Brief Communication

Strides in elasmobranch research: glimpses of ICAR-CMFRI's contributions over the last decade

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The ICAR-Central Marine Fisheries Research Institute (CMFRI) is the country's largest research institute catering to the sustainable development of and harvest from both, marine capture fisheries and mariculture. ICAR-CMFRI has made significant strides and contributions to these sectors, with focus on capture fisheries as the primary mandate since its inception in 1947. The Institute has been carrying out research on elasmobranch fisheries and biology since then. The growing global significance of elasmobranch conservation in the backdrop of declining populations of sharks that were targeted for fins, and the fact that India is one of the major elasmobranch fishing nations in the world prompted ICAR-CMFRI to initiate a dedicated national in-house research project on elasmobranchs in 2012. Since then, we have had three in-house projects and two externally funded projects focusing on different aspects of elasmobranch fisheries and conservation.

The first of the in-house projects ran from 2012-2017 and was aimed at assessing the elasmobranch resources of the Indian seas with a focus on the fishery, species composition and biology of selected elasmobranch species. This project resulted in 26 peer-reviewed articles on elasmobranch resources from Indian waters including new reports, taxonomic re-descriptions, biology, and stock assessment. A major output during this period was the "Guidance on National Plan of Action for Sharks in India" in 2015 (Kizhakudan *et al.,* 2015) which provided a framework for developing an NPOA for Sharks in India. This project also led to 25 technical articles primarily dealing with field observations of elasmobranch landings along the Indian

coast. ICAR-CMFRI was identified as a CITES Scientific Authority, and a Non-Detriment Findings document (NDF) on CITES Appendix II listed species harvested from Indian waters was brought out for the export of these species from the country (Zacharia *et al.,* 2017). Several pamphlets, posters and teaching resources were also published for easy transmission of research outputs to the public and other stakeholders.

A key achievement was the listing of 155 species of chondrichthyans (elasmobranchs and chimaeras) from Indian waters through a collaborative work by ICAR-CMFRI and the National Bureau of Fish Genetic Resources (NBFGR), Kochi Centre during 2008-2013. A parallel project funded by the Ministry of Earth Sciences supported DNA barcoding (using 655 bp region of the mitochondrial cytochrome c oxidase gene subunit 1 (COI)) for the accurate identification of chondrichthyans in India's commercial marine fishery. This has resulted in >220 GenBank submissions that helped update genetic information on several elasmobranch species available from the country. Many rare species of deep-sea elasmobranchs were re-describe, one species new to science were described and several species of elasmobranch were recorded for the first time from Indian waters

The resounding success of the first project resulted in a second in-house project on elasmobranchs which commenced in 2017 that focused on developing management strategies for sustainable exploitation and conservation of elasmobranchs in Indian seas. This project also had a sub-project on assessing the status of elasmobranchs protected under the Indian Wildlife (Protection) Act, 1972 (WPA). During this project, over 24 peer-reviewed articles have been published, including the most recent one titled "Elasmobranch conservation, challenges and management strategy in India: recommendations from a national consultative meeting" (Akhilesh *et al.*, 2023) in 'Current Science' which provides a comprehensive roadmap for elasmobranch management in India. This publication was the result of discussions held during a national "Consultative Workshop on Threatened and Protected Elasmobranchs of India: Conservation status and Policy needs" with elasmobranch researchers in the country, as part of this research project. The workshop also highlighted the need to modify the WPA with respect to the ten existing list of elasmobranchs and their conservation status. The recommendations of this workshop to amend the elasmobranch listings in different Schedules of the WPA were reflected in the recent Amendment to the Act in 2022. A field guide on batoids was also brought out

during this project (Kizhakudan *et al.,* 2018). Following the addition of more elasmobranchs in CITES Appendix II, NDFs on Silky shark (Kizhakudan *et al.,* 2019a), Thresher sharks (Kizhakudan *et al.,* 2019b), Bowmouth guitarfish (Kizhakudan *et al.,* 2022), Mako sharks (Thomas *et al.,* 2022a) and Devil rays (Thomas *et al.,* 2022b) were also brought out. Several technical articles, posters, abstracts, and online resources have also been published during this period. Since 2014, ICAR-CMFRI has estimated the Minimum Legal Size (MLS) of capture of commercially exploited marine resources, including elasmobranchs (Table 1); the MLS advisories have been adopted and enforced in some states.

As a result of these projects, India's visibility in the elasmobranch research domain was enhanced, resulting in an FAO funded project on non-fin shark and ray commodities carried out by ICAR-CMFRI, through which trade route maps were traced for different non-fin commodities, within and from the country. With FAO support, ICAR-CMFRI hosted a Global Expert Meeting to Provide Expert Guidance on Collection and Reporting on Use, Market and Market Chain Information for Shark and Ray Commodities in July 2019, in which delegates from nearly 20 countries participated. ICAR-CMFRI has also been working tirelessly to increase the researcher stakeholder interface and during the past decade, 30 stakeholder meetings and 14 awareness campaigns on elasmobranch fisheries and conservation were conducted in all the maritime states, for stakeholders across various levels. The impact of these interactions has been visible in the increasing instances of live release of protected elasmobranchs accidentally caught and increased transparency in data from fishers and traders.

Table 1. Minimum Legal Size of capture for elasmobranchs in India

Scientific name	Common name	MLS	Reference
Carcharhinus limbatus	Blacktip shark	98 cm TL	Sivadas *et al,* 2017
Carcharhinus falciformis	Silky shark	180 cm TL	Sivadas *et al,* 2017
Scoliodon laticaudus	Spadenose shark	38 cm TL	Anulekshmi *et al,* 2018
Rhizoprionodon acutus	Milk shark	58 cm TL	Sivadas *et al,* 2017
Rhizoprionodon oligolinx	Grey sharpnose shark	53 cm TL	Mohamed *et al,* 2014
Brevitrygon imbricata	Bengal whipray	14 cm DW	Mohamed *et al,* 2014
Pateobatis jenkinsii	Jenkin's whipray	61 cm DW	Mohamed *et al,* 2014
Gymnura poecilura	Longtailed butterfly ray	50 cm DW	Anulekshmi *et al,* 2018
Sphyrna lewini	Scalloped hammerhead shark	220 cm TL	Thomas *et al,* 2021

In August 2023, ICAR-CMFRI brought out the biology-based Marine Fish Stock Status of India 2022 (CMFRI, 2023) that provided an overall assessment of the health status of 135 marine fish stock under the prevalent fisheries management regime in the country, following the FAO's sustainability indicators criteria based on the MSY concept. The report has covered a wide variety of fisheries resources commercially harvested along the Indian coast including five stocks (four species) of elasmobranchs of which two species were identified as being overfished – the Smoothback guitarfish *Rhinobatos lionotus* along the northeast coast of India and the grey Sharpnose shark *Rhizoprionodon oligolinx* along the northwest coast. The report was appreciated by the Department of Fisheries–Govt. of India, and it advised all the coastal states to follow the recommendations and management measures given in the report.

One of the major services provided by ICAR-CMFRI is monitoring and identifying elasmobranch products moving into international trade from India. On several occasions ICAR-CMFRI experts have been called upon to identify elasmobranch species from trade consignments for regulatory agencies like Wildlife Crime Control Bureau (WCCB), Customs, Directorate of Revenue Intelligence (DRI), Port authorities etc. Species and product identification are done using classical and molecular taxonomy tools. The first instance of forensic identification of tissue of the protected whale shark in an export consignment was done by the collaborative effort of ICAR-CMFRI and NBFGR.

ICAR-CMFRI's expertise in elasmobranch research continues to receive global recognition. Our researchers were included in IUCN Subject Specialist Groups and CITES panels. ICAR-CMFRI has also provided information to the most recent initiative of spatial-management of elasmobranchs namely, Important Shark-Ray Areas (ISRA) led by IUCN. The most recent recognition has been a request from the Government of Oman to review and provide technical guidance for their shark and ray

research programs, including the use of classical and genetic taxonomic identification tools. ICAR-CMFRI has also made noteworthy contributions to genetic studies on several elasmobranch species such as hammerhead and spadenose sharks, which will help in fine-tuning species-specific management actions.

ICAR-CMFRI's work on elasmobranchs will continue in the next five years with a focus on decoding the interplay of fisheries-dependent and fisheries-independent factors on these important resources to improve their conservation, sustainability, and management in India as well as ensure the livelihood security of communities that are dependent on elasmobranch fishing and trade in the country.

All the references mentioned here are ICAR-CMFRI's open-accesspublications on elasmobranchs are open-access and can be accessed from

http://eprints.cmfri.org.in/view/subjects/Shark.html
http://eprints.cmfri.org.in/view/subjects/rays.html
http://eprints.cmfri.org.in/view/subjects/Sub24.html

References

Anulekshmi *et al.,* 2018. *Mar. Fish. Infor. Serv., T & E Ser.*, 238: 23-25.

Kizhakudan *et al.,* 2022. *CMFRI Marine Fisheries Policy Series No.22/2022: India Non-Detriment Finding (NDF) for bowmouth guitarfish Rhina ancylostoma in the Indian Ocean.* ICAR- Central Marine Fisheries Research Institute, Kochi.

Kizhakudan *et al.,* 2019a. *CMFRI Marine Fisheries Policy Series No.13/2019 India Non-Detriment Finding (NDF) for silky shark, Carcharhinus falciformis, in the Indian Ocean.* ICAR- Central Marine Fisheries Research Institute, Kochi.

Kizhakudan, *et al.,* 2019b. *CMFRI Marine Fisheries Policy Series No.14; India Non-Detriment Finding (NDF) for thresher sharks, Alopias* spp.*, in the Indian Ocean.* ICAR- Central Marine Fisheries Research Institute, Kochi.

Kizhakudan *et al.,* 2018. *Field identification of batoids – a guide to Indian species.* ICAR–Central Marine Fisheries Research Institute, Kochi.

Kizhakudan *et al.,* 2015. *CMFRI Marine Fisheries Policy Series No.2; Guidance on National Plan of Action for Sharks in India.* Central Marine Fisheries Research Institute, Kochi.

Mohamed *et al.,* 2014. *Mar. Fish. Infor. Serv., T & E Ser.,* 220: 3-7.

Sivadas *et al.,* 2017. *Mar. Fish. Infor. Serv., T & E Ser.,* 232: 3-6.

Thomas *et al.,* 2022a. *CMFRI Marine Fisheries Policy Series No.19/2022: India Non-Detriment Finding (NDF) for Mako sharks, Isurus* spp. *in the Indian Ocean, 2022 to 2026.* ICAR- Central Marine Fisheries Research Institute, Kochi.

Thomas *et al.,* 2022b. *CMFRI Marine Fisheries Policy Series No.21/2022: India Non-Detriment Finding (NDF) for Devil Rays Mobula* spp. *in the Indian Ocean, 2022 to 2024.* ICAR- Central Marine Fisheries Research Institute, Kochi.

Thomas *et al.,* 2021. *Aquatic Conservation: Marine and Freshwater Ecosystems.* pp. 1-15.