A call for spatial management approach to control exploitation of juvenile sharks

K. V. Akhilesh[1], Thakur Das[1], C. Anulekshmi[1], T. Swapnil[1], Y. Gladston[1] and Shoba Joe Kizhakudan[2]
Mumbai Regional Station of ICAR-Central Marine Fisheries Research Institute, Mumbai - 400 061, Maharashtra
Madras Regional Station Research Centre of ICAR-Central Marine Fisheries Research Institute, Chennai-600 028, Tamil Nadu
E-mail: akhi.kv@gmail.com

Historically in the Indian coastal regions, elasmobranchs have been caught, traded, and consumed for centuries. In some regions (including non-coastal, high-altitude and interior regions), there is a high preference for certain elasmobranch species, products, and cuisines. While India has banned international trade of shark fins since 2015, and extended protection to ten species of sharks under the Wildlife (Protection) Act,1972, there is no restriction on the harvest, domestic trade, and consumption of elasmobranchs. Maharashtra accounts for 8.2 % of the average annual (2014-19) estimated elasmobranch landings in India that show a declining trend from 5779 tonnes in 2014 to 1786 tonnes in 2019.Here, unusual landing of neonatal and juvenile sharks dominated by carcharhinids are observed in the landings by the nearshore (operated within 10-30 m depth zone) monofilament gillnet (10-20 cm mesh size) or trawl fishery, soon after resumption of fishing activities in August after the mandatory annual monsoon fishing ban period of 45 -60 days. The landing of juvenile sharks extends for 2-3 months, the quantity fluctuates and declines over the period (Fig.1). After this the fishery usually shifts to other species and locations. These operations in nearshore regions, are mostly with gillnets and its local variants or specialized nets for sharks, called as "*mushichi jal*" or "*dharey*". Juvenile shark landing is mostly observed from gillnet fisheries operated off northern Maharashtra (off Murud) and trawl, gillnet and hook and line fisheries in southern Maharashtra (mostly operated off Dandi, Malavan, Harne) with minor variation in species composition, size class and quantity. In southern Maharashtra, non-motorised or motorised gillnetters (OAL 8-10 m) operating in April-September also catch shark juveniles which are sold at a high price.

Sharks belonging to Carcharhinidae and Sphyrnidae families were observed in the nearshore gillnet landing during August regularly for the last three years (2017-2019) at one of the regular fishery monitoring locations, Sassoon Dock, Mumbai (Table.1). Each boat (wooden/FRP 10-16 m OAL) landed ~120-800 kg sharks. Interestingly, the total number of rays observed in this particular seasonal fishery was less than 1%. In 2018, the estimated gillnet landing at Sasson dock, Mumbai was 274 tonnes, where *S. laticaudus* accounted for 56% sharks landed, followed by *C. brevipinna* (8.3%) and *C. limbatus* and *Sphyrna lewini* (7.3%), with monthly average 70 kg/unit, ranging from 1.6 kg/unit in June to 157 kg/unit in August. Though diverse sharks and rays are caught and landed in Maharashtra, the species composition of these nearshore

Fig. 1. Juvenile shark landings in Maharashtra in A) September 2014, Sassoon Dock; B) October 2015, Sassoon Dock; C) August 2017, Sassoon Dock; D) July 2018, Malvan; E) April 2019, Harne; F) August 2019, Sassoon Dock; G & H) August 2020, Malvan; I) August 2020, Sassoon Dock

Table.1. Sharks occurring in the gillnet fishery landings in August at Sassoon Dock, Maharashtra (2017-2019)

Scientific name	Common name	Size range (cm)	Biological details *			IUCN Red List Assessment status (Global)	IUCN Red List Assessment Arabian Sea Region**
			Size at birth (cm)	Size at Maturity (cm)	Maximum length (cm)		
Carcharhinus amblyrhynchos	Grey reef shark	49-105 (n=165)	45-75	♀120-142, ♂110-145.	255	Near Threatened	Endangered
C. amblyrhynchoides	Graceful shark	52-112 (n=22)	50-60	♀167, ♂140.	178	Near Threatened	Vulnerable
C. brevipinna	Spinner shark	65-106 (n=202)	60-81	♀170-220, ♂159-203.	283	Near Threatened	Vulnerable
C. leucas	Bull shark	76-185 (n=13)	55-81	♀180-230, ♂157-226.	340	Near Threatened	Endangered
C. limbatus	Blacktip shark	60-116 (n=85)	38-72	♀120-190, ♂135-180.	258	Near Threatened	Vulnerable
C. melanopterus	Blacktip reef shark	84-89 (n=3)	33-52	♀96-120, ♂91-113.	<200	Near Threatened	Vulnerable
C. macloti	Hardnose shark	38-100 (n=12)	38-50	♀70-89, ♂69-81.	110	Near Threatened	Near Threatened
C. sorrah	Spottail shark	51-116 (n=153)	45-60	♀110-118, ♂103-128.	<180	Near Threatened	Vulnerable
Lamiopsis temminckii	Broadfin shark	63-140 (n=26)	42-65	♀143, ♂136.	178	Endangered	Endangered
Rhizoprionodon acutus	Milk shark	40-90 (n=32)	25-40	♀70-81, ♂68-72.	178	Least Concern	Near Threatened
R. oligolinx	Grey sharpnose shark	35-87 (n=25)	20-30	♀32-41, ♂29-45.	90	Least Concern	Near Threatened
Scoliodon laticaudus	Spadenose shark	26-73 (n=83)	12-15	♀33-35, ♂24-36.	75	Near Threatened	Near Threatened
Sphyrna lewini	Scalloped hammerhead shark	40-110 (n=89)	40-57	♀200-250, ♂140-198.	420	Critically Endangered	Endangered

*Source : Ebert et al. 2013; Jabado & Ebert, 2015 ** Jabado et al 2017

gillnet fisheries remain mostly unchanged (Table 2). The presence of neonates and juveniles suggests that these could possibly be nursery areas and there is a need for dedicated studies to ascertain the same.

The practical implementation of shark conservation measures is often limited due to complex and challenging issues. Many commonly suggested management measures like gear modification, live release, and blanket ban on exploitation are impossible in the mixed-species fishery of India where diverse craft and gear combinations are operated in the same fishing locations. The possible and suitable solution to address this recurring juvenile bycatch is spatial conservation planning in consultation with all the stakeholders. The immediate challenges of spatial management will be identifying the geographic range, spatial movement of aggregation, if any, and the duration. Juvenile sharks are generally caught in the nearshore waters from April to October along the Maharashtra coast. Considering the high quantum of juvenile landings in August and their decreasing numbers in the succeeding months any conservation spatial planning should be made with detailed ecosystem, species habitat preference information and migration details.

Though shark consumption is common and there is a good local demand for juvenile sharks in Maharashtra, the entire landed quantity is not wholly used in the state. The juvenile sharks are normally sold at ₹150-350 per kilogram (except *S. laticaudus,* which fetches a lower price in comparison to other species) and traded to different parts of the country. Even though this type of short-term juvenile shark harvest is a source of income for gillnet fishers, the fishers are not solely dependent on shark fisheries, and most of them are willing to change their fishing patterns if proper incentives are provided by the government. During multiple awareness programs and stakeholder consultation meetings organised by ICAR-CMFRI in Mumbai, several fishermen had agreed to share information on juvenile aggregation grounds of exploited fishes, to consciously

Table.2. Estimated shark landing in the seasonal gillnet fishery of 2018 at Sassoon Dock

Species	Estimated landing (kg)
C. amblyrhynchoides	6549
C. amblyrhynchos	13612
C. brevipinna	22794
C. leucas	1700
C. limbatus	20059
C. macloti	907
C. melanopterus	488
C. sorrah	19587
C. arabicum	573
G. cuvier	953
L. temminckii	748
R. acutus	6112
R. oligolinx	5659
S. laticaudus	152923
S. lewini	20110
Other sharks	1013
Total landings (kg)	273785
Units	4024
Hours	110791
CPU (kg/unit)	70

avoid fishing in such areas and move towards spatial or other conservation measures. However, the support and cooperation of all fishers is required and a challenge to achieve this is a general trend of reasoning "*if I do not catch it, someone else will, so why should I lose my opportunity?*". A common regulatory approach with scientific support, for all crafts and gears effecting temporal and spatial closures, demarcation of no-fishing zones and simultaneous intensive awareness programs among all the stakeholders is highlighted.

References

Ebert *et al.*, 2013. Sharks of the world. Wild Nature Press,Plymouth, UK.

Jabdoo, R. W. and D. A. Ebert. 2015. Sharks of the Arabian Seas: An identification guide, 240 p.

Jabado, R. W. *et al.*, 2018. Fish and Fisheries, 19: 1043 - 1062.