

Shark diversity in the Indian Sundarban biosphere

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Abstract

Human activities are rapidly expanding, posing a danger to ocean biodiversity. A review of shark diversity in the Indian Sundarban Biosphere is presented in this present study. Out of the 70 shark species found in the Indian Ocean, researchers discovered 22 have a limited distribution, 12 are quite abundant but not consistently taken, and just 6 have a vast range. Records confirmed the existence of 16 species in Sundarban. *Glyphis gangeticus* is the sole indigenous species to the Gangetic delta, although it, along with *Carcharhinus hemiodon*, is uncommon that it was never spotted in the previous decade.

Keywords: Shark diversity, Sundarban Biosphere, Gangetic delta, Ocean biodiversity.

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Introduction

Sharks are a major component of marine and estuarine ichthyofauna, and their ecological and commercial importance is remarkable (Haroon 2011; Roy 2011). Currently, 1199 chondrichthyan species are identified, of which 611 are rays, 536 are sharks and 52 are chimeras (Dulvy et al. 2021), with over 117 of them found in the Indian Ocean (Mandal et al., 2013; Ebert, 2014; Mitra, 2019).

According to Dulvy et al. (2021), overfishing is the universal threat affecting all 391 threatened species and is the sole threat for 67.3% of species, and interacts with three other threats for the remaining third: loss and degradation of habitat (31.2% of threatened species), climate change (10.2%), and pollution (6.9%). Similarly, human stressors originating locally, regionally, and globally are affecting the Sundarban ecosystem (Vyas 2012; Kandasamy 2017). Human-wildlife conflicts (24.35%), salinity change (19.93%), and climate change (18.82%) are the three major anthropogenic causes influencing the fragile balance of the Sundarban ecosystem, according to stakeholder engagements (Vyas 2012; Khan et al. 2020). Recurrent coastal flooding is caused by climate change (global warming), changes in sea level (rise in sea level), huge silt deposition, uncontrolled collection of prawn seedlings and fishing in the water of reserve forests, pollution from both the landward and seaward sides through marine paints and hydrocars, and other anthropogenic activities such as reclamation, human encroachment, and influence, geomorphic stress caused by the neo-tectonic tilting of the Bengal basin (Huxham et al. 2010; Kumara et al. 2010; Bain et al. 2019).

The Sundarban mangrove forest is a unique environment of estuarine and coastal marine fish fauna that has drawn a lot of attention due to the great economic importance of many species and the livelihoods of thousands of poor people living in the area (Raha 2004). It accounts for 2-5% of total catch fisheries (Mozumder et al. 2018; Habib et al. 2020). However, due to a paucity of species-specific studies on their ecology, biology, habitat, trade, and species composition, little is known about its sharks (Haldar 2010; Hoq et al. 2011; Fischer et al.

Table 1. List of shark species reported in Indian Sundarban and their status (A = Available, C = Common, CR = Critically endangered, E = Endangered, L = Least concern, N = Near threatened R = Rare, VR = Very rare, V = Vulnerable).

Species	Common name	Local name	Distribution	Occurrence	Physical characteristics features	Feeding behaviour	IUCN status
<i>Carcharhinus dussumieri</i> (Valenciennes, 1893)	White cheeked shark	Ramkuki	Coastal areas	C	Slender body; snout pointed and long, attains upto 1 m.	Feeds largely on small fishes, crustaceans and molluscs.	E
<i>Carcharhinus hemiodon</i> (Muller & Henle, 1839)	Pondicherry shark	Kamat	Coastal areas	VR	Robust build body; moderately long; pointed snout; upper and lower jaws contain 14-15 and 12-14 tooth rows respectively, grows upto about 1 m.	Feeds on bony fishes, crustaceans, squids etc.	CR
<i>Carcharhinus leucas</i> (Muller & Henle, 1839)	Bull shark	Hangar	Coastal and offshore waters; also ascends rivers including Hooghly	C	Large stout body; snout very broadly rounded and extremely short; attains upto 2.25m	Feeds on mackerel, tuna, small sharks, rays, invertebrates and turtles.	V
<i>Carcharhinus limbatus</i> (Muller & Henle, 1839)	Black tip shark	Hilsa/lish Kamat	Coastal and offshore waters	R	Body fusiform and moderately slender; teeth in 14/16 rows and with erect narrow cusps and serrated edges; attains upto 2.5m length.	Feeds predominantly on fish and crustaceans.	V
<i>Carcharhinus melanopterosus</i> (Quoy & Gaimard, 1824)	Black fin reef shark	Madhukuki	Coastal and ocean waters	C	Body slender; snout very short and bluntly rounded; teeth in 11 or 13 rows; attains about 2.5m.	Mainly feeds on fish.	V
<i>Carcharhinus sorrah</i> (Muller & Henle, 1839)	Spot tail shark	Hangor	Coastal and ocean waters	C	Spindle-shaped; fairly long, pointed snout and moderately large eyes; large and curved first dorsal fin and second dorsal fin is small and low; grows upto about 1.6 m.	Feeds on bony fish, cephalopods and crustaceans.	N
<i>Chiloscyllium griseum</i> (Muller & Henle, 1838)	Grey bamboo shark	Bans hangor	Coastal and ocean waters	A	Brown coloured and has no colouration, grows upto about 74 cm.	Feeds on fish.	V
<i>Eusphyra blochii</i> (Cuvier, 1816)	Winghead shark	Haturi mukho hangar	Coastal	C	Body elongated and laterally compressed; broad arrow shaped head extremely wide; eyes and nostrils widely separated; attains a length of about 1.5m.	Feeds on fishes and crustaceans.	E
<i>Galeocerdo cuvier</i> (Peron & Lesueur, 1822)	Tiger shark	Bhagha	All tropical seas, oceans, coastal and offshore water; prefers to remain in shallow water	C	Body fusiform, snout short and broadly rounded; large sized and can attain length upto 5.5 m.	Feeds on fish, squids, sea snakes, turtles, dolphins and even small sharks.	N
<i>Glyphis gangeticus</i> (Muller & Henle, 1893)	Ganges Shark	Gangar hangar	Hooghly-Matla River system; endemic to Gangetic delta	VR	Body moderately stout; short snout; cusps of lower teeth narrow; tail erect and strongly hooked. It can attain length upto 204 cm.	Feeds mainly on fish.	CR
<i>Glyphis glyphis</i> (Muller & Henle, 1839)	Spear tooth shark	Kamat	Exclusively in the heavy turbid fresh to estuarine areas with fast tidal currents and muddy bottoms.	R	Robust streamlined body with a short, wide head; snout flattened; eyes are small; upper and lower jaws contain 26-29 and 27-29 tooth rows respectively. It can attain length upto 260 cm.	Feeds on bony fishes, shrimps and crustaceans.	V
<i>Lamiopsis temminckii</i> (Muller & Henle, 1839)	Broad fin shark	Boropakhna hangar	Coastal waters, not far off the coast.	R	Pectoral fins are broad shaped. It can attain length upto 168 cm.	Primarily feeds on crustaceans, bony fish and cephalopods.	E
<i>Rhizoprionodon acutus</i> (Ruppell, 1837)	Milk shark	Kamat	Coastal near beaches and in estuaries.	C	Slender body with a long, pointed snout and large eyes, and is a nondescript gray above and white below; typically measures 1.1 m long.	Primarily on small bony fishes.	L

Table 1. Continued

<i>Scoliodon laticaudus</i> (Muller & Henle, 1838)	Yellow dog shark/ Indian dog shark	Kamat	Widespread	C	Body slender and fusiform; snout long and depressed. It can attain length upto 120 cm.	Feeds largely on small fishes, crustaceans and squids.	N
<i>Sphyrna mokarran</i> (Ruppell, 1837)	Great hammerhead shark	Raban	Widespread	R	Body elongated and laterally compressed; head hammer shaped; eyes and nostrils close together; attains a length of approximately 5m.	Feeds on fishes, small sharks, string rays etc.	V
<i>Stegostoma fasciatum</i> (Herman, 1783)	Zebra shark	Hangor	On the sea floor	C	Cylindrical body with 5 longitudinal ridges; large, slightly flattened head and a short, blunt snout; eyes are small and placed on the sides of the head; low caudal fin comprising nearly half the total length; usually present of dark spots on a pale background; 28–33 and 22–32 tooth rows in the upper and lower jaw respectively; attains a length of 2.5 m.	Usually feeds on small fishes, molluscs and crustaceans.	V

2012). The goal of this work is to determine the current state of sharks, their conservation status, and the fishing equipment and crafts deployed on the Indian side of the Sundarban, which may help in the preparation of a local as well as a national plan of action (NPOA) on sharks and their management.

Shark diversity in Indian Sundarban: India holds second position to have catch shark globally (Lack and Sant 2011). Hanfee (1999) found 22 shark species have a limited distribution, 12 are reasonably plentiful but not regularly captured, and just 6 have a widespread distribution out of 70 shark species found in the Indian Ocean. In Sundarban, records revealed the presence of 16 species (Table 1). Among them, *Glyphis gangeticus* is the only species endemic to Gangetic delta but the species along with *Carcharhinus hemiodon* are so rare that they were never seen in last decade (Pal et al., 2014). Again, they have also reported absence of *G. glyphis* in Sundarban.

Status of Shark fishery in Sundarban: Sharks keep the number of many species in the environment under check as a highly efficient predator. Shark fisheries were mostly ignored in the 1950s and 1960s since shark flesh was less desirable for food due to its unpleasant odor caused by the presence of tri-methylamine (TMA) (Joshi et al., 2008). Because shark fins have a high export value, it was normal practice to extract and keep the fins while discarding the injured sharks obtained by various fishing gears. However, shark fishing has gained popularity in recent years, particularly in India and other parts of the world, owing to a rise in demand for seafood in general. The high price of shark fins, liver oil, cartilage, and skin fueled the tremendous demand for shark fins, liver oil, cartilage, and skin (Hanfee, 1999). In the Sundarban, however, shark fishing is a by-catch rather than a targeted or regular fishery (Prado and Drew, 1991; Joshi et al., 2008; Hoq et al., 2011).

The human-shark conflict in Indian Sundarban: A human-shark fight is a low-key event, with most victims escaping with injuries and unable to determine whether the damage was inflicted by a shark or by another aquatic species (Vyas 2012). Those most impacted are those working in the collecting of tiger prawn (*Penaeus monodon*) seed or “bagda meen” (Pal et al., 2014). Basically, the fisherfolk involved in catching are most susceptible to the shark, which is not aiming the whole body but bites off limbs (Joshi et al., 2008; Das et al., 2016).

Threats to sharks: Shark conservation efforts are partly impeded by popular perceptions of sharks based on misconceptions and incorrect information (Garla et al., 2015). The survival of the sharks is threatened by poaching, accidental killing through entanglement in fishing gear, primarily in a nylon gill net, overexploitation (of pray fishes) mainly using small mesh-sized bottom trawl nets and irregular fishing (Bornatowski et al., 2014). Further, a mixture of domestic sewage and industrial waste is being discharged into the canal systems of Kolkata and these waters eventually reach the Sundarbans resulting in the accumulation of heavy metals and other organic pollutants in the fish body including sharks (ADB 2003). Thus, with the pace of the global picture, the

shark population in the Indian Sundarban has also been declining considerably (Pillai and Parakkal, 2000; Haroon, 2011). Reductions in shark populations have severe ecological and economic effects (Bornatowski et al., 2014). Despite increased global awareness of shark population declines and collapses over the last two decades, no international mechanism exists to ensure funding, implementation, and enforcement of chondrichthyan fishery management plans that are likely to rebuild populations to levels where they are no longer threatened (Lack and Sant, 2011; Techera and Klein, 2011; Dulvy et al., 2014).

The Bay's Marine Protected Area (MPA) should be expanded to allow them to circulate freely. A comprehensive list of shark species should be compiled, and a Shark Action Plan should be developed and implemented based on their IUCN conservation status. The trade and export of sharks should be checked on a regular basis, and correct records should be preserved. The public should also be made aware of the negative consequences of illegal shark catching and trade, as most people appear to be unaware of the existence of sharks and shark fishing in India's Bay of Bengal region.

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