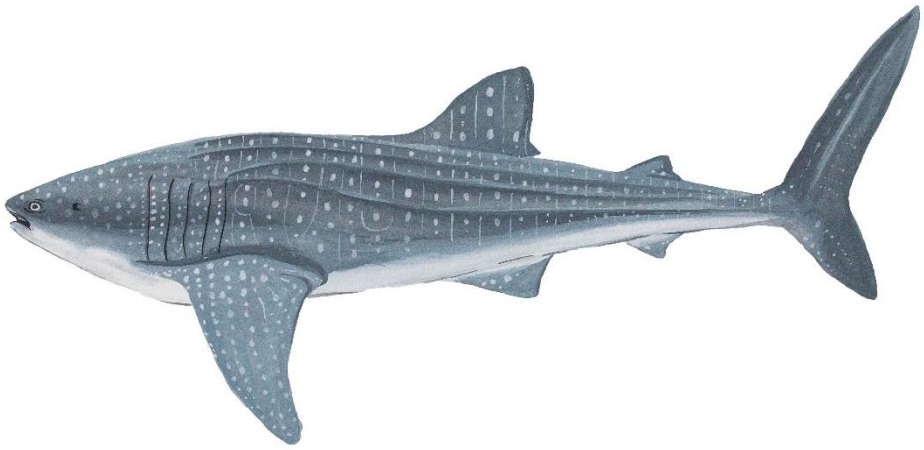

Report of the Consultative Workshop on Threatened and Protected Elasmobranchs of India: Conservation status and Policy needs

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4-6th February 2020, ICAR-CMFRI, Kochi, India

Editors: Akhilesh, K.V., Kizhakudan, S.J., Muktha, M., Thomas, S. and Zacharia, P.U.

भा. कृ. अनु. प- केंद्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान
(*भारतीय कृषि अनुसंधान परिषद*)

ICAR-CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
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Contents

List of Acronyms and Abbreviations

BOBLME	Bay of Bengal Large Marine Ecosystem
BOBP	Bay of Bengal Programme
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMFRI	Central Marine Fisheries Research Institute
CMS	Convention on Migratory Species
CMLRE	Centre for Marine Living Resources and Ecology
FAO	Food and Agriculture Organization
FSI	Fishery Survey of India
ICAR	Indian Council of Agricultural Research
IOTC	Indian Ocean Tuna Commission
IPOA-Sharks	International Plan of Action for Conservation and Management of Sharks
IUCN	International Union for Conservation of Nature
MPEDA	Marine Products Export Development Authority
MoA&FW	Ministry of Agriculture & Farmers Welfare
MoEF&CC	The Ministry of Environment, Forest and Climate Change
MoFAH&D	Ministry of Fisheries, Animal Husbandry and Dairying
NCF	Nature Conservation Foundation
NPOA	National Plan of Action
WCCB	Wildlife Crime Control Bureau
WCS	Wildlife Conservation Society
WII	Wildlife Institute of India
WTI	Wildlife Trust of India
WWF	World Wide Fund for Nature
ZSI	Zoological Survey of India

Executive Summary

Chondrichthyans (sharks, rays, sawfishes, chimaeras, and guitarfishes; collectively hereafter called *sharks**) are a regular constituent in India's mixed species marine fisheries. At least one-quarter of the chondrichthyans in the world's oceans are considered highly threatened by extinction risk. There is widespread concern about this group globally and several conservation actions are in place in many countries to reduce their extinction risk. To develop management strategies to ensure the conservation and management of sharks and their long-term sustainable use globally, United Nations Food and Agriculture Organization (UN-FAO) adopted the International Plan of Action for Sharks (IPOA-Sharks) in 1999. India has figured among the top five shark fishing nations for a long time, though most sharks are caught as bycatch in its diverse fishery. At the national level, India's Wildlife (Protection) Act, 1972 (henceforth WPA) provides a legal framework for the protection of 10 sharks in India's marine waters since 2001. In 2015, a Guidance to National Plan of Action in Sharks of India was published. The scope of protection and status of marine fauna has changed over the years since WPA has been enforced.

For years it has been felt that threatened marine fauna has received little attention in comparison to their terrestrial counterparts in India, even concerning those listed in Scheduled I of the WPA, in multiple aspects including research grants, access, and dedicated conservation programs/projects, etc.

There has been a lot of deliberation in several scientific and conservation meetings to improve conservation attention to marine fauna, review the protected marine species in WPA or to consider marine fauna as a separate category, etc. Recognizing the urgent need for concentrated attention on threatened marine fauna, ICAR-Central Marine Fisheries Research Institute (ICAR-CMFRI) planned a scientific consultative workshop for suggestions from various organizations associated with shark research on how effective protection and conservation of sharks and other marine wildlife can be undertaken in India.

Sharks face a relatively high level of threat, compared to other marine fauna and are comparable or worse than the most threatened terrestrial fauna. In view of this special attention is needed on this group. Though India has been a leading nation in shark catch reports, mostly contributed by bycatch/incidental catch in its mixed species fishery, limited actions have been undertaken to improve its international commitments and policy decisions on conservation, management and sustainable utilization of sharks. Apart from the present provision of common conservation measures for both terrestrial and marine organisms in the WPA, the latter should be given special attention for ensuring that conservation measures are implementable and practical, considering the multiple-use and stakeholders involved in ocean utilization and fishery interaction.

* *The term sharks is used in this report as a general term for all chondrichthyans, unless specified*

Therefore, the major objective of this consultative workshop was to engage research experts, managers, policy developers, and relevant government representatives to share their experiences and views about threatened sharks in India and suggest measures to improve their conservation, sustainable utilization, and relevant policy requirements in general.

This meeting was an experience-sharing event in refining strategies to promote sustainable fishing and conservation of threatened sharks in India which highlighted -

1. Special consideration to marine flora/fauna in WPA [in case of the MoEF&CC, continuing to cater to the conservation needs of marine fauna or delegating/sharing the implementation to the Department of Fisheries under the Ministry of Fisheries, Animal Husbandry and Dairying] or a special section for marine fauna with additional conservation efforts considering the complexity.

2. Periodic consultation to amend the WPA listing based on species status assessment.

3. Revisiting the current shark species listing/listed in the WPA.

4. Instituting special grants and programs which aid improved conservation research

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Background

India's marine waters account for 2.02 million km^2 (EEZ) with an extensive coastline, harboring diverse fauna. The diversity of biota in India's coastal waters is yet to be completely known. Many of the faunal groups known from Indian marine waters are threatened with population declines as they face several natural and anthropogenic threats and are in dire need of conservation.

Chondrichthyans (sharks, rays, skates, sawfishes, guitarfishes and chimaeras; hereafter "sharks") are a regular constituent in India's marine fishery and India has figured among the top five shark fishing nations for a long time. The annual landing of sharks in India has averaged ~55000 t, during 1985-2019. About 160 species of sharks have been documented from Indian waters. However, by and large, the fishery deviates from being targeted, and sharks are often a part of the incidental catch of gears operated for other resources. The contribution of sharks, therefore, to the total marine fish landings in the country is under 2%.

Most of the sharks in the world's oceans are considered highly sensitive to anthropogenic and natural impacts, and are threatened by a high extinction risk. There is widespread concern about this group globally and several conservation actions are in place in many countries to reduce their extinction risk. To develop management strategies to ensure the conservation and management of sharks and their long-term sustainable use, United Nations' Food and Agriculture Organization (UN-FAO) adopted the International Plan of Action for Sharks (IPOA-Sharks) in 1999. A spurt in the continued large scale harvesting of whale sharks from Indian waters, particularly off the north-west coast, drew wide attention from conservationists worldwide and in 2001, the whale shark *Rhincodon typus*, Pondicherry shark *Carcharhinus hemiodon*, Gangetic shark *Glyphis gangeticus*, speartooth shark *Glyphis glyphis*, large-tooth sawfish *Pristis microdon* (now as *Pristis pristis*), green sawfish *Pristis zijsron*, knife-tooth sawfish *Anoxypristis cuspidata*, giant guitarfish *Rhynchobatus djiddensis*, Gangetic stingray *Himantura fluviatilis* (now as *Pastinachus sephen*) and porcupine ray *Urogymnus asperrimus* were accorded protection in India under Schedule I of the Wildlife (Protection) Act, 1972 (hereafter as WPA). WPA provides the highest protection status for any fauna in India. Several awareness and conservation campaigns by different government agencies and NGOs contributed to a slump in the exploitation of the protected species and increased interest in research on Indian sharks.

ICAR-CMFRI has been researching the fishery and stock characteristics of different fishery resources since its establishment in 1947 including sharks. A research program focused exclusively on studying the resource characteristics of sharks were carried out since the early years of inception of the Institute, in the early 1970s a dedicated program "Studies on commercially important shark resources (FB/0P/1)" was initiated. In 2005, however, the research programs were tuned towards state-wise themes and a special focus on the national status of these groups was diverted. However, with the growing concern for shark resources the world over, in 2012, ICAR-CMFRI once again adopted a focused research project to assess the status of sharks in Indian seas, which in 2017 branched into two themes – developing management

strategies for sustainable exploitation and conservation of sharks in India and assessing the status of the sharks protected under the WPA. In 2015, as an output of its research programs, ICAR-CMFRI published a "Guidance to the National Plan of Action for sharks in India", based on the IPOA-sharks of the FAO as a precursor to a national POA.

India is a signatory to several global conservation and management frameworks such as the CITES, CMS, IOTC, etc. which provide scope for conservation measures, sustainable utilization, and trade within the ambit of the legal framework of the participating nation. In 2013, India adopted a no-finning policy and in 2015, the export of shark fin was prohibited. ICAR-CMFRI, one of the CITES Scientific Authority of India has prepared Non-Detrimental Findings (NDF) documents for sharks listed in Appendix II of the CITES –the oceanic whitetip *Carcharhinus longimanus*, hammerhead sharks *Sphyrna lewini*, *Sphyrna zygaena* and *Sphyrna mokarran*, manta rays *Manta birostris* and *Manta alfredi*, in 2017 and for silky shark *Carcharhinus falciformis* and thresher sharks *Alopias pelagicus* and *Alopias superciliosus*, in 2019.

However, the WPA is, currently, the only tool that provides a legal framework for protecting the flora and fauna of India, for both terrestrial and aquatic, and remains the key action source for the protection of few (10) sharks in India. Almost two decades have elapsed since the inclusion of the ten shark species Schedule I of the WPA, and ongoing research on the status of different shark species, including the protected species calls for a relook into marine conservation actions and beyond the listing and focused conservation attention on other species. There is also a growing urgency to evolve a separate Act for aquatic life, particularly marine, and to treat it differently from terrestrial life.

ICAR-CMFRI being the premier fisheries research institute in the country and one of the CITES Scientific Authority for marine fauna and based on the outcomes of ongoing research programmes, felt that there was a need for improving conservation measures and actions for sharks in India. Therefore, ICAR-CMFRI organized a consultative workshop of leading shark researchers of India and organizations focused on shark research, policy and conservation to discuss the way forward. The workshop was held during 4-6 February 2020 at ICAR-CMFRI, Kochi, Kerala.

Workshop objectives

The overall goal of the national consultative workshop, a first of its kind was to gather ideas from all stakeholders involved in shark conservation and fishery management towards evolving a focused policy within the ambit of the legal frameworks or as provided in the WPA for protection of threatened and endangered species and the penal actions that would arise upon their exploitation, utilisation and trade.

The specific objectives of the national consultative workshop were -

- To assess policy needs for shark conservation - identify issues and suggest solutions and provide evidence-based suggestions for authorities to act upon.
- To deliberate on the need for a separate Marine life Protection Act or a separate section for marine fauna as the terrestrial and marine have entirely different scopes and issues.

- To discuss on the potential of marine conservation and prioritizing same in WPA or similar legal systems.
- To discuss the need for delisting and adding of shark species to the Act, based on research results on the status of different species.
- To develop strategies to improve the efficiency of stakeholders, including policy enforcement personnel and shark fishers and traders, on species identification concerning potential conservation importance.
- To initiate the creation of a network of shark researchers in India.

Workshop participation

ICAR-CMFRI invited key representatives of the scientific community, research and educational institutions, policy institutions (Government/Ministry), NGOs, and independent researchers involved in shark research, conservation, and fishery management in India for the workshop. In addition, scientists of CMFRI, undertaking research on sharks all along the coast were also participated. The list of participants and invitees are presented in Appendix II. The workshop gathered about 30 in-person participants from 13 agencies; however, the policy institutions (government/ministry level) were under-represented.

Participants on the second day of the workshop
Sitting from left: Dr. Shoba Joe Kizhakudan, Dr. E. Vivekanandan, Dr. A. Gopalakrishnan (Director, ICAR-CMFRI), Dr. P.U. Zacharia, Dr. Sujitha Thomas
Standing from left: Dr. G.B. Purushottama, Mr. Mayuresh Gangal, Dr. Divya Karnad, Ms. Alisa Barnes, Dr. Naveen Namboothri, Ms. Trisha Gupta, Dr. Vardhan Patankar, Ms. Zoya Tyabji, Dr. K.V. Akhilesh, Dr. Muktha M, Mr. Vinod M, Dr. Bineesh K.K, Dr. Najmudeen T M, Ms. Malaika Vaz, Dr. Mahesh V, Mr. Sajan John, Mr. Vishnu, Dr. Livi Wilson, Dr. Rekha J. Nair, Mr. Sipson Augustine

Workshop program

The consultative workshop progressed over three days through a sequence of activities that began with the presentation on activities pertinent to shark research, conservation, and fishery management being carried out by the participating institutional representatives, focused group discussions on pre-decided themes, presentation of suggestions arising from the group discussion and brainstorming to finalize the recommendations. The group constitution is given in Appendix III.

Day 1:

Day 1. featured presentations by Dr. S.J. Kizhakudan Principal Scientist & PI of ICAR-CMFRI's national project on sharks, Dr. E. Vivekanandan (former Principal Scientist, ICAR-CMFRI) talked on "Is Wildlife (Protection) Act, 1972 effective in conservation of elasmobranchs India?" and Dr. Akhilesh K V, (Scientist, ICAR-CMFRI) on "Status of protected sharks under WPA". This was followed by inputs from Dr. P.U. Zacharia (Head, Demersal Fisheries Division, ICAR-CMFRI), and different organizations viz., Dr. Bineesh K.K, (Scientist D, Zoological Survey of India), Dr. Sijo Varghese (Zonal Director, Fishery Survey of India), Mr. Vinod M (WWF-India), Dr. Divya Karnad (Ashoka University), Dr. Naveen Namboodiri and Ms. Trisha Gupta, (Dakshin Foundation), Dr. Vardhan Patankar (WCS-India), Mr. Mayuresh Gangal, (NCF), Ms. Zoya Tyabji (WCS-India) and Alisa Barnes, independent researcher.

Major issues discussed

1. **Diversity & Taxonomy issues**: Dedicated shark diversity studies are very few in the country which calls for more focused studies. Shark taxonomy is challenging with a large number of taxonomic ambiguities. India being a hotspot for shark diversity needs to maintain a checklist, preserved reference materials and habitat information with genetic details of available species. Besides, it is important to correct the wrongly identified species, update species names as per international revisions and clear ambiguities using genetic tools. International collaborations need to be increased, especially in research on the taxonomy of sharks, in addition to the development to local taxonomy capacities in sharks.
2. **Museum collections**: India's museum collections of sharks are very poor. Most of the shark specimens available are small-sized. Though there are several public-funded institutions with collections, many have not been updated, catalogued or are inaccessible. There is an urgent need for increasing shark collections in museums and preferably developing multiple regional collections, without depending on a single organization or repository for collection/depositions.
   National repositories can be identified in each region and Universities/colleges can pass important or rare materials to national collections if adequate facilities are not available with them. A 'single' national catalogue /database must be maintained with details of specimens in the designated national/regional repositories linked with local collections. For this, a strong network has to be in place, with one organization to coordinate and update the catalogue.
   Indian researchers need to be trained in foreign museums and with international experts on methodology for the collection and preservation of samples, and procedure to transfer/handling of materials, especially rare specimens. Necessary infrastructure must be developed in all designated repositories to handle and preserve large specimens.

3. **Criteria for assessing threatened status and inclusion in WPA**: The IUCN Redlist criteria are the most widely used tool for assessing the status of species globally which depends upon available information, both published and inferences from observations and also takes into account the impact of multiple stress factors. India needs to carry out a national Red Listing of its sharks using IUCN methodologies or modified methods for national relevance every decade also in support of CBD commitments. Regular, periodic assessments based on updated scientific information and amendments are rarely possible with the current WPA. A modified methodology has been framed for species prioritization for conservation actinons (Annexure IV) which however should be integrated with local knowledge and expert advice.

4. **Estimation of the stock size of sharks in Indian waters**: Two national agencies, ICAR-CMFRI and FSI are the major public funded organizations working on shark research in India. FSI is currently estimating shark stock size by the swept area method using trawls. FSI also has an estimate of bycatch of sharks in long lines. The surveys are done up to 500 m, with more intensity in 30-100 m. This information is published in FSI bulletins and are made available on request. ICAR-CMFRI has been estimating stock status from fishery landing data. The data is collected from landing centres through a statistically designed sampling methodology by a network of field survey staff across all major and most minor landing centers in all the maritime states. An updated estimation of the stock size of sharks in Indian waters using both FSI and ICAR-CMFRI data is needed to arrive at better estimates than each of these methods alone. Estimation of time-series of CPUE of each shark species which are identified to species level will be necessary for any management measures.

5. **Protection of shark juveniles**: Lucrative fisheries for juvenile sharks operate in certain coastal regions of the country. Awareness generation to reduce the targeted exploitation of juvenile sharks has mostly been met with a mixed response since the catches are highly economically beneficial for the fishers due to market demand. Conservation incentives, temporary spatial closures and sanctuaries are potential necessary step to prevent over-exploitation of shark juveniles with awareness creation and participation of stakeholders.

6. **Bycatch reduction:** Bycatch and target catch in Indian fisheries are not properly defined due to mixed-species fishery and commercial use of both. The term bycatch used now mostly includes low-value catch, trash fish, etc. Earlier, when trawl fishing was done mainly for shrimps, all other fishes that were caught were grouped as bycatch. But now, almost every species is exploited and holds commercial value. In tuna longlining, sharks are taken as bycatch, however, they are also retained as they are a valuable commercial resource. Now that fisheries have become dynamic and complex and fishing boats operate multiple nets, lines or hooks, ascertaining the CPUE and estimating bycatch is difficult even though bycatch is present. Moreover, bycatch reduction measures in India are not extensively developed, even though there are several options with scope for implementation. Mesh size regulation has been implemented and complied with in several places. Bycatch Reduction Devices (BRDs) have been tried out in

trawls but are yet to gain widespread acceptance. BRDs need to be tested in other fishing gears too, with detailed habitat information on the species to affect a comprehensive reduction in bycatch. A bycatch mitigation framework will help manage India's complex fishery sustainably.

7. **Duplication of research efforts and Isolated research by multiple organizations**: At present multiple organizations and independent researchers are working on shark fishery, biology, utilization and trade in India, and other aspects in limited spaces. Most of the research remains isolated from each other and often there is an overlap of interest and work. This should be avoided in the future at least for public-funded organizations. With networking and collaboration to improve the quality of data and research outputs generated. A shark research network for the country can be mooted which could result in effective research on sharks in India.

8. **Research gaps**: There are huge gaps in shark research in India, including information gaps on diversity, stock and fishery. The mainstay of research is still oriented in fisheries monitoring, biology and new geographical reports. Research needs to improve on habitat understanding, ecology, migration, stock, human dimension, fisheries livelihoods, etc.

9. **Beyond WPA**: Currently, only WPA is the tool for species-specific conservation action for sharks. The scope of other relevant management tools such as Marine Fisheries Regulation Acts (MFRAs) and biodiversity rules can be looked into.

10. **India's NPOA-sharks:** ICAR-CMFRI published the Guidance on National Plan of Action for sharks in India in June 2015, which was presented to the DAHDF. Subsequently, an NPOA-Sharks was prepared by BOBLME/BOBP-IGO on 'concurrence with Government of India' (BOBLME, 2015). Steps need to be taken to hasten the adoption or creation of the NPOA-sharks for country, in order to put effective fishery management and conservation measures in place

Day 2:

On Day 2, Dr. A. Gopalakrishnan, Director, ICAR- CMFRI and an expert on molecular genetics spoke on the importance of genetic tools in shark research which included estimation of population size, diversity and taxonomy, in addition to the identification of illegal trade of protected and threatened animals. He recalled the use of genetic tools in identifying that a processed product was from a protected species and therefore was illegal.

Discussions (Day 2 & Day 3)

Based on the discussions on Day 1, five themes were identified as essential to move forward with shark conservation and protection in India.

→ Theme 1. Criteria for assessing the status of species
→ Theme 2. Species to be considered for listing/delisting

→ Theme 3. Research needs and data collection
→ Theme 4. Conservation opportunities and barriers
→ Theme 5. Formation of a network of shark researchers in India

Three groups (Annexure-III) were formed on the second day of the consultative workshop to brainstorm upon the first three themes. At the end of the group brainstorming sessions, each group presented the key points that arose from their discussions and the other groups were asked to comment on or suggest modifications to the same, before finalizing the needs to meet the requirements of each theme. Themes 4 and 5 were discussed as a single group involving all participants the next day. The key points that emerged from the group discussions on the three themes are:

Theme 1. Criteria and framework for assessing the status of species

As multiple regional and international criteria are available, a suitable model is necessary for India, which will recommend the conservation and protection status according to vulnerability scoring patterns. A framework "SHIFT analysis" (Annexure IV) was conceptualized wherein a preliminary assessment can be done to ascertain major drivers, the threat to the species and other local factors which are often undermined when following a global rationale.

Table. 1 Risk assessment and vulnerability factors for considering in

Biological criteria	Ecological criteria	Economic criteria	Social dynamics	Threats
Resilience	Migratory patterns	Demand	Cultural significance	Fishing
Population doubling time	Dispersal potential	Price	Consumer preference	Climate change
Trophic Level	Habitat	Trade		Habitat degradation
Fecundity/Litter size		Drivers		Pollution
Growth rate				Other anthropogenic threats
Life span				
Age/Size at maturity				
Natural mortality rate				
Reproductive strategies				

Table. 2. Recommended categories of protection and conservation actions

Absolute protection	Control harvest	Control trade	Species of concern	Data Deficient
Schedule 1 species WPA	Local quota	Shark fin trade#	Country-level list	Dedicated research
Mandatory release	Time-restricted spatial management	Minimum Legal size for commercial trade	Wanted / attention category species	
Mandatory sighting reporting	Gear restriction on known habitats	Species-specific trade control in domestic markets	Critical habitat identification	
Punishments on deliberate exploitation or trade				
If stranded dead access to research				

#No finning in India as meat has a good market value

- Criteria listing and scoring to be done by scientists/expert researchers through consultations
- Assessments and listing to be discussed in stakeholder consultations
- Status of species to be revisited every 5 years with updated scientific information

Theme 2. Species to be considered for listing/delisting in WPA

There are modifications needed in WPA, as the species inclusion is based on the parliamentary act it's a complex process for inclusion and removal from the list. The Act may have provisions for assessment-based modifications on a 5-yearly basis. Or, the Act can remain the same with list modification as the purview of the expert committee. Blanket protection is not the best way for effective conservation of marine fauna. Criteria for delisting to be developed if the threat status has been reduced.

Table. 3. Recommended modifications/actions in WPA

Species currently listed in the WPA	Suggested action	Remarks
Carcharhinus hemiodon	Requires intensive surveys to understand status in Indian waters.	Not reported from India for more than 30 years.
Glyphis gangeticus	Requires intensive surveys to establish population status in Indian waters.	There are no recent confirmed records of sightings or landings, except for the report of a single specimen photographed in Mumbai Maharashtra
Glyphis glyphis	The species name can be removed from WPA and it can be listed as *Glyphis* spp.	The status of *Glyphis glyphis* in Indian waters remains to be confirmed.
Rhincodon typus	National Conservation programs needed	Country-based information low
Urogymnus asperrimus	To be retained as *Urogymnus* spp.	Rarely reported due to non-importance in fishery, trade. Requires intensive surveys to understand the stock status of *Urogymnus* spp. in Indian waters.
Himantura fluviatilis	To be removed from WPA until existence/identity is confirmed.	Uncertain species. Dedicated studies on river stingrays. The "Ganges stingrays" should be revisited.
Rhynchobatus djiddensis	To be retained as *Rhynchobatus* spp.	*Rhynchobatus* spp. is a species complex and as multiple species occurring in Indian waters have a similarly high risk and threats.
Pristis microdon	To be retained as *Pristis* spp. or *Pristis pristis*	Dedicated National conservation programmes needed
Pristis zijsron	To be retained as *Pristis* spp. or *Pristis zijsron*	
Anoxypristis cuspidata	To be retained as *Anoxypristis cuspidata*	

Table. 4. Species to be considered on priority for research support and conservation attention in India *

Species	Remarks
Giant freshwater stingray, *Urogymnus polylepis*	Currently known from Northern Bay of Bengal and riverine systems of West Bengal, Odisha, and Andhra Pradesh. It is assumed that Indian populations are under severe threat due to habitat degradation as elsewhere in the known distribution globally. Critically Endangered (CR) in IUCN RLA. Can be included in WPA as *Urogymnus* spp. or *Urogymnus polylepis*.
Devil & manta rays *Mobula* spp. & *Manta* spp.	These large-sized batoids are under threat as evident from low numbers of observations in the recent past. Though mostly taken as bycatch, the body parts and gill plates have huge market demand. Migration and stock studies are needed in the Indian context. CMS and CITES listed species. To add a special section in WPA for conservation attention.
Giant guitar fish *Glaucostegus* spp.	4 species in Indian waters, *G. granulatus*, *G. obtusus*, *G. thouin*, and *G. typus* are assessed as Critically Endangered (CR) in IUCN RLA. *Glaucostegus* spp. are CITES listed. To add a special section in WPA for conservation attention.
Stripenose guitar fish, *Acroteriobatus variegatus*	Small-sized poorly known, restricted distributed Critically Endangered (CR) species in IUCN RLA. Conservation attention low in smaller sized species. Reduce trawl fleet in known distribution range. To add a special section in WPA for conservation attention species like this.
Scalloped hammerhead *Sphyrna lewini*	Taken as bycatch in various gears. Dominated by juveniles. Catch declines and effective population size reductions reported. Endangered in IUCN RLA. CITES listed species Add a special section in WPA for higher focus on conservation on all hammerhead sharks, *Sphyrna* spp.

**The complexity of marine ecology in comparison with terrestrial ecology, with high stakeholder interaction chances of marine fauna and incidental bycatch, should be taken into consideration while planning species-specific protection and to restrain using the term "hunting" or equating the cases for fisheries.*

Theme 3. Research needs and data collection

Major gaps exist in shark research in India, even at the basic level. It is recommended to enhance research and undertake multidisciplinary research.

Table. 5. Research themes identified to address data gaps in shark research in India

Broad theme	Suggestions
Taxonomy	1. Core resource group (through network) 2. Protocols for standardization of collection; regular revisions of the methodology through workshops 3. Cataloging specimens across institutes 4. Central repository 5. Molecular genetics protocols 6. National depository for genetic samples eg. NBFGR
Distribution	1. Website – share sighting information, similar to http://seatizens.sc/ 2. Data access and sharing platforms, FSI, CMLRE 3. Pan-India survey: – Fishery dependent – Fishery independent
Biology & life history	1. Species-specific 2. Standardizing protocols for: a. Field study b. Lab c. Ageing
Trade & utilization	1. Commodity chains 2. Market structure 3. Value & supply chains 4. Traditional use 5. Impacts of government regulations on trade
Fisheries interactions	1. Landing trends – gear specific information on catch and bycatch 2. Photo IDs – Software, Image J, common platform. 3. Enumerators to collect information (training workshops) 4. Citizen report website or app. Eg. seatizens
Population estimates	1. Combined database using ICAR-CMFRI and FSI data 2. Use of New methodologies relevant in tropical countries
Socio-economics	1. Perception studies 2. Stakeholder involvement 3. Resource dependency 4. Role of traditional management in sharks 5. Identification of fishing groups
Habitat & ecology	1. Migratory patterns 2. Tagging, telemetry 3. MPAs 4. BRUVs 5. AUV
Economic valuation	Ecosystem services – educational, tourism, cognizant and cultural values
Essential prelude: ❖ **MAPPING OF AGENCIES** **One national level portal –species information, distribution, habitat, research etc.** **Funding Institutes – database & opportunities** **Transparent and simple collaboration policies**	

Theme 4. Conservation opportunities and barriers

Opportunities	Barriers
• The NPOA Sharks with guidance document • Increased interest in sharks, both globally and nationally particularly among young researchers, resulting in higher mobilization of funds for research and conservation • A good pool of researchers with expertise within the country • Available information on species • Charismatic nature of sharks • Eco-tourism • Popularizing research outputs in terms of simplicity and wider distribution • Database creation • Technological developments	• Delay with NPOA Sharks • Lack of awareness regarding conservation at different steps of the management system from fishermen to policy makers • Data gaps and access to data • Weak monitoring and surveillance systems • Poor inter-agency/institution linkages and coordination • Fish not considered as wildlife • Lack of information on the ecological value of sharks • Lack of information on policies and their impacts on fishing communities • Funding at a national level • Research gaps

Theme 5. Formation of a network of shark researchers in India

It was unanimously agreed that a network of shark researchers in India should be formed. It was also suggested that the possibility of the network being hosted by the Marine Biological Association of India may be looked into. It was also suggested that a core group be constituted to support implementing the NPOA-Sharks and to monitor the progress. It was discussed that potential collaborations among like-minded organizations may be explored.

The participants were requested to mail any additional comments or suggestions on the formation of the network, to ICAR-CMFRI. It was also decided to obtain the views of invitees who were unable to attend the workshop, through online interactions.

Recommendations

1. Acknowledging that marine species in general, and sharks[1] in particular, have not received adequate attention for conservation, the Ministry of Environment, Forests & Climate Change (MoEF&CC) may consider establishing a suitable body to devise conservation strategies of marine fauna - ***"Marine Life wing*** or "***National Board for Marine Life***"
    - Members of this board may be inclusive of representatives of various departments including, but not limited to, the MoEF & CC, Fisheries Department, MPEDA, and eminent researchers for subject groups.
    - The mandate of this board should be the conservation and management of marine life, including the development of robust species conservation criteria, not restricted to listing and delisting of marine species in the WPA and regular assessment and implementation of the assessment, and improved guidelines and conservation policies related to marine life.

    Recognizing that some species of sharks currently listed in Wildlife (Protection) Act 1972 are either not available in the Indian EEZ or have been misidentified. This expert meeting may be called for modifications in WPA.

2. Recognizing the complexities of marine faunal conservation, form a new section in WPA to cater to the conservation actions in marine sections.

3. Understanding that the listing of marine species has been done following listing criteria of terrestrial species, it is essential that
    - A standard set of scientifically justified criteria to assess species for a listing of marine species, particularly sharks, on the WPA be developed through consultative workshops,
    - Shifting of species from one category to another may be done if required, based on periodic scientific assessment,
    - Conservation actions may be designed, implemented, and adapted to address the objectives of each Schedule with provision for de-listing and shifting between the Schedules,
    - Listing and delisting species may be considered every 5 years, after extensive stakeholder consultations between researchers, policy-makers, fishers and traders

4. Knowing that protection of listed species is the domain of MoEF&CC and fisheries management is the mandate of the Department of Fisheries (DoF) of the Ministry of Fisheries, Animal Husbandry and Dairying (MoFAH&D), while fisheries research is under the purview of the Ministry of Agriculture & Farmers Welfare (MoA&FW), coordination between the three Ministries/concerned Departments is necessary for effective conservation of sharks. it is also necessary to empower the Fisheries Departments of every State and Union Territory to take necessary steps to implement the WPA.

[1] *Sharks – including sharks, rays, guitarfishes, sawfishes and skates*

5. Considering that India does not have a shark management plan in place, despite being one of the major shark fishing nations in the world and fishery trends suggest that the populations of many species of sharks are declining in the Exclusive Economic Zone of India (EEZ), early implementation of the National Plan of Action-Sharks, updated to suit the present-day needs and with revised timelines in place is called for.

6. Identifying that fishing (including overfishing and bycatch) is the single largest cause for the decline of shark populations, it is critical to devise, implement and adapt spatial and temporal management measures at the species level in a participatory mode and not affecting the livelihood of dependent communities.

7. Recognizing the need to develop a strong database on shark landings, diversity, abundance and biology, research institutes may strengthen the collection of relevant data on the biological characteristics required for conservation, particularly on spatial and seasonal aggregations of different species, and stock assessments from landings must be mandatorily done using a standard methodology for as many landed species as possible.

8. Recognizing the global significance of shark conservation, research institutes must undertake detailed ecological studies on rare, endangered and threatened species to develop conservation measures and devise Species Recovery Plans using existing and recognized guidelines (e.g. IUCN).

9. Acknowledging the complexities in shark taxonomy that limit correct identification of many species in field-level observations, catalogues of specimens in institutes/repositories across the country may be shared and made available on a public portal, with provisions for updating identification and nomenclature using the latest identification guides and tools.

10. Noting that the information and interest groups on sharks in India are scattered, with little coordination, a network of interest groups may be established to exchange information, advice and referrals to assist in meeting the objectives of shark conservation –
    - a network including shark researchers, conservationists, policymakers, specialist fisher groups, shark traders, across mainland India and the islands,
    - creation of a public portal for information sharing (sighting, identification, images, habitat information, landing data etc.)

11. Considering the lucrative global trade on the non-fin parts of sharks, and the domestic demand for shark meat in fresh and dried forms, it is important to evaluate, regulate and monitor fishery and trade, and drivers with catering to specific provisions –
    - reach out to areas not directly associated with marine life, to control the movement of sharks/shark parts from India to international markets,

- allow internalization of CITES Appendices for implementation in India with species reported in India being treated following the WPA-1972,
- establish inter-agency coordination mechanism for trade controls, especially for CITES-listed species reported and recorded within Indian waters and reporting of the same to the CITES Secretariat as part of India's commitments towards CITES resolution.

12. Recognizing the importance of molecular tools in the control of illegal trade in protected sharks and other marine species, it is necessary to establish a National Data base of Genes through already existing (NBFGR) schemes of preserving genes/genetic details of endangered species or creating a new system.

13. Recognizing the importance of public awareness for successfully implementing conservation plans, stakeholder-specific programmes may be undertaken for –
    - capacity enhancement of enforcement agencies for implementation and monitoring of illegal trade and wildlife crime in marine species, particularly sharks,
    - awareness generation among stakeholders involved in the supply chain, ranging from fishermen to traders, exporters and consumers.

14. Observing the interest and passion shown by the participants of the Consultative Workshop held in Kochi, a larger Consultative Workshop/meeting at Delhi may be held with the participation of policymakers, marine life researchers, fishermen, traders and representatives from DoF, MoEF&CC, MoA and non-governmental organizations.

Annexure-I

Consultative Workshop on Threatened and Protected Elasmobranchs Of India: Conservation Status and Policy Needs
4-6 February 2020, ICAR-CMFRI, Kochi, India
Venue- Room 201

Program schedule

Day 1 4th February 2020

09.30	**Registration**	
10.00	Welcome & Opening Remarks/Address **ICAR-Central Marine Fisheries Research Institute**	Dr. Zacharia. P.U Head, DFD, ICAR-CMFRI Dr A. Gopalakrishnan Director, ICAR-CMFRI
10.45	Background of the Workshop	Dr Shoba Joe Kizhakudan – CMFRI
11.00	**Tea/Coffee Break**	
11.15	**Information Session** Role of organizations involved in elasmobranchs research, conservation and management in India	Presentations/talks by representatives of : WWF, Dakshin Foundation, WTI, WCS, ZSI, FSI, Kerala University, KUFOS, Ashoka University, ICAR-CMFRI
13.00	**Lunch**	
13.30	**Discussion session** Is the Wildlife (Protection) Act, 1972 effective in the conservation of elasmobranchs in India?	Dr. E. Vivekanandan Former Principal Scientist & Head, DFD, ICAR-CMFRI
15.00	**Coffee break**	
15.30	**CMFRI open house-Visit Institute laboratories, Museum, Aquarium**	
16.30	**Meeting Photograph, Break for the day**	

Day 2 5th February 2020

10.00	**Discussion session** Sharks in Wildlife (Protection) Act, 1972: what we know?	Dr. Akhilesh KV, ICAR-CMFRI & Group discussion
11.00	**Coffee break**	
11.10	Genetic tools in elasmobranch conservation	Dr. A. Gopalakrishnan Director, ICAR-CMFRI
11.30	**Discussion session** Scope for modifications of species list in WPA (what, where, when) Criteria for including marine species in WPA (Draft criteria to be developed based on IUCN/CITES/NDF/CMS etc.)	Group discussion

13.00	**Lunch**	
13.30	Assessing the status, high-risk elasmobranchs in Indian waters	Participant Driven/Group discussion
15.00	**Coffee break**	
15.30	Issues and opportunities for conservation and how to implement conservation measures	Participant Driven/Group discussion
16.30	**Break for the day**	

Day 3 6th February 2020

10.00	Outputs of the workshop Recommendations	Moderated discussion & Work Group presentations
11.00	**Coffee break**	
11.30	Outputs of the workshop Recommendations	Moderated discussion & Work Groups presentations
13.30	**Lunch**	

END OF THE WORKSHOP

Day 3 6th February STAKEHOLDER MEETING

Moderators: Dr. P U Zacharia, Dr. Shoba Joe Kizhakudan, Dr. Najmudeen T M, Mr. Majeed (Stakeholder)

14.30	**Discussion session: stakeholders,** Shark Policy, Interventions and impacts	Moderated discussion (fishers/traders/agents/exporters)
16.15	**Coffee**	

Annexure-II

List of invitees and participants

Sl. No.	Name, Designation & Affiliation	E-mail
Invitees and Participants from Government Organizations, Universities and NGOs		
1	Inspector General of Forests (WL)* The Ministry of Environment, Forest and Climate Change (MoEF&CC) New Delhi	igfwl-mef@nic.in
2	Chairman* The Marine Products Export Development Authority, Kochi, Kerala	chairman@mpeda.gov.in
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5	Shri. N. Vasudevan, IFS*, Additional Principal Chief Conservator of Forests, Maharashtra	nvasudevan@rediffmail.com
6	Dr. Shekhar Kumar Niraj IFS* Advanced Institute for Wildlife Conservation Tamil Nadu	shekhar.niraj@gmail.com
7	Dr. Saket Badola, IFS* Head, TRAFFIC – India New Delhi	trafficind@wwfindia.net
8	Dr. Dr Kailash Chandra* Director, Zoological Survey of India (ZSI), Calcutta, West Bengal	director@zsi.gov.in
9	Dr. Pravin P* Assistant Director General (Marine Fisheries), ICAR, Delhi	pravinp2005@gmail.com
10	Dr. Ramalingam. L* Director General Fishery Survey of India, Maharashtra	
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*Did not attend
**Participated in post workshop online interactions

Annexure III

Group discussion – Themes and teams

Themes

Theme 1 Criteria and framework for assessing the status of species

Theme 2 Species to be considered for listing/delisting in WPA

Theme 3 Research needs and data collection

Theme 4 Conservation opportunities and barriers

Theme 5 Formation of a network of shark researchers in India

Teams

Theme 1	Theme 2	Theme 3
Dr. E. Vivekanandan	Dr. P.U. Zacharia	Dr. Naveen Namboothri
Dr. Shoba Joe Kizhakudan	Dr. V. Mahesh	Mr. Vishnu
Ms. Trisha Gupta	Dr. Divya Karnad	Ms. Alissa Barnes
Dr. Vardhan Patankar	Ms. Zoya Tyabji	Dr. Muktha M.
Dr. Rekha J Nair	Dr. Sijo Varghese	Dr. T.M. Najmudeen
Mr. Sajan John	Dr. K.V. Akhilesh	Dr. Livi Wilson
Mr. Mayuresh Gangal	Dr. G.B. Purushottama	Ms. Malaika Vaz
Dr. Sujitha Thomas	Mr. Vinod M	Dr. K.K. Bineesh

Themes 3 & 4: Open discussion

Annexure IV

To identify the conservation status and prioritization of species that need urgent attention and for an easy framework, SHIFT analysis was developed during the workshop.

Criteria and scoring for SHIFT analysis

Criteria*	Explanation (with a scale of 1-5, 5 as highly vulnerable score)
Size	Though size varies with species, the higher the size, higher are the chances of fishing or other anthropogenic interaction. Size/age at maturity scale can replace the same.
Habitat	Habitat specific or generalists, within the known distribution range. Endemism and special habitats to be considered for highly vulnerable score.
International /regional legislation	Many species are included in CITES, IUCN, IOTC and CMS etc. due to conservation needs. Global trends may not always reflect national or regional trends. However, with relevant knowledge on regional status, scoring can be improved.
Fishing pressure or other threats	The area inhabited and that is exploited or under threat.
Trade pressure	Exploitation for utilization in addition to special drivers for incentives (Gills, fins, export, etc.)

**Additional criterion and scoring for local trends, individual species/family (see Table 1)*

- Species conservation score (SCS) = Total added score for species /Maximum score that can be obtained from criterion *100
- The species with an SCS score of >50% may be considered for conservation attention.

Annexure V

Workshop photographs

Dr. A. Gopalakrishnan, Director, ICAR-CMFRI interacting with participants

Workshop discussions in progress

Workshop discussions in progress

Participants of the workshop

Post-workshop stakeholder meeting with fishers and traders

Incidental landing of some threatened and protected elasmobranchs @CMFRI Annual Report, 2017

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- Dr E. Vivekanandan, Principal Scientist (Retd.) & Former Head, Demersal Fisheries Division, ICAR-Central Marine Fisheries Research Institute, Kochi, for leading the workshop discussions and expert advice provided.

- Dr Daniel Fernando, Blue Resources Trust, Sri Lanka, for support and valuable insights provided.

- Dr Nick Dulvy, Professor, Simon Fraser University, Canada & Co-Chair, IUCN Shark Specialist Group, for comments and valuable insights provided.

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