

## Elasmobranch Fishery Resources of Gulf of Mannar, Southeast Coast of India

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**Abstract:** Various species of elasmobranchs are fishing out by fisher folk with increasing fishing pressure. The cartilaginous fishery resources were studied from April 2012 to October 2012 from Gulf of Mannar. The samples were identified based on their morphological characters and grouped under their family and orders. The rays shared first position and sharks contribute next among all the elasmobranch fishery resources of this region. There are 6 orders lamniformes, carcharhiniformes, orectolobiformes, myliobatiformes, pristiformes and rajiformes that hold 65 species of various elasmobranchs landed during this research. Myliobatiformes and carcharhiniformes represents 49.23% and 32.31% respectively, regarding species diversity is concerned.

**Key words:** Gulf of Mannar • Elasmobranchs • Carcharhinidae • Dasyatidae

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### INTRODUCTION

Elasmobranchs are an important part of the Chondrichthyes. The Class Chondrichthyes constitutes a distinct group of fishes whose most apparent common feature is the attainment of a cartilaginous skeleton as opposed to the bony skeleton of the Osteichthyes or bony fishes. Elasmobranchs are evolved during Devonian era 400 million years ago. At the time of Carboniferous period they did diversification in to various species, but most of them became extinct at Permian [1]. The extant species were undergone a burst of adaptive radiation during the period of Jurassic, when the first skates and rays were appeared. The living orders of elasmobranchs are date back to cretaceous or earlier [2]. The elasmobranchs consists of sharks, sawfishes, rays and skates. Their habitat ranges from near shore regions to deep oceanic waters. In the past decades, elasmobranchs have not been a highly priced fishery product. They shared low economic value ranks low between other marine commercial fisheries. Some elasmobranch species are highly priced only for their teeth and jaws, such as the great white shark. Economically viable elasmobranch product is shark fin for oriental soup, its demand recently has been increased [3]. Biological characteristics and ecological roles of elasmobranchs suggest they are vulnerable due to the continuous fishing pressure [4].

The majority of elasmobranchs are predators; they are sharing a quaternary consumer state in food chain. Their affluence is therefore rather small compared to groups settled in lower trophic levels. They are chronic and long-lived and become adult at a late age. This, together with their low fertility, results in a low procreative potential for most of the species. Reestablishments of population numbers from severe reductions either by natural or anthropogenic activities would take many decades for the majority of elasmobranchs [5]. Besides, the removal of top carnivores from marine ecosystems might elicit disagreeable logical effect for the habitat and other fishery resources [4]. Before few decades, there was no organized shark fishery in the world and the sharks were caught erratically and formed only a by catch. In the early of 1960s the shark fishery was more or less abdicated and the resource was not properly studied for a reason that the shark flesh was less preferred as an edible meat owing to its pungent odour caused by the presence of trimethylamine [6]. When there is a low demand for shark meat, the fishermen would remove the fins and throw the maimed sharks back into the sea. In recent years shark meat has high demand, both in domestic and international market. The high economic value gained by the fins, liver oil, cartilage and skin. This causes fishermen to target this species without any hesitation. This trend accelerated with the entry of attenuated fishing trawlers into the

fisheries and it has been increasing export demand for shark products. Fishermen are followed after sharks equipped with different gears exclusively to exploit sharks. As fishing for sharks gained thrust in recent years in India emanated as a major shark producing country [7]. Much of the trade is still restricted to the west coast of India. According to Misra [8], there are 78 species of elasmobranchs which include 51 species of sharks, 20 species of rays and 7 species of skates. Talwar and Kacker [9] reported 76 species of commercially important elasmobranchs. Compagno had listed 55 species of sharks from Indian Ocean in [10]. The recent list was given by Raju *et al.* [11] includes 66 species of sharks, 8 species of guitar fishes, 4 species of saw fishes and 32 species of rays thus totaling to 110 species from the Indian seas. In the last decade elasmobranch fishery in India has recognized as commercially important. During 1950 to 1990 the average annual fishery was about 53, 546 tons. A raised fishery level was estimated during 1996 to 2000 with 69, 618 tons [12]. Elasmobranchs consisting of sharks, sawfishes, rays and skates form one of the largest marine fish resources, which are exploited by different types of gears such as trawl net, mechanized (drift) gillnets and hooks and line (H and L) [13].

**Methodology:** Gulf of Mannar has declared as World Biosphere Reserve under UNESCO's Man and Biosphere Program in 1989. The Gulf of Mannar falls in the Indo-Pacific region and constitutes one of world's richest marine biological resources. This biosphere reserve extends from Rameswaram to Tuticorin, lies between 78°5'E-79°30'E and 8°45'N-9°25'N and extends to a distance of 140 km. There are 21 islands present almost parallel to the coastline of Gulf of Mannar. It is one of the world's richest forms of marine biodiversity aspect and the first Marine Biosphere Reserve in Southeast Asia. The Biosphere Reserve comprises 21 islands with estuaries, mudflats, beaches, forests of the near shore environment, including 22 marine components like algal communities, sea grasses, coral reefs, salt marshes and mangroves etc. The Exclusive Economic Zone (EEZ) of GoM is about 15,000 km<sup>2</sup> out of which the Gulf of Mannar biosphere reserve has an area of about 10,500 km<sup>2</sup> and the commercial fishing is carried out in about 5,500 km<sup>2</sup> [14].

The entire coastline of Gulf of Mannar from Thoothukudi to Dhanuskodi is protected from the fury of wind and waves by the continuance of a chain of islands or sand cays. The Island system and coral reefs spread over this region offer shelter for a variety of marine fauna

and flora. Both mechanized trawlers and non-mechanized vessels carry out the fishing throughout the year [15]. But the shore seine fishing is seasonal in certain areas particularly in the southern region, When the Gulf of Mannar covering its southern portion becomes rough during April to September, the shore seine operations shift to Palk Bay and when the Palk Bay become rough during October March, the units migrate to Gulf of Mannar [15]. The major fish landing centers are Pamban, Mandapam, Kilakarai, Ervadi, Valinokkam, Mundal, Vembar and Thoothukudi. This study carried out from April 2012 to September 2012. Elasmobranchs are the targets for this study. The landed fishes were identified based on their morphological characters. The identified cartilaginous fishes were grouped under their orders (Table 1). And total catch was also estimated while every landing has done at the fish auction centers. In recent times, fishing pressure has been increased on elasmobranchs from this biosphere. Shark products trade to foreign countries had increased from 386 tons to 1,508 tons and the value from Rs.9.5 to Rs.35.49 crores during 1996-1997 to 2000-2001 [12].

## RESULTS AND DISCUSSION

The elasmobranchs fishery exists in all the maritime states of India. Identified elasmobranchs were sorted in Table 1. Lamniformes, carcharhiniformes, orectolobiformes, myliobatiformes, pristiformes and rajiformes are the orders encountered during this study. There are 19 families that contribute 65 species of elasmobranchs in this region regarding marine fishery. The elasmobranch resources are mainly exploited by shrimp trawlers (42%) followed by gill net (26%), hooks and line (16%), dol net (3%) and others (11%). Majority of shark species are exploited by trawl net (32%), gill net (31%) and hooks and line (20%) skates are mainly clear out by shrimp trawl (86%) and rays (67%) [12]. During 1981-2000 elasmobranchs exploitation in the country as follows sharks constituted 62%, rays (34%) and skates (4%). The sharks are predominant species along west coast (76%) and rays along the east coast (52%). The sharks offered by Gujarat 78%, Maharashtra 74%, Goa 83%, Karnataka 80%, Kerala 66%, Andhra Pradesh 63% and West Bengal 61%. The rays, which dominated in the east coast, constituted 69% in Tamil Nadu and 64% in Pondicherry during 1981-2000. In India, elasmobranch landing is 49, 656 tons in 1980 and the same 116, 820 tons in 2007 [16].

Table 1: List of elasmobranch species recorded during the study

S. No.	Order	Family	Common name	Scientific name
<b>SHARKS</b>				
1.	Lamniformes	Alopiidae	Common thresher	<i>Alopias vulpinus</i>
2.	Lamnidae	Shortfin mako shark	<i>Isurus oxyrinchus</i>	
3.	Carcharhiniformes	Carcharhinidae	Graceful shark	<i>Carcharhinus amblyrhynchoides</i>
4.	Bull shark	<i>Carcharhinus leucas</i>		
5.	Blacktip shark	<i>Carcharhinus limbatus</i>		
6.	Blacktip reef shark	<i>Carcharhinus melanopterus</i>		
7.	Spottail shark	<i>Carcharhinus sorrah</i>		
8.	Tiger shark	<i>Galeocerdo cuvier</i>		
9.	Broadfin shark	<i>Lamiopsis temminckii</i>		
10.	Sliteye shark	<i>Loxodon macrohinus</i>		
11.	Milk shark	<i>Rhizoprionodon acutus</i>		
12.	Grey sharpnose shark	<i>Rhizoprionodon oligolinx</i>		
13.	Spadenose shark	<i>Scoliodon laticaudus</i>		
14.	Hemigaleidae	Hooktooth shark	<i>Chaenogaleus macrostoma</i>	
15.	Snaggletooth shark	<i>Hemipristis elongatus</i>		
16.	Sphyrnidae	Winghead shark	<i>Eusphyra blochii</i>	
17.	Scalloped hammer head	<i>Sphyrna lewini</i>		
18.	Great hammerhead	<i>Sphyrna mokarran</i>		
19.	Smooth hammerhead	<i>Sphyrna zygaena</i>		
20.	Zebra shark	<i>Stegostoma fasciatum</i>		
21.	Scyliorhinidae	Bristly catshark	<i>Halaelurus hispidus</i>	
22.	Triakidae	Bigeye houndshark	<i>Iago omanensis</i>	
23.	Arabian smooth hound	<i>Mustelus mosis</i>		
24.	Orectolobiformes	Hemiscyllidae	Grey bamboo shark	<i>Chiloscyllium griseum</i>
25.	Slender bamboo shark	<i>Chiloscyllium indicum</i>		
26.	Rhincodontidae	Whale shark	<i>Rhincodon typus</i>	
<b>RAYS</b>				
27.	Myliobatiformes	Myliobatidae	Longheaded eagle ray	<i>Aetobatus flagellum</i>
28.	Spotted eagle ray	<i>Aetobatus narinari</i>		
29.	Banded eagle ray	<i>Aetomylaeus nichofii</i>		
30.	Javanese cownose ray	<i>Rhinoptera javanica</i>		
31.	Dasyatidae	Pale spot whip ray	<i>Dasyatis alcockii</i>	
32.	Rough tail sting ray	<i>Dasyatis centroura</i>		
33.	Blue spotted sting ray	<i>Dasyatis kuhlii</i>		
34.	Small eye sting ray	<i>Dasyatis microps</i>		
35.	Common sting ray	<i>Dasyatis pastinaca</i>		
36.	Sharp nose sting ray	<i>Dasyatis zugei</i>		
37.	Bleeker's whip ray	<i>Himantura bleekeri</i>		
38.	White spotted whip ray	<i>Himantura gerrardi</i>		
39.	Scaly whip ray	<i>Himantura imbricata</i>		
40.	Jenkins' whip ray	<i>Himantura jenkinsii</i>		
41.	Black edge whip ray	<i>Himantura marginata</i>		
42.	Reticulate whip ray	<i>Himantura uarnak</i>		
43.	Dwarf whip ray	<i>Himantura walga</i>		
44.	Cowtail stingray	<i>Pastinachus sephen</i>		
45.	Blue spotted ribbontail ray	<i>Taeniura lymma</i>		
46.	Blotched fantail ray	<i>Taeniura meyeni</i>		
47.	Porcupine ray	<i>Urogymnus asperrimus</i>		
48.	Pelagic sting ray	<i>Pteroplatytrygon violacea</i>		
49.	Gymnuridae	Butterfly ray	<i>Gymnura japonica</i>	
50.	Smooth butterfly ray	<i>Gymnura micrura</i>		
51.	Long tail butterfly ray	<i>Gymnura poecilura</i>		
52.	Plesiobatidae	Deepwater stingray	<i>Plesiobatis daviesi</i>	
53.	Mobulidae	Giant oceanic manta ray	<i>Manta birostris</i>	
54.	Spine tail devil ray	<i>Mobula japonica</i>		
55.	Sickle fin devil ray	<i>Mobula tarapacana</i>		
56.	Bentfin devil ray	<i>Mobula thurstoni</i>		
57.	Short fin pygmy devil ray	<i>Mobula kuhlii</i>		
58.	Long horned pygmy devil ray	<i>Mobula eregoodootenkee</i>		

Table 1: Continued

S. No.	Order	Family	Common name	Scientific name
SKATES				
59.	Pristiformes	Pristidae	Knifetooth sawfish	<i>Anoxypristis cuspidata</i>
60.	Large tooth sawfish	<i>Pristis microdon</i>		
61.	Long comb saw fish	<i>Pristis zijsron</i>		
62.	Rajiformes	Rhinidae	Bowmouth guitar fish	<i>Rhina ancylostoma</i>
63.	Rhinobatidae	Sharpnose guitar fish	<i>Rhinobatos granulatus</i>	
64.	Widenose guitar fish	<i>Rhinobatos obtusus</i>		
65.	Rhynobatidae	Giant guitarfish	<i>Rhynchobatus djiddensis</i>	

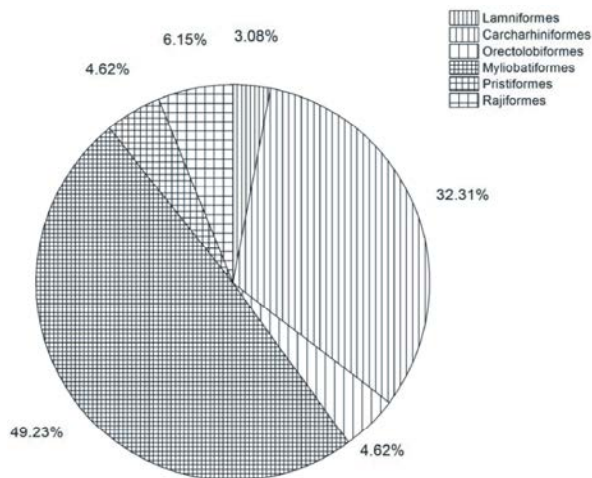


Fig. 1: Percentage of diversity between various orders of elasmobranchs

The lamniformes and carcharhiniformes are the major producers in the fishery with the value of 49.23% and 32.31% respectively in the elasmobranch landings from the study area (Figure 1). Particularly, caracharhinidae is the most diverse family with 11 species in sharks and as far as rays are concerned dasyatidae represents 18 species from the study area. The other families marked are, alopidae (sharks), lamnidae, hemigaleidae, sphyrnidae, scyliorhinidae, triakidae, hemiscyllidae, rhincodontidae, myliobatidae (rays), dasyatidae, gymnuridae, plesiobatidae, mobulidae, pristidae (skates), rhinidae, rhinobatidae and rhynobatidae. Gulf of Mannar coast is known for the rich elasmobranch resources consisting of sharks, rays and skates. Elasmobranchs are mainly caught by trawlers, hooks and line and gillnets [17]. Overfishing is the primary threat to the conservation status of these sharks and rays. 21 oceanic pelagic species are caught regularly in high-seas fisheries, 52% are threatened [18]. Most of them are caught incidentally that targeting of tunas and billfishes, with blue, short fin mako, silky and oceanic white tip sharks being the most existing species in such catches. The present world scenario and the

economic value for shark fins and its meat has been insisted the fisher folk to target the sharks and rays predominantly [19]. Pelagic sharks score for about one-third of the fins committing the global shark fin trade [20]. These slow growing species fishery and trade goes faster than the productivity. The shark products are high valued in international trade such as frozen shark meat, gutted finless sharks, shark tails, dried shark fins, shark fin rays and shark bones are being exported from India [12]. Due to the demand for these products the Whale shark (*Rhincodon typus*) occurring along the Gujarat coast has become an easy target since 1980. The species is subjected to over exploitation [21]. Hence Government of India banned this species from fishing under Wild life Protection Act, 1972 (Schedule I). Since the peak period of spawning in elasmobranchs coincides with the monsoon season a restriction on trawling during such times would prevent recruitment of pregnant animals and growth of overfishing. Some species of cartilaginous fishes shoals by school by age, sex and reproductive level. They should be protected from intensified fishing.

Sharks and rays are direct targets in some areas and by catches from others. Illegal off-shore fishing is one of the major threats because of demand for a world wide range of products. Shark and ray meat is eaten fresh or salted and sundried and is a valuable food item in many western Indian Ocean countries [22]. Dried shark fins are used for soup in many Asian countries. As far as western Indian Ocean fishers are concerned, they likely to get far higher prices for shark fins than for the meat. Sharks provided with bigger size livers which can produce notable quantity of oil. In some of the traditional African countries people uses this oil as wood preservative for their small boats [22]. It is also used in various industries such as textile, leather, lubricant, cosmetics and pharmaceuticals. Moreover now it has recognized as an active biochemical component for treating certain cancers. Shark curios or memorabilia, such as entire jaws, dried and varnished, or teeth set in jewellery are of secondary value

(but can be very valuable and in certain cases may drive a fishery), as is shark skin for watch-straps or specialized furniture sandpaper. Major catches of rays were caught by trawlers 69% in Tamil Nadu [11]. Rays afforded 67% in the total elasmobranchs catch of Chennai during 2007. In addition to the elasmobranchs, sharks catch was to the extent of 28% on the east coast. During 2002-2006, at Kasimedu fisheries harbour, Chennai, elasmobranchs contributed 4% (1160 t) to the total fish catch fluctuating between 717 t in 2004 and 2074 t in 2002. The contribution of sharks, rays and guitar fishes were 23, 67 and 10%, respectively. Elasmobranchs were predominantly landed by trawls (72.5%), followed by gillnets and H and L (26.8%) [13]. The extraordinary speed on fishing of this important marine resource will lead to extinction from this biosphere reserve. This study suggests that awareness creation should be done to conserve these animals among all level of people who are involved in the fishery and trade of elasmobranchs.

#### REFERENCES

1. Palmer, D. ed., 1999. The Marshall Illustrated Encyclopedia of Dinosaurs and Prehistoric Animals. London. Marshall Editions, pp: 26.
2. Martin, R. Aidan, 2003. Copyright and Usage Policy. World Wide Web Publication, [www.elasmobranch-research.org/copyright.htm](http://www.elasmobranch-research.org/copyright.htm).
3. Cook, S.F., 1990. Trends in shark fin markets: 1980, 1990 and beyond. *Chondros.*, 2(1): 3-6.
4. Van der Elst, R.P., 1979. A proliferation of small sharks in the shore-based Natal sport fishery. *Env. Biol. Fish.*, 4(4): 349-362.
5. Ramon Bonfil, 1994. Overview of world elasmobranch fisheries. *FAO fisheries technical paper*, 341: 119.
6. Hanfee, F., 1997. Trade in Sharks and shark products in India. *TRAFFIC-India publication*, pp: 50.
7. Hanfee, F., 1999. Case studies of the management of elasmobranch fisheries. *In. Management of shark fisheries in two Indian coastal states: Tamil Nadu and Kerala*. Ed: Ross shoton. *FAO Fisheries technical paper*, 378/1: 479.
8. Misra, K.S., 1959. An aid to the identification of the commercial fishes of India and Pakistan. *Rec. Indian Mus.*, 57: 1-320.
9. Talwar, T.K. and R.K. Kacker, 1984. *Commercial sea Fishes of India*, Publ. by Zoological Survey of India. Calcutta, pp: 997.
10. Compagno, L., 1984. *FAO species catalogue*. Vol. 4. Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Part 1. Hexanchiformes to Lamniformes. *FAO Fish Synop.*, (125) Vol.4, Part., 1: 249.
11. Raje, S.G., Grace Mathew, K.K. Joshi, Rekha J. Nair, G. Mohanraj, M. Srinath, S. Gomathy and N. Rudhramurthy, 2002. *Elasmobranch Fishery of India-An Appraisal*. *CMFRI Special Publication*, 71: 76.
12. Raje, S.G. and K.K. Joshi, 2003. Status of exploited marine fishery resources of India. *In. Elasmobranchs*, Ed. M. Mohan Joseph and J.J. Jayaprakash, pp: 308.
13. Mohanraj, G., S. Rajapackiam, S. Mohan, Batcha, Hameed and S. Gomathy, 2009. Status of Elasmobranchs Fishery in Chennai, India. *Asian Fisheries Science*, 22(2): 607-615.
14. Kumaraguru, A.K., V. Edwin Joseph, N. Marimuthu and J. Jerald Wilson, 2006. *Scientific information on Gulf of Mannar-A Bibliography*. Centre for Marine and Coastal Studies, Madurai Kamaraj University, Madurai, Tamilnadu, India, pp: 656.
15. Raju, A., 2000. *Fish and Fisheries of Gulf of Mannar, Souvenir 2000*. Mandapam Region Centre of CMFRI., pp: 44-46.
16. *FAO, 2009. FISHSTAT Plus (v. 2.30), Capture Production Database, 1950-2007 and Commodities Trade and Production Database 1976-2007*. *FAO*, Rome, Italy.
17. Zacharia, P.U. and K.P. Kanthan, 2010. Unusual heavy landing of rays and skates at Tuticorin Fisheries Harbour. *Marine Fisheries Information Service; Technical and Extension Series*, 205: 13-15.
18. Dulvy, N.K., S.I. Rogers, S. Jennings, V. Stelzenmuller, S.R. Dye and H.R. Skjoldal, 2008. Climate change and deepening of the North Sea fish assemblage: A biotic Indicator of warming seas. *J. Applied Ecol.*, 45: 1029-1039.
19. Camhi, M.D., S.V. Valenti, S.V. Fordham, S.L. Fowler and C. Gibson, 2009. *The Conservation Status of Pelagic Sharks and Rays: Report of the IUCN Shark Specialist Group Pelagic Shark Red List Workshop*. *IUCN Species Survival Commission Shark Specialist Group*. Newbury, UK. x + 78.

20. Clarke, S.C., M.K. McAllister, E.J. Milner-Gulland, G.P. Kirkwood, C.G.J. Michielsens, D.J. Agnew, E.K. Pikitch, H. Nakano and M.S. Shivji, 2006. Global estimates of shark catches using trade records from commercial markets. *Ecology Letters*, 9: 1115-1126.
21. Kasim, M.H., 1991. Shark fishery of Veraval Coast. *J. Mar. Biol. Ass. India*, 33(1 and 2): 213-228.
22. IUCN, 2004. *Managing Marine Protected Areas: A Toolkit for the Western Indian Ocean*. IUCN Eastern African Regional Program, Nairobi, Kenya, pp: xii+172.