium of best handling and release guidance that can be applied across oceans and should therefore be also implemented at IOTC. Several other scientists have published additional gear specific measures mostly for purse sein and longline vessels, but continuous review and updates are suggested to be included as part of a periodic review of the new resolution.

Provided guidance should be as practical and easy to perform as possible but indeed be as prescriptive as possible and the crew must be trained in their use while all required equipment and tools are on board of the vessel, ready to be used prior to starting the setting or hauling.

The guidance provided to IATTC by its scientific staff has been further updated this year as IATTC SAC-16-10 presenting the state-of-the-art approach while being straight forward to apply.

And while safety of the crew should of course always be a priority it should not be used to avoid having to apply existing best practice or be used as an excuse to avoid the loss of other catch or extra efforts needed to release bycaught sharks as quickly and safely as possible, for both the animal and the crew. In this aspect some recommendations included in Res 25-08 should therefore, be reviewed and revised by more appropriate guidance provided by SAC-16-10.

2.5.1. Best handling and release practices for whale sharks

Resolution 25-08 Para 29 determines "*that best practice guidelines for the safe release and handling of encircled whale sharks are to be developed by the IOTC Scientific Committee by 31 December 2025 and subsequently submitted to the Commission for consideration and endorsement at its annual Session in 2026.*"

As whale sharks have long been considered of specific concern and requiring different handling procedures due to the large size and weight IATTC, ICCAT and WCPFC have already adopted best handling and release practices for whale sharks for purse seine nets hat should also be considered by IOTC. Hutchinson et al have summarised generally recognised practices in 2025 in SAC-16-10 – Shark Best Handling and Release Practices – REV 7 and provide detailed descriptions for best release practices based on several other authors and researchers (see also Escalle et al. 2016 & 2018; Hutchinson et al. 2020). ICCAT's Rec 23-12 (in effect since 2025) recommends in its App I similar measures for the safe handling of incidentally caught whale sharks which could together be summarised, as

- leaving whale sharks in the water for release.
- prioritizing release of whale sharks prior to brailing or when the shark surfaces.
- if head of the animal points to the stern of the boat, having a crewmember to open the net and/or cut a few meters of net in front of the shark's mouth to release it.
- if head of the animal points towards the bow of the boat, the crew in charge of the net hauling operation could maneuver 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 go 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

Both sets of best handling and release guidance warn, **NOT** to

- 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
- to leave towing ropes attached to the trunk of the animal
- to gaff whale sharks or bore holes into a fin

WCPFC suppl_CMM 2024-05-1 provides specific advice for the safe release of encircled whale sharks encircled in purse seine fisheries and requires since 2015 "*that when a whale shark is encountered in a purse seine net in PNA waters the net roll must be immediately stopped" to release the whale shark*.

2.5.2. Best handling and release practices for sharks – gear specific advice

Resolution 25/08 Para 24 determines "*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*."

At tuna RFMOs the gear types most commonly involved in shark bycatch are pelagic longlines, purse seine nets and gill nets, while other gear types such as pole and line or handlines may also cause shark bycatch although to a lower degree and are usually associated with overall smaller catch sizes, more direct interaction of the crew with the catch and easier possibilities to release individual sharks quickly, while overall the same principles apply as for the described gear types.

2.5.2.1. For purse seine vessels

Sharks caught as a bycatch during purse seine fishing generally face high at vessel mortality and chances of survival depend on when sharks are brought on board during the fishing process but also on the age respective size of the sharks, juveniles showing the highest mortality rates and being the main shark bycatch when purse seiners set on dFADs, in which juvenile silky sharks can make up 0.2 – 2% of the total catch by weight with 30 – 60% on board mortality and 60 – 90% overall mortality due to low post release survival rates following the stress they had been exposed to during the catch and release process. (Filmalter et al. 2013; Poisson et al 2014a; Eddy et al. 2016; Grande et al. 2022; Murua et al. 2022)

Oceanic whitetip sharks may also be caught during purse sein fishing but have been reported to be subject to lower on-board mortality as well as improved post release survival rates as generally less fragile than silky sharks (Sabarros et al. 2023) Hammerhead sharks, bull sharks, tiger sharks and other shark species may also be caught as bycatch in purse seine nets but are less commonly observed while mobulids and devil rays are depending of the fishing area are also species of concern in purse seine fisheries as e.g. the PNA purse seine fishery reported 3,485 interactions with oceanic mantas between 2019 and 2021 with only 15.8% of animals released alive (MSC PNA 2024) and therefore require specific handling practices to be applied during release as outlined also in the recently adopted ICCAT conservation measure (ICCAT Rec 2023-14) and the use of manta sorting grids is also recommended by Murua et al as part of a species specific compilation of best handling and release practices for purse seine fisheries including sharks, mantas and mobulids, whale sharks and large cetaceans, and sea turtles. (Murua et al. 2024)

Overall survivorship is compromised once confined in the sack (Poisson et al. 2014; Hutchinson et al. 2015; Eddy et al.2016) and further compromised when they end up in the lower well decks. Especially juvenile animals need to be returned back to the water as quickly as possible to limit the increase of blood lactate levels when no longer free swimming and to reduce stress when buried under the weight of the tuna catch. (Hutchinson et al. 2015, Onandia et al. 2021). Hutchinson et al. (2024) summarised post release survival rates from studies across all oceans demonstrating decreased chances of survival for later stages of the purse seine fishing process and therefore IATTC SAC-16-11 provides best handling and release recommendations based on these studies specific for each stage, from the net hauling stage, the sacking up stage, and finally, the brailing stage, where fish are brought on board.

(1) Releasing silky sharks and other sharks from the open net while still free swimming would maximise chances of survival based on all existing studies but is not applied in routine processes as too difficult and weather dependent (Restrepo et al. 2018)

(2) 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.

Therefore,

- 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 maneuvered 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; 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 providing a cheaper alternative to double conveyor belts although so far sample size has been very limited (Murua et al. 2025)

(3) As survival rates of sharks that are present on the top of the sack and brought on board during the first few brails have substantially higher survival rates than those brought on board in later brails and survival rates are seriously compromised once the animals have entered the loading hatch and release is initiated from the lower (well) decks (2022 Poisson et al 2014a; Hutchinson et al. 2015; Eddy et al. 2016; Onandia et al. 2021; Grande et al. 2022).

(4) The presence of double, i.e. separate bycatch release, conveyer belts to allow for the immediate and safe release of sharks limiting their exposure to air and the weight pressure they are exposed to during the brailing process to a few minutes has been proposed to substantially reduce at vessel mortality and improve also post release survival. (Onandia et al. 2021, Grande et.al 2022)

Therefore,

- Vessels should, whenever possible separate bycatch on the working/main deck before passing the loading hatch
- 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.
- Maneuver sharks into a stretcher/cradle or ramp immediately and release it on the opposite side of the vessel from the net.
- In cases when the passage of sharks through the loading hatch can not be avoided, sharks should be released as quickly as possible (e.g. via a bycatch waste chute, or using stretchers).

The following should **NOT** be done when handling sharks

- Roll sharks through the power block.
- Use gaffs or hooks to maneuver 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

Tools on board and ready to use when starting the net haul include

- Stretcher or cradle.
- Portable release ramp that can be attached to a release door and wetted with an attached hose (Murua et al. 2025)
- Bycatch sorting devices for work deck/main deck (e.g., hopper with a door, ramp).

- Bycatch/waste chute on lower/well deck

2.5.2.2. For longline vessels (also applicable to other surface fleet fisheries)

Several studies have been conducted across ocean basins to assess shark mortality and post release survival rates in longline fisheries in the past including reviews for different gear modifications (IATTC SAC-15-11; IOTC WPEB(DP) 2024; Bowlby et al. 2020; Francis et al. 2023; Hutchinson et al. 2021; Musyl & Gillman 2018)

Most studies showed that removing sharks from the water for gear removal reduces survival rates and increases time to recovery (Bowlby et al. 2020, Campana et al. 2016, Hutchinson et al.,2021) while stress and air exposure is reduced when not lifted on board especially when vessels are larger and freeboard is > 1 meter so that fishermen can't directly reach the waterline with their hands, thereby requiring gaffing for handling of the animal when bringing it on board.

Studies have also shown that the amount of trailing gear left on an animal has a negative effect on post release survival and delayed mortality rates for multiple species (Francis et al. 2023; Hutchinson et al. 2021)

Therefore, SAC-16-10 recommends:

- Slow the vessel and line hauling rate (if applicable) to bring the shark alongside the vessel for identification and removal of gear.
- Avoid bringing sharks on board for gear removal, if possible.
- If attempting to remove hooks, use pliers or dehookers or long-handled de-hookers for vessels with high freeboards (i.e. > 1 meter).
- When hooks are not removed, use line cutters to cut the line as close to the hook or mouth as possible leaving no more than 1 meter of gear attached to the animal and ensuring that weights are removed.
- If sharks have to be brought on board for gear removal (should only be done if freeboard is less than 1 m)
  - Use a net, lasso or second point of attachment to help lift them onboard
  - Maneuver 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.

The following should **NOT** be done when handling sharks

- 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.

Tools on board and ready to use when start hauling the line(s)

- 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
- Stretcher/cradle

2.5.2.3. For gillnets

Gillnet fisheries are usually multispecies fisheries and may include also use of other gear, but mortality of sharks is usually high, mostly depending on species and soak time with shark bycatch being mostly retained if not targeted in the first place.

Therefore, avoiding shark bycatch in the first place is the best mitigation and a study to test the potential of elasmobranch bycatch in gillnets in the IOTC area of competence has been longtime overdue although suggested again at the 2024 WPEB Meeting (IOTC WPEB(AS) 2024) and noted by the SC. However, so far, no study design has been discussed or planned by the SC, although available literature has demonstrated that green LED lights in gillnets are not only helpful to avoid sea turtle bycatch (Allman et al. 2021) but also do have great potential in reducing elasmobranch bycatch by 95%, so reducing the total biomass of elasmobranchs in the catch from 16% to 1% as the animals can see the wavelength of the emitted light and avoid swimming into the nets while the catch of target species in not or only minimally impacted. (Senko et al. 2022) whereas Snape et al. found orange LED lights to be even more effective in reducing elasmobranch bycatch with CPUEs being most significantly decreased for *Myliobatiformes, Rhinopristiformes* and *Carcharhiniformes* as compared to gillnet catches without illumination. (Burgher et al 2025). In the Mediterranean Sea the use of even cheaper flashing LEDs emitting light of a wavelength of 520 nm resulted in significant reduction of bycatch of both sea turtles and batoids (Snape et al. 2024).

Existing recommendations for best handling and release of sharks that must not be retained and are unwanted is limited as summarised in SAC-16-10 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.

This requires the use of a line cutter capable of cutting through all materials used in the gillnet and thereby damages the net which then needs to be repaired. This further emphasises the importance of avoiding the bycatch of elasmobranchs in the first place which can be achieved without compromising other target catch e.g. by the use of green LED light illuminating the net and making them visible to elasmobranchs and other ETP species such as marine mammals and sea turtles. Therefore, such a study shows great potential for multispecies bycatch mitigation via avoidance, respectively minimisation and should be accordingly prioritised if transition to other gear is not an option. In view of the high use of gillnets especially in the IOTC Area of Competence where about one third of all catches are made by gillnets with Iran accounting for about 40% of all gillnet catches and India, Pakistan and Indonesia together for another 38% of total catches. (IOTC Multi Taxa Bycatch Mitigation 2022) there is a clear need for action that should also be addressed by the SC when reviewing measures to reduce shark mortality, and specifically mortality of critically endangered hammerhead species that are particularly vulnerable to gillnet fishing (IOTC WPEB 2022) but also other pelagic sharks.

2.6. Strengthening finning ban as a remediation measure – annual review of the effectiveness of alternatives to 'Fins Naturally Attached '

Resolution 25/08 Para 11 requires that "*Each year in their compliance questionnaire, the CPC shall report the information on the implementation of the alternatives in paragraph 8:*

- *any enforcement difficulties encountered from observer, electronic monitoring, aerial, boarding, and landing inspection reports;*
- *how monitoring of authorised vessels has been enhanced;*
- *how many vessels used the alternative measures in the previous year;*

- *how compliance is enforced at sea and in port, including how possible incidents of disproportionate fin counts, high grading and species substitution have been addressed.*
- *an explanation of why the fleet has adopted its fin-handling practice; and*
- *any other information Compliance Committee might deem necessary* "

While this is a compliance and not a scientific task, considerations should be taken ahead of the first reporting time period for next year's Compliance Committee Meeting to update the compliance reporting templates accordingly. It will be important to ensure that all required information can be provided by the CPCs in an easy to fill but conclusive format in order to allow for respective compilation of all required data by the Secretariat. Only thereby a meaningful review of compliance with the adopted measures and reporting requirements can be done and the effectiveness of the respective alternative measure chosen and announced by each CPC by 1. September 2025 then compared to the acknowledged best practice of landing all sharks with their fins naturally attached.

Therefore, the new Compliance reporting template could be finalized by the Secretariat and presented to all CPCs for review as soon as possible, ideally at the Scientific Committee Meeting in December for further scientific input before adopting it for use by the Compliance Committee.

2.7. Stipulating better data by closing the gaps in reporting requirements and facilitating reporting compliance

Resolution 25-08 Para 33 states "*The Commission, on advice from the IOTC Scientific Committee, shall develop and consider for adoption at its annual Session in 2026 mechanisms to encourage CPCs to comply with their reporting requirements on sharks, notably on the most vulnerable shark species as identified by the IOTC Scientific Committee*."

This highlights the urgent need to step up compliance with reporting obligations outlined in Resolutions 15/02 and 15/01, mandating the reporting of all shark catches whether landed or discarded. As a matter of fact, however, so far only very limited discard reporting is available at all and only few CPCs have so far submitted data on discarded sharks as part of their National Reports, although this is required by the active resolutions for all gear types at least for major shark species. Total mortality is highly uncertain for all sharks including those of substantial commercial value with more than 30,000 tonnes of sharks annually are reported as 'nei' (not reported elsewhere) either at a highly aggregated level (Carcharhinidae) or even only as 'various sharks'.

The Compliance report summary for 2024 highlights that only 52% of the CPCs fully reported the retained catches across all fisheries categories and 33% of CPCs did consecutively not provide data according to reporting obligations. When reviewing the National Reports submitted by CPCs in 2024 not all of the 28 submitted reports included data on discarded sharks and out of the purse seine fishing fleets only the EU and Korea have reported discards suggesting that all other purse seine fleets have either not reported discards or retained bycaught shark. (IOTC CoC 2025) However, large purse seine vessels operated by EU companies but flagged to the Seychelles have previously reported silky shark discards for MSC certification (Ziegler 2022) it is inconsistent with no discard data reported in its national report although this data is mandatory.

Comparing available discard data for some key shark species for each gear substantial gaps are apparent even for those fleets that claim having close to 100% nominal observer coverage (e.g. large purse seine vessels) whereas the reported discards from longline fleets are if at all reported are extremely limited by the low observer coverage of only 5% required by IOTC and no discard reporting at all exists from gillnet fisheries at all which is also further impeded by existing gaps and inconsistencies in reporting requirements for sharks for all gear.

Resolution 15/02 requires all fleets (including coastal fleets) to submit "*Estimates of the total catch by species and gear, [….] (separated, whenever possible, by retained catches in live weight and by discards in live weight or numbers) for all species under the IOTC mandate as well as the most commonly caught elasmobranch species according to records of catches and incidents as established in Resolution 15/01 on the recording of catch and effort data by fishing vessels in the IOTC area of competence (or any subsequent superseding Resolution)*."

Resolution 15/01 requires the mandatory reporting according to Res 15/02 requirements of the following elasmobranchs species per gear and recommends the reporting of additional species as optional. As

outlined in Table 2 the reporting requirements differ substantially by gear type and most species do not have to be reported in all relevant gear types even when known to be a regular bycatch in those gears. Mantas and devil rays are known to be caught in purse seine fisheries but are optional for reporting, as well as hammerhead sharks and tiger sharks, bull sharks and other elasmobranchs.

For gillnets silky sharks don't have to be reported at all at species level and critically endangered scalloped hammerhead sharks only have to be reported at genus level for longline and gillnet fisheries and not at all for purse seine fleets, although most of the 9 different species of hammerhead sharks can be easily distinguished and especially scalloped hammerheads and silky sharks are a known bycatch in all fisheries, but in gillnet fisheries in particular (Moazzam 2022). As a result of this poor reporting and differentiation requirement most fisheries do not report them or report them as simply sharks, regardless of whether retained or discarded. In addition, there is a high separation of catches of juvenile in coastal waters and adults in pelagic waters and therefore driven by different dynamics. Therefore, the stock status is unknown and an attempt to perform an indicative stock assessment for scalloped hammerhead in 2022 failed due to the lack of reliable time series and CPUE data (Geng 2022), while a new assessment is planned for 2026.

Reporting obligation	Longlines	Purse seine	Gillnets and other surface fisheries	Pole and Line
Mandatory	Blue shark (*Prionace glauca*) - BSH Mako sharks (*Isurus* spp.) - MAK Porbeagle shark (*Lamna nasus*) - POR Hammerhead sharks (*Sphyrna* spp.) -SPN Silky shark (*Carcharhinus falciformis*) - FAL Other sharks - SKH Thresher sharks (*Alopias* spp.) - THR Oceanic whitetip shark (*Carcharhinus longimanus*) - OCS	Whale sharks (*Rhincodon typus*) (in number) - RHN Thresher sharks (*Alopias* spp.) - THR Oceanic whitetip shark (*Carcharhinus longimanus*) - OCS Silky sharks (*Carcharhinus falciformis*) - FAL	Blue shark (*Prionace glauca*) - BSH Mako sharks (*Isurus* spp.) - MAK Porbeagle shark (*Lamna nasus*) - POR Hammerhead sharks (*Sphyrna* spp.) - SPN Other sharks - SHK Whale sharks (*Rhincodon typus*) (in number) - RHN Thresher sharks (*Alopias* spp.) - THR Oceanic whitetip shark (*Carcharhinus longimanus*) - OCS	Sharks SHK Rays
Optional	Tiger shark (*Galeocerdo cuvier*) - TIG Crocodile shark (*Pseudocarcharias kamoharai*) - PSK Great white shark (*Carcharodon carcharias*) - WSH Mantas and devil rays (*Mobulidae*) - MAN Pelagic stingray (*Pteroplatytrygon violacea*) - PLS Other rays	Mantas and devil rays (*Mobulidae*) MAN Other sharks - SHK Other rays	Tiger shark (*Galeocerdo cuvier*) - TIG Crocodile shark (*Pseudocarcharias kamoharai*) - PSK Mantas and devil rays (Mobulidae) - MAN Pelagic stingray (*Pteroplatytrygon violacea*) - PLS Other rays	

Table 2: Reporting requirements for sharks for each gear; information summarised from IOTC Resolution 15-01;

Aligning and completing the species list for all fisheries according to the scientifically documented bycatch composition and updating Resolution 15/01 accordingly should therefore be a priority as part of this task. Only species which are difficult to tell apart should be allowed to be recorded at family or genus level and all fisheries should be required to have up to data species identification guides on board to facilitate reporting.

In particular, the following shark species should be included into the list of to be reported as mandatory for each gear type

- Silky sharks for gillnets and pole and line
- Hammerhead sharks at species level at least for scalloped, smooth and great hammerhead for all gear types (including explicitly purse seine fisheries)
- Mantas and devil rays at species level differentiating at least manta rays (pelagic and reef mantas) from other devil rays at least for purse seine fisheries and gillnet fisheries as mandatory and not optional
- Great white sharks as mandatory in all gear types
- Oceanic whitetip sharks for all gear types

However, it remains a challenge to be tackled by the IOTC how reporting of catch data including discards of elasmobranchs can be facilitated and made easier for fisheries lacking electronic batch logbooks or other electronic reporting facilities. This mostly applies to developing coastal states which do have in addition long coastlines and large numbers of small fishing vessels operating especially as part of their coastal fleets but at the same time also responsible for substantial elasmobranch catches, many of them as part of multi-species fisheries and as targeted species. Therefore, improving reporting compliance should be made a priority and a workshop for coastal states should be hosted by IOTC in 2026 discussing alternatives to existing methodology for reporting and submission and how shark catch data availability could be reasonably improved. Financial support for such a workshop and resulting measures should be provided from all CPCs as data availability is a key prerequisite to improve assessments of the status of elasmobranch stocks at the IOTC and inform management decisions on required conservation and management needs.

Further reporting requirements on gear specification as outlined in Res 15/01 may also require better specification especially in regard to support the requirement made in Res 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.*" Whereas the resolution mandates the Secretariat to compile such data by July 2026 the continued collection on more detailed information on the type of leader materials used in longline fisheries (although a differentiation between monofilament leaders and other leader types is already requires by today's resolution) improved reporting as to the

- Specific type of leaders including a list of material description as monofilament, multifilament, wire, others to be described (e.g. tared filament)
- Distribution of leader types per set if using more than one type
- Specification of hook type used in combination with leader type

Would also support information collection throughout the anticipated scientific study on the impact of leader type on mortality of vulnerable shark species (including oceanic whitetip shark, silky shark, shortfin mako and thresher sharks).

3. Conclusion and Recommendations

Adoption of Resolution 25/08 may have been the start for turning the tide for sharks in the Indian Ocean as providing a mandate to scientists for the assessment and development of effective measures to limit shark mortality for both targeted species and incidental bycatch and ending the area of an "only bycatch" policy that has clearly failed halting shark extinction in the Indian Ocean in the past.

However, the defined tasks and requested responses from scientists also highlight that there are many gaps to be closed and adequate resources will be needed to do so. In this aspect it is important to also refer to existing knowledge and advice from other ocean basins and collaborate closely between fisheries scientists and NGOs, avoiding to "reinvent the wheel" and instead focus on new research where really needed such as gear modifications and new methods to avoid and minimise shark bycatch, while aligning already established remediation measures with other areas and available state of the art advice.

The tasks assigned to scientists by the Resolution demonstrates the intent of the resolution to step up shark management and conservation at IOTC but also highlight that guidance and information from scientist is needed to do so.

The best way to address all existing gaps and effectively reduce mortality and provide long-term sustainable management of shark populations, would therefore be to establish a systematic bycatch mitigation hierarchy with prioritisation of measures for implementation with SMART objectives to limit the mortality of threatened sharks combined with MSE tested Management Procedures for commercially targeted species. While an ecosystem-based approach to both MPs and bycatch mitigation would be preferrable single species approaches may be faster to establish and implement and a strategy should be proposed by scientists as part of the long-term shark research project. Priorities for implementation should be recommended by scientists based on the threatened status of species, the respective fishing practices and the commercial importance of sharks in IOTC fisheries.

This provides a unique opportunity for science to take the lead for shark conservation in the IOTC Area of Competence and could serve as a blueprint for other tuna RFMOs and should therefore by no means be wasted by the traditional call for more data and research as a stand-alone measure but instead integrate data and scientific research into a systematic hierarchy for mortality reduction and reviewing the effectiveness of implemented or envisioned measures throughout the duration of this project until a good environmental health and full recovery of depleted stocks has been achieved and implemented measures proven to be suitable maintaining such state for all stocks. This objective could be used to establish the terms of reference for the envisioned long-term shark project, which should also be subdivided including the immediate actions to be presented to the Commission for approval next year, within the next 2-3 years and in the long-term until 2035 with annual updates on the achieved progress.

Following such a hierarchy and aware that many of these tasks are due to be delivered to the Commission for review and adoption at its 2026 Commission Meeting, the key recommendations listed below could help avoiding excessive work, prioritising work on the most important topics for which no precedence exists while referring and endorsing already existing knowledge and prior experience from other ocean basins where available and applicable to the Indian Ocean.

A draft for the terms of reference including also the short-term tasks could be structured as proposed below pursuing a mortality hierarchy approach for the objectives and respective measures as suggested in the literature previously. Thereby the objective should be to step up efforts over time shifting from a Remediation, Compensation and Research & Data Collection approach towards a Minimisation and Avoidance approach supported by scientific research. Three phases might be defined for such a project with SMART objectives and deliverables for each phase. These could also summarise into a Regional Plan of Action for Sharks for the IOTC Area of Competence, that is

- Specific to reducing mortality of elasmobranchs and rebuilding depleted stocks,
- Measurable achievements in relation to mitigation hierarchy
- Appropriate measures for either commercially used sharks or threatened bycatch or both
- Realistic to be achieved within foreseen timeframe for the project and supported by funding
- Timebound including milestones and evaluation / review periods

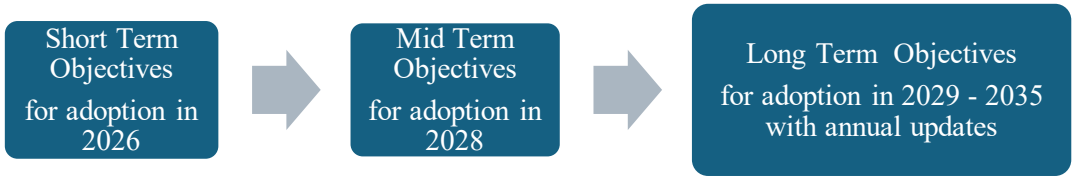


Figure 5: Longterm research project on sharks should be divided into three separate phases, each of which can be performed independently from each other or building up on the outputs and results of previous project phases.

Figure 6 below outlines how the three phases of the project could be structured including tasks and deliverable split over the five categories of a mitigation hierarchy while including both, threatened bycatch species and sharks targeted for commercial reasons.

Phase I refers to the requests made by the Commission to the WPEB and SC in its 2025 meeting to be presented to the Commission for adoption in its 2026 meeting.

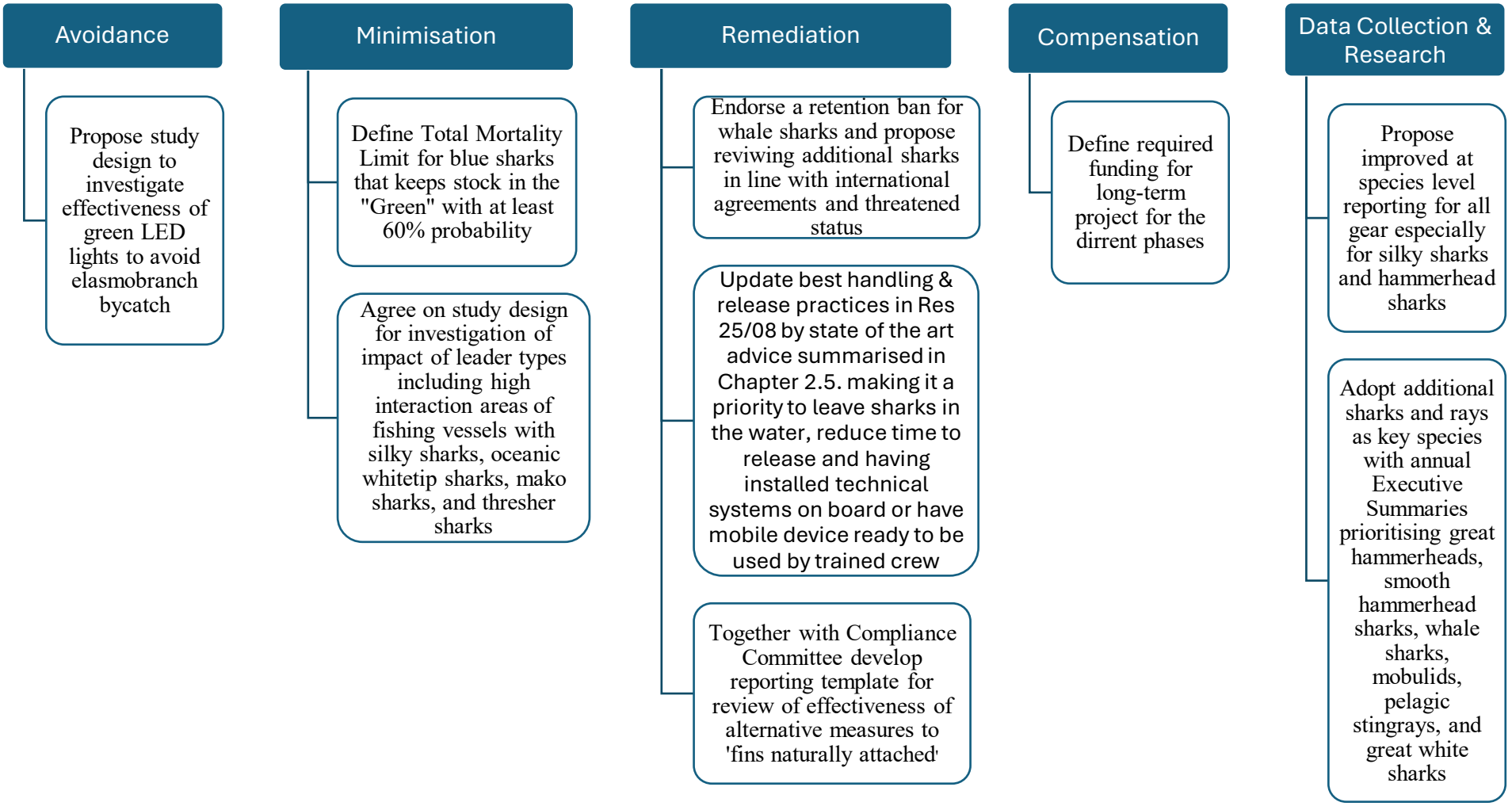
Phase II outlines next steps the scientists should initiate and deliver to the Commission for adoption in 2028 including follow up from actions already defined in Resolutions 25/08 and 25/09 for review and adoption in 2028.

Phase III provides an outlook to long-term continuation with the intention to effectively reduce

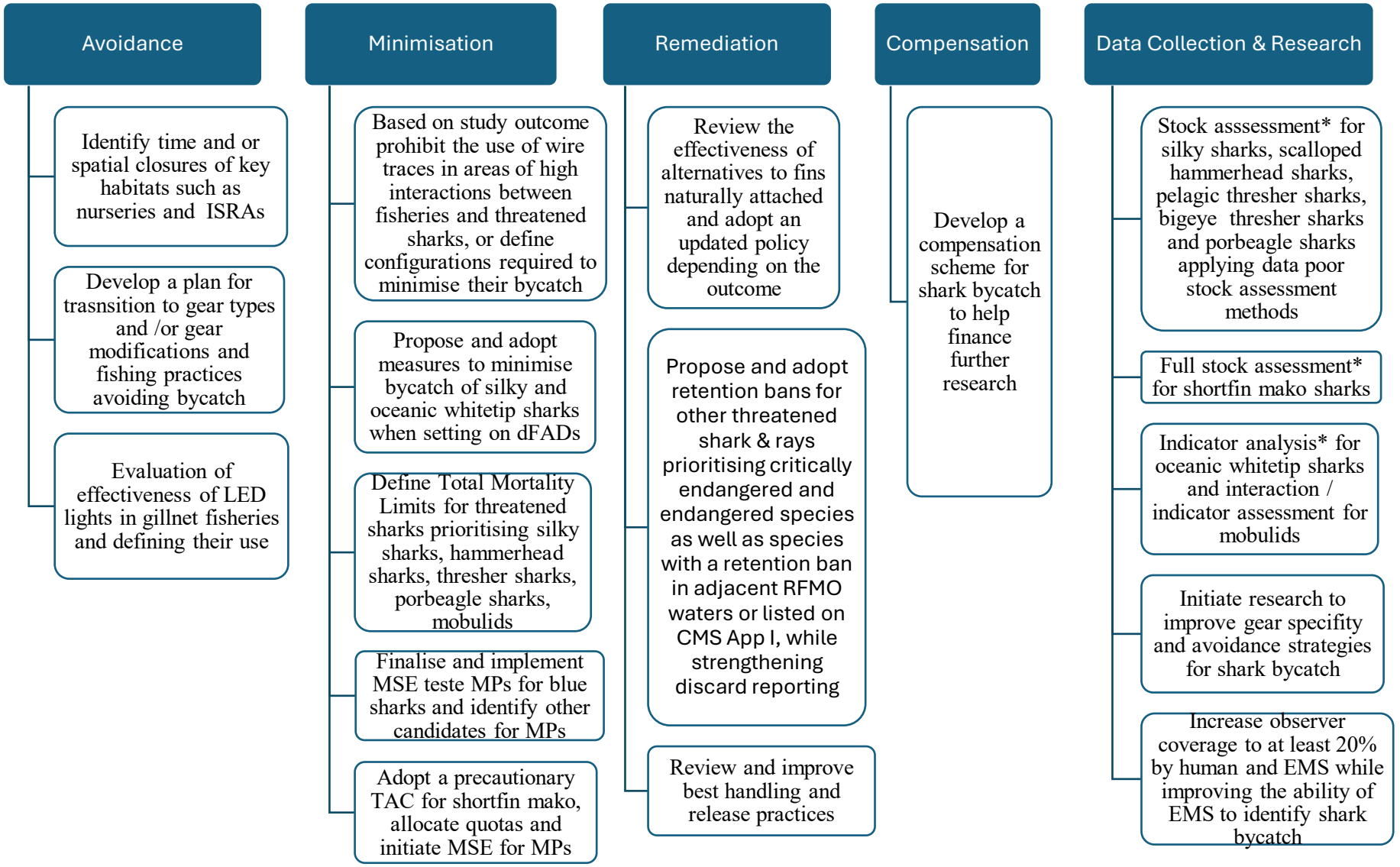
shark mortality applying science based solutions and alternatives while continuing to apply a precautionary approach in the absence of data instead of refraining to the need of more data, a vicious cycle that has proven to be hindering progress in halting the collapse of stocks and the increasing risk of extinction for about 40% of all elasmobranchs in the Indian Ocean (Pollom et al 2024).

In summary, Resolution 25/08 lays out a path that scientists should now go and endorse to go to finally change the tide for sharks at IOTC and transform IOTC from a tuna RFMO that has been lagging behind for many years into a role model that other can follow to ensure healthy and resilient ecosystems that continue to support food security and livelihoods in the Global South and in particular for developing coastal states and help combating the negative impacts of global warming and climate change, an ecosystem service that strongly depends on resilient marine ecosystems for which elasmobranchs and in particular pelagic sharks and rays play a key role.

Short Term = Phase 1 2025/2026



Mid Term = Phase 1I 2026 - 2028



Long-term = Phase III 2029 - 2035

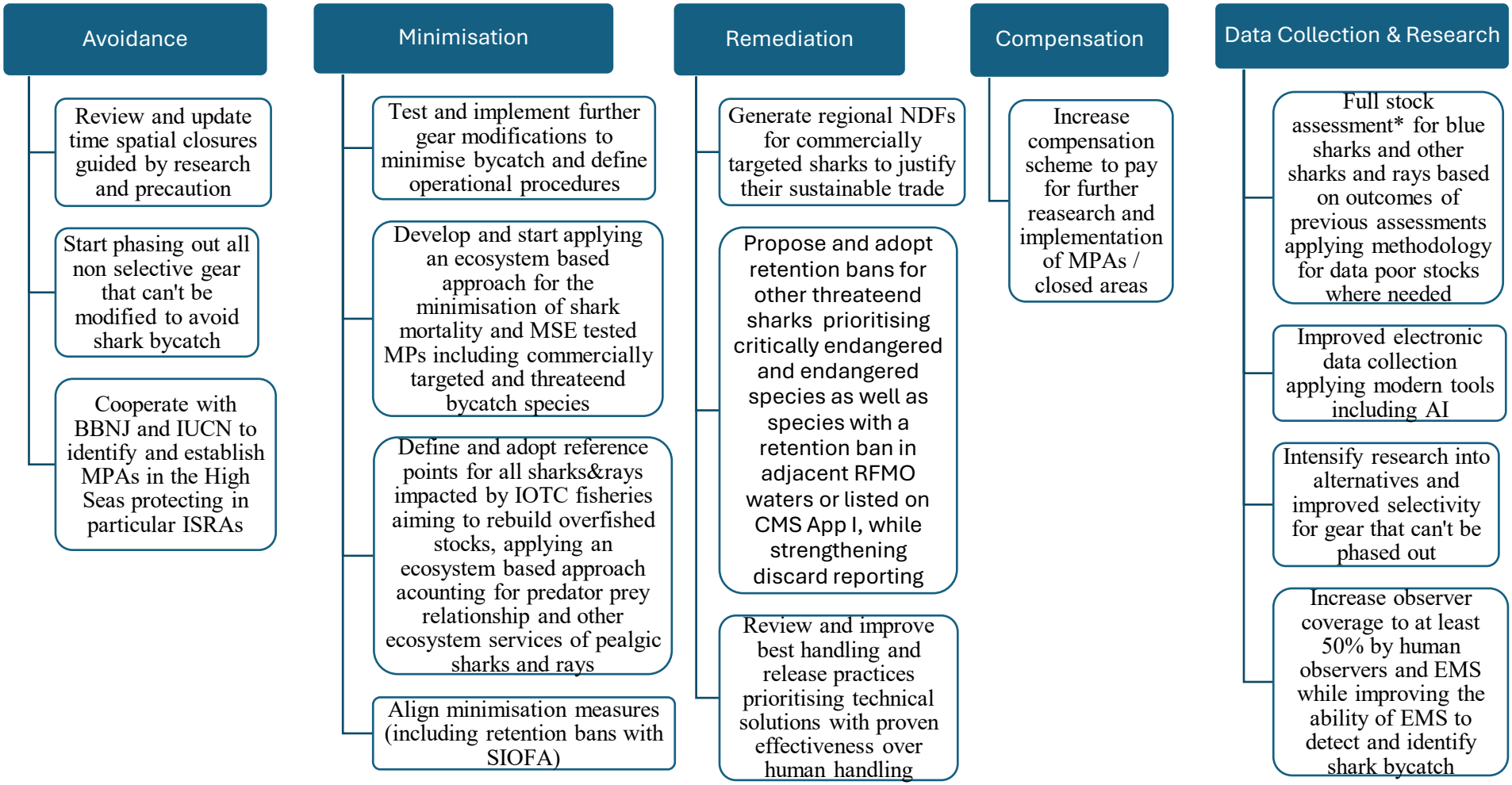


Figure 6: Terms of Reference for a long-term shark research project divided in 3 phases, each of them set up following the mortality reduction hierarchy and over time moving from remediation and data collection to minimisation and avoidance as the key objectives to guide scientific research and translating scientific advice into effective management and conservation measures.
** Stock assessments and indicator analysis as already listed in the workplan of the Scientific Committee*

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