

# PRELIMINARY STUDY ON ELASMOBRANCH SPECIES ALONG THE COAST OF MAHARASHTRA

Final Report  
April 2019 – January 2020



# **Preliminary study on Elasmobranch species along the coast of Maharashtra**

## **Final Report**

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## Introduction:

The Elasmobranchs, represented by sharks, sawfishes, skates, rays and chimaeras (Rat fishes) are an important group of demersal fishes. These fishes have a skeleton made of cartilage, instead of bone. The members of this group are characterised by having five to seven pairs of gill clefts opening individually to the exterior, rigid dorsal fins, small placoid scales embedded in the skin (sharks) or naked (rays). The teeth are in several series and the details of jaw anatomy vary between species which are useful in differentiating the Elasmobranch species. Their distribution ranges from nearshore regions to the deep oceanic waters. Some species are known to travel long distances, hence can be considered as highly migratory. Their stock can be found in more than one Exclusive Economic Zone (EEZ).

They are widely distributed in the Oceans but are most diverse in the tropical and subtropical Indo-Pacific Ocean (Bonfil, 2002). Elasmobranchs species diversity in Indian seas is higher than that reported in many other tropical Indian Ocean countries like Sri Lanka, Arabian Gulf, Maldives and Thailand (Akhilesh K. V *et al.* 2014). However, higher numbers have been reported from Indonesia (White *et al.*, 2006; Fahmi, 2010). Chondrichthyans are one of the most vulnerable groups due to their biological characteristics such as slow growth rate, delayed maturation, long reproduction cycles and low fecundity. They are exploited for their various body parts such as the fins, liver, teeth, meat and hide which gives very high price. Sharks play a crucial role in the marine ecosystem as they are apex predators and keep ecosystem populations in control. High fishing exploitation has decreased their stocks which has become a global concern. The commercial demand for elasmobranch has increased over the years which have led to overexploitation of these fish resources. As per the Indian Wildlife Protection Act, 1972 ten species of elasmobranchs are protected under Sch-I part 2A. This preliminary study focuses on documentation of the diversity of these elasmobranchs and their juveniles from coastal regions of Maharashtra.

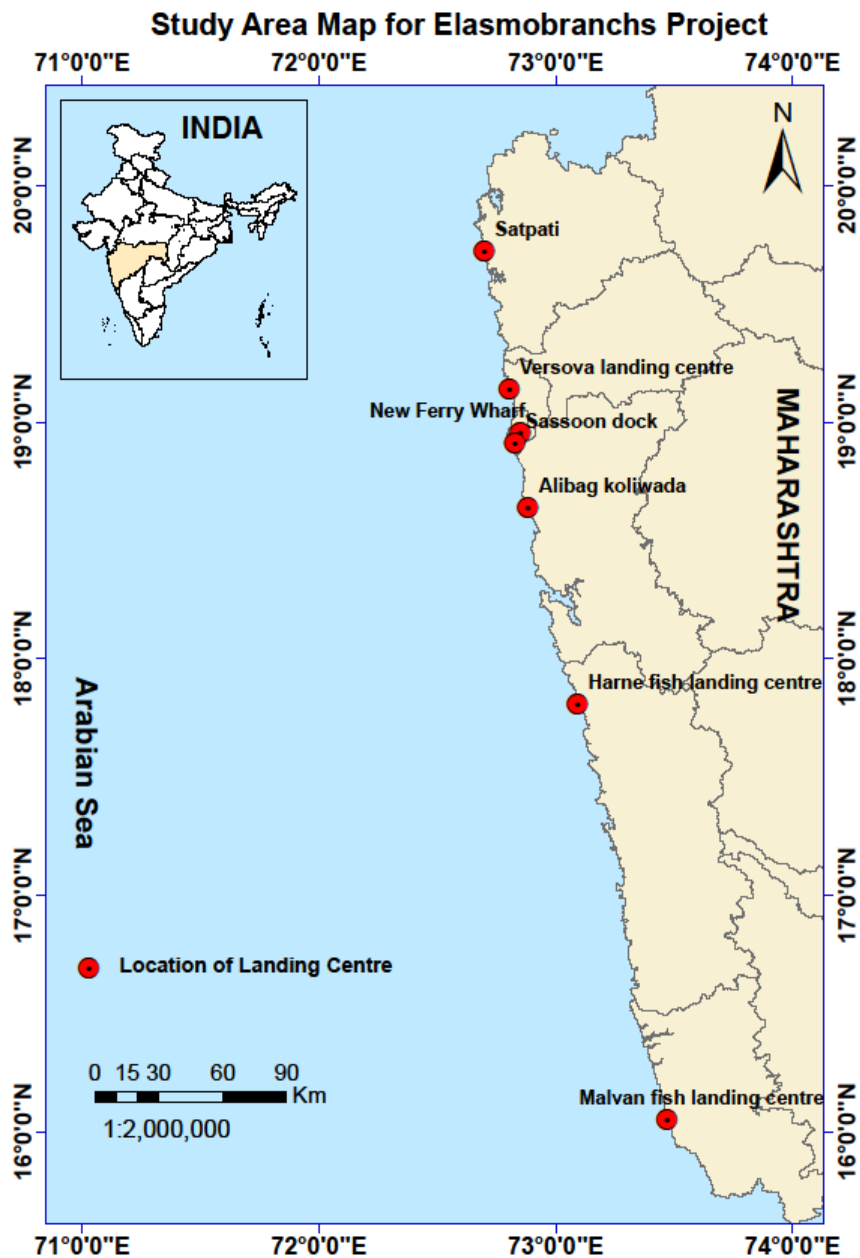
## Study Area:

Commercially important and major landing centres and jetties were surveyed for observing the Elasmobranchs catch from all the gears along the coastal districts of Maharashtra. Two additional landing centres that is Mirkarwada (Ratnagiri) and Vengurla (Sindhudurg) were also visited during the field trips to understand the landing and diversity of elasmobranchs.

**Table 1. List of major landing centres surveyed for Elasmobranchs study.**

Sr. No	Landing Centre	District	Latitude Longitude	Majorly Operated Gear
1.	Satpati	Palghar	19.43'30.75N 72.42'08.30E	Gill net, Dol net

2	Sassoon Dock (Old)	Greater Mumbai	18.54°42.42N 72.49°33.23E	Gill net, Dol Net, Trawl net, Purse sein net
3	New ferry wharf	Greater Mumbai	18.57°28.35N- 72.51°01.61E	Gill net, Dol Net, Trawl net, Purse sein net
4	Versova	Mumbai Sub	19.08°39.34N- 72.48°16.13E	Trawl net, Dol net, Gill net
5	Alibaug	Raigad	18.38°13.84N- 72.52°50.80E	Single day trawl, Gill net, Dol net
6	Harnai	Ratnagiri	17.48°32.90N- 73.05°22.65E	Trawl net, Gill net
7	Malvan	Sindhudurg	16.3°18.69N- 73.27°47.40E	Trawl net, Gill net





Photographs of landing centres - Harnai



Sassoon Dock

**Study duration:**

1. 7 months excluding Fishing ban period (April 2019 to January 2020).
2. Study period included Pre-monsoon, Monsoon and Post-monsoon seasonal observations.

**Number of visits:**

**Table 2. No. of visits done during the study period**

Landing centre name	No of Visits	Season wise visit		
		Pre monsoon	Monsoon	Post monsoon
Satpati	3	Pre monsoon	Monsoon	Post monsoon
		April	not surveyed due to poor landing	October
Sassoon Dock (Old)	5	April, May	September	October, December
New ferry wharf	4	April, May	September	October
Versova	4	April	September	October, December
Alibaug	3	April	August	October
Harnai	4	April	August	November. January
Malvan	3	April	August	December

## Objectives:

1. Documentation of the species diversity of Elasmobranchs landed in the study area.
2. Study distribution and seasonal abundance of Elasmobranchs.
3. Study of seasonal occurrence of juveniles

## Methodology:

Field trips were carried out by visiting selected commercially important landing centres of Maharashtra coast during pre-monsoon, monsoon and post-monsoon season. The elasmobranchs landing data was recorded by doing six hours of morning and evening observations (depending upon landing times) of study area. The boats were operated at 70-80 km off Maharashtra coast at a depth of 20-80 mtr. For understanding the growth pattern of the species total length and weight of specimen were recorded during the survey. The species constituted in these groups were identified; measurements were taken from caudal lobes for sharks and skates and disc width for rays. Males were considered to be fully matured when the claspers were completely calcified (Pratt, 1996) i.e. elongated and rigid/hard. Immature males have short and soft claspers which are sometimes overlooked.



Recording length and weight of the specimen

## Species identification:

Species identification was done from photographs covering key characters like fin position and shape, presence of anal fin, No. of gill slits, possession of dorsal fin spines, vertebral counts, tooth shape and counts. These characters are important for species identification by comparing them with diagnostic keys from published data and identification keys. In some Elasmobranchs like batoids, tooth characters are less useful but disc and tail shape, colour and markings, position of the dorsal fins, structure of the mouth and nostril region and shape of dermal thorns and denticles are important.

Some characters vary between the sexes and so it is very important to record the sex of the individual specimen. Males can be distinguished by their claspers, paired cylindrical extensions of the pelvic fins used for mating.

**Equipments used during Elasmobranchs survey:**

1. A good quality camera
2. Field books
3. Measuring tape
4. Sharp knife/scissors
5. Selected identification sheets from regional guides (FAO Identification Sheets etc.)

**Observations:**

From the published information and available data collected by CMFRI, a consolidated list of 160 species of elasmobranchs is known to occur in India’s commercial fishing zone (National plan of action for sharks in India, 2015). The Food and Agricultural Organisation estimated that until 2018, of the 26 shark fishing nations in the world, India ranked second in the volume of sharks caught annually and contributed about 9% to total catch. In 2019, India was the third-largest shark catching nation in the world after Indonesia and Spain from 2007 till 2017 (Wildlife trade monitoring group, Traffic Report). The coast of Maharashtra has a very rich diversity of elasmobranchs, which needs to be documented for undertaking conservation initiatives for this group of fishes.

For the said study district wise commercial important landing centres were surveyed during all the three seasons. The data was collected from commercially operating gears majorly Trawlers, Gill nets and Dol nets from selected landing centres during April 2019 to December 2019 which formed the basic material for this study and following observations were made:

- Total 34 species of elasmobranchs were recorded during the six months of study period from selected study area.
- 14 species of sharks, 15 species of rays and 5 species of wedge and guitarfishes were recorded from commercially important landing centers of Maharashtra.

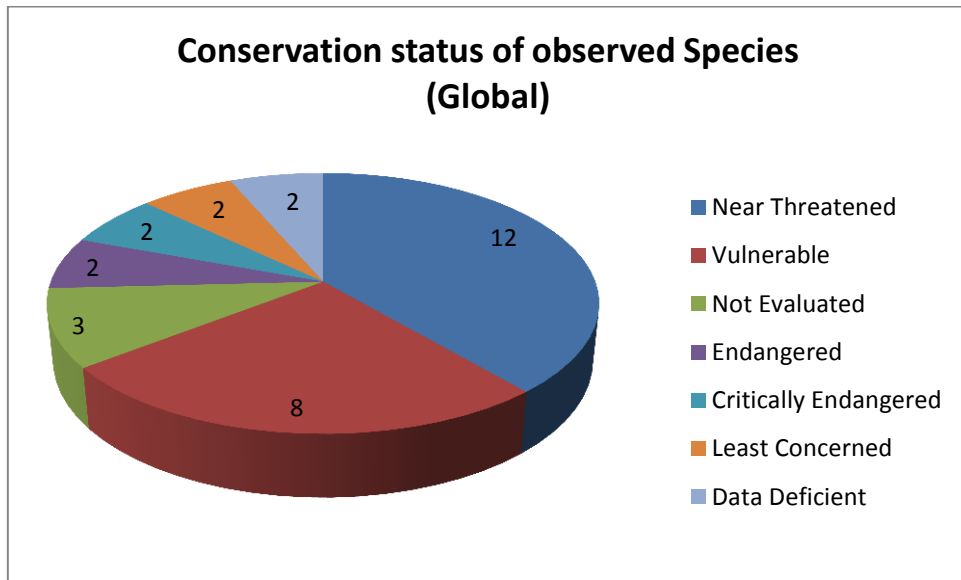
**Table 3. List of the Elasmobranch species recorded during study**

Sr. no	Family	Scientific name	Common name	Conservation status under IUCN Global Red List	Conservation status under IUCN Regional Red List
1.	<b>CARCHARHINIDAE</b>	<i>Scoliodon</i>	Spadenose	Near	Near

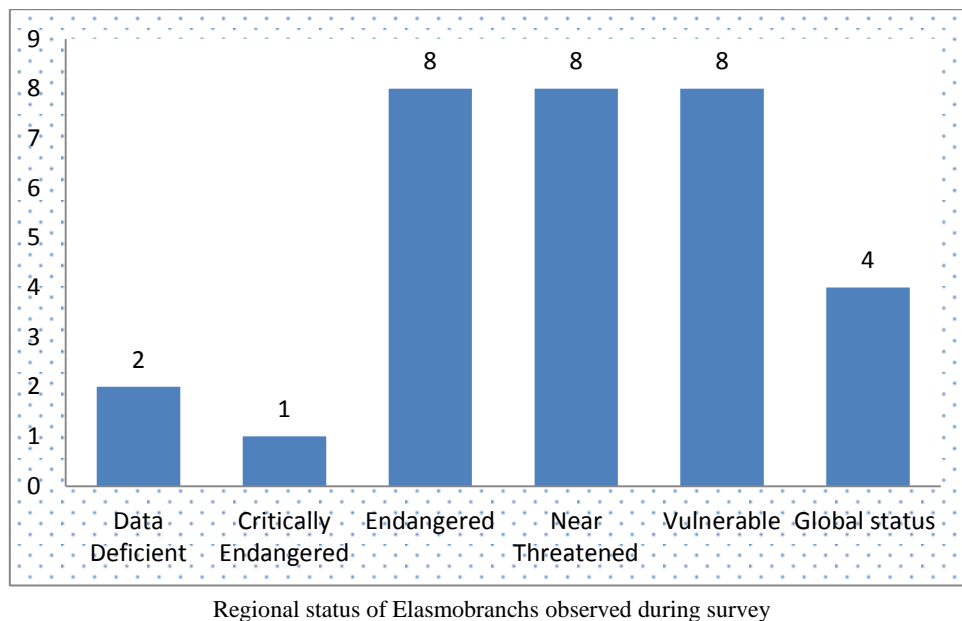
		<i>laticaudus</i>	shark	Threatened	Threatened
2.		<i>Galeocerdo cuvier</i>	Tiger shark	Near Threatened	Vulnerable
3.		<i>Rhizoprionodon oligolinx</i>	Grey dog shark	Least Concerned	Near Threatened
4.		<i>Rhizoprionodon acutus</i>	Milk dog shark	Least Concerned	Near Threatened
5.		<i>Carcharhinus limbatus</i>	Black tip shark	Near Threatened	Vulnerable
6.		<i>Carcharhinus sorrah</i>	Spot tail shark	Near Threatened	Vulnerable
7.		<i>Carcharhinus leucas</i>	Bull shark	Near Threatened	Endangered
8.		<i>Carcharhinus amblyrhynchoides</i>	Graceful Shark	Near Threatened	Vulnerable
9.		<i>Lamiopsis temminckii</i>	Fawn shark	Endangered	Endangered
10.		<i>Carcharhinus macloti</i>	Hard nose shark	Near Threatened	Near Threatened
11.	<b>HEMISCYLLIIDAE</b>	<i>Chiloscyllium griseum</i>	Grey bamboo shark	Near Threatened	Near Threatened
12.		<i>Chiloscyllium arabicum</i>	Ridge-back catshark	Near Threatened	Near Threatened
13.	<b>SPHYRNIDAE</b>	<i>Sphyrna lewini</i>	Scalloped Hammerhead shark	Critically Endangered	Endangered
14	<b>ALOPIIDAE</b>	<i>Alopias pelagicus</i>	Thresher shark	Endangered	Endangered
15.	<b>DASYATIDAE</b>	<i>Brevitrygon imbricate</i>	Bengal Whipray	Data Deficient	Data Deficient
16.		<i>Brevitrygon walga</i>	Scaly whipray	Near Threatened	Near Threatened
17.		<i>Maculabatis gerrardi</i>	Whitespotted Whipray	Vulnerable	Endangered
18.		<i>Maculabatis arabica</i>	Pakistan whipray	Critically Endangered	-
19.				Not Evaluated	Endangered



		<i>Pateobatis bleekeri</i>	Bleeker's Whipray		
20		<i>Himantura uarnak</i>	Reticulate Whipray	Vulnerable	Vulnerable
21.		<i>Himantura undulata</i>	Honeycomb Whipray	Vulnerable	-
22.		<i>Pastinachus sephen</i>	Cowtail Ray	Near Threatened	-
23.		<i>Himantura Sp.</i>	Whipray		-
24.		<i>Neotrygon kuhlii</i>	Indian Ocean Blue-spotted Maskray	Not Evaluated	-
25.	<b>GYMNURIDAE</b>	<i>Gymnura poecilura</i>	Longtail Butterfly Ray	Near Threatened	Near Threatened
26.	<b>TORPEDINIDAE</b>	<i>Torpedo sinuspersici</i>	Gulf Torpedo	Data Deficient	Data Deficient
27.	<b>AETOBATIDAE</b>	<i>Aetobatus flagellum</i>	Longhead Eagle Ray	Endangered	Endangered
28.		<i>Aetobatus ocellatus</i>	Spotted Eagle Ray	Vulnerable	Vulnerable
29.	<b>MOBULIDAE</b>	<i>Mobula sp.</i>	Devil ray	-	-
30.	<b>GLAUCOSTEGIDAE</b>	<i>Glaucostegus granulatus</i>	Sharpnose Guitarfish	Vulnerable	Endangered
31.		<i>Glaucostegus obtusus</i>	Widenose Guitarfish	Vulnerable	Critically Endangered
32.	<b>RHINIDAE</b>	<i>Rhina ancylostoma</i>	Bowmouth Guitarfish	Vulnerable	Vulnerable
33.		<i>Rhynchobatus laevis</i>	Smoothnose Wedgefish	Vulnerable	Vulnerable
34.		<i>Rhynchobatus sp.</i>	Wedgefish		



- It is observed that out of 31 identified species, 12 species are fall under Near Threatened, 8 species are under Vulnerable category of IUCN Global Red list. It is also observed that two species come under each category namely Critically Endangered, Endangered, Least concern, Data deficient and three species come under Not Evaluated.
- According to Regional Red list of IUCN the status of observed elasmobranchs species is given below:



- There are eight species of Elasmobranch in each of the Endangered, Near-Threatened and Vulnerable category. One species of guitarfish is under critically endangered category and two species have been assessed as data deficient. The remaining four species have been evaluated according to their global red list.
- High species diversity was observed in Sassoon Dock, New Ferry Wharf, Versova, Harnai and Satpati as majorly diverse gears were being operated from these landing centres.

- It was also found that last year Marine fish landing of Maharashtra was hampered majorly by 4 cyclones which occurred in Arabian Sea i.e. Vayu in June, Hika in September, Kyarr and Maha cyclones in October- November 2019. According CMFRI Report the marine fish catch of Maharashtra for the year 2019 decreased by 32% as compared to previous year.

**Table 4. Season and landing centre wise observation of Elasmobranchs during study period**

Sr. No.	Name of the species (common name)	Name of landing Centre	Elasmobranch Species observed in Season
1.	<i>Scoliodon laticaudus</i> (Spadenose shark)	Sassoon dock, New ferry Wharf, Versova, Alibag, Satpati, Harne, Malvan	all three seasons
2.	<i>Galeocerdo cuvier</i> (Tiger shark)	Sassoon dock, Satpati	Pre-monsoon, post monsoon
3.	<i>Rhizoprionodon oligolinx</i> (Grey dog shark)	Sassoon dock, New ferry Wharf, Versova, Alibag, Satpati, Harne, Malvan	all three seasons
4.	<i>Rhizoprionodon acutus</i> (Milk dog shark)	Sassoon dock, New ferry wharf	all three seasons
5.	<i>Carcharhinus limbatus</i> (Black tip shark)	Sassoon dock, New Ferry Wharf, Harne, Alibag, Malvan	Pre-monsoon, Monsoon
6.	<i>Carcharhinus sorrah</i> (Spot tail shark)	Sassoon dock, Alibag, Harne, Malvan	Pre-monsoon, Monsoon
7.	<i>Carcharhinus leucas</i> (Bull shark)	Satpati, Sassoon dock	Pre monsoon, Monsoon
8.	<i>Carcharhinus amblyrhynchoides</i> (Graceful Shark)	Malvan	Monsoon
9.	<i>Lamiopsis temminckii</i> (Fawn shark)	Satpati, Sassoon Dock	Premonsoon, Monsoon
10.	<i>Carcharhinus macroti</i> (Hard nose shark)	Alibag, Harne,	Monsoon
11.	<i>Chiloscyllium griseum</i> (Grey bamboo shark)	Sassoon dock, New ferry Wharf, Versova, Alibag, Satpati, Harne, Malvan	all three seasons
12.	<i>Chiloscyllium arabicum</i> (Ridge-back catshark)	Sassoon dock, New ferry Wharf, Versova, Malvan	all three seasons
13.	<i>Sphyrna lewini</i> (Scalloped Hammerhead shark)	New ferry wharf, Sassoon dock, Alibag, Harne,	all three seasons

		Malvan	
14.	<i>Alopias Sp.</i> (Thresher shark)	Sassoon dock	Post monsoon
15.	<i>Brevitrygon imbricate</i> (Bengal Whipray)	Sassoon dock, New ferry Wharf, Versova, Alibag, Satpati, Harne, Malvan	all three seasons
16.	<i>Brevitrygon walga</i> (Scaly Whipray)	New ferry wharf, Versova, Sassoon dock, Harnai	Monsoon, Pre monsoon
17.	<i>Maculabatis gerrardi</i> (Whitespotted Whipray)	Sassoon dock, New ferry Wharf, Versova, Alibag, Satpati, Harne, Malvan	all three seasons
18.	<i>Maculabatis arabica</i> (Arabic Whipray)	Satpati, Sassoon dock, Versova, New ferry wharf	Pre monsoon, Post monsoon
19.	<i>Pateobatis bleekeri</i> (Bleeker's Whipray)	Sassoon dock, New ferry Wharf, Versova, Alibag, Satpati, Harne, Malvan	all three seasons
20.	<i>Himantura uarnak</i> (Reticulate Whipray)	Sassoon dock, Malvan	Pre-monsoon, Post monsoon
21.	<i>Himantura undulata</i> (Honeycomb Whipray)	New ferry wharf, Versova	Monsoon
22.	<i>Pastinachus sephen</i> (Cowtail Ray)	New ferry wharf, Sassoon dock, Harne, Versova	Monsoon, Post monsoon
23.	<i>Himantura Sp.</i>	Harnai	Monsoon
24.	<i>Neotrygon kuhlii</i> (Indian Ocean Blue-spotted Maskray)	Malvan	Pre monsoon, Post monsoon
25.	<i>Gymnura poecilura</i> (Longtail Butterfly Ray)	Versova, Sassoon dock, New ferry wharf	all three seasons
26.	<i>Torpedo sinuspersici</i> (Gulf Torpedo)	New Ferry wharf	Pre monsoon
27.	<i>Aetobatus flagellum</i> (Longhead Eagle Ray)	Versova, Sassoon dock, Malvan	Pre-monsoon, Post monsoon
28.	<i>Aetobatus ocellatus</i> (Spotted Eagle Ray)	Versova, Sassoon dock, New Ferry wharf, Harne,	Pre-monsoonm Post monsoon
29.	<i>Mobula sp.</i> (Manta ray)	Sassoon dock	Post monsoon
30.	<i>Glaucostegus granulatus</i>	Harne	Post monsoon

	(Sharpnose Guitarfish)		
31.	<i>Glaucostegus obtusus</i> (Widenose Guitarfish)	Mikarwada, Harne	post monsoon
32.	<i>Rhina ancylostoma</i> (Bowmouth Guitarfish)	New Ferry wharf	Monsoon
33.	<i>Rhynchobatus laevis</i> (Smoothnose Wedgefish)	New Ferry wharf, Versova, Sassoon dock	all three seasons
34.	<i>Rhynchobatus sp.</i> (Wedgefish)	New Ferry wharf	Monsoon

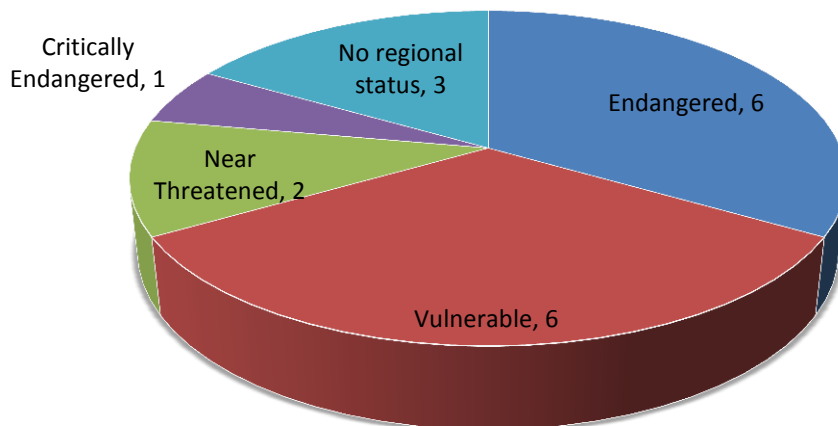
- Of the total 34 species recorded during the survey, it is observed that the Juveniles of 18 species of elasmobranch were caught at various landing centre such as Scalloped Hammer head shark (*Sphyrna lewini*), Tiger shark (*Galeocerdo cuveri*), Bull shark (*Carcharhinus leucas*), Black tip shark (*Carcharhinus limbatus*), Spot tail shark (*Carcharhinus sorrah*), Smoothnose wedge fish (*Rhynchobatus laevis*), Spotted eagle ray (*Aetobatus ocellatus*), Blue spotted stingray (*Neotrygon kuhli*), Spade nose shark (*Scoliodon laticaudus*).

**Table 5. List of the Juveniles of Elasmobranchs with length range observed during survey**

Sr. no.	Name of Species	Length range (cm) of juvenile species observed during survey	Length at Maturity (cm)/ Maturity length range	Remarks
1.	<i>Sphyrna lewini</i> (Scalloped Hammer head shark)	40.8-79.3	140-200	Juveniles of <i>S. lewini</i> were observed during premonsson and Monsoon season in Malvan, Harnai, Alibag, Sassoon dock and New ferry wharf
2.	<i>Galeocerdo cuvier</i> (Tiger shark)	114.3-172.0	210-350	Two Juvenile specimen of the species were observed during pre-monsoon at Satpati and two juvenile specimen of the species were observed during monsoon season on Sassoon dock landing centre
3.	<i>Alopias pelagicus</i> (Pelagic thresher shark)	150.8	260-292	Single juvenile specimen of the species was observed during post monsoon on Sassoon dock
4.	<i>Scoliodon laticaudus</i> ( Spadenose shark)	17.9-26.8	33.8-35.8	Juveniles and adult specimen were observed during the survey from study area throughout the

				study period
5.	<i>Carcharhinus limbatus</i> (Black tip shark)	53.7-90.1	171-293	Juveniles of the species were observed during premonsoon and monsoon season on Sasoon dock, New ferry wharf, Harnai, Alibag, Malvan
6.	<i>Carcharhinus sorrah</i> (Spot tail shark)	38.1-91.0	132-235	Juveniles of the species were observed during pre monsoon and monsoon season on Harnai, Sassoon dock, Alibag, Malvan
7.	<i>Carcharhinus leucas</i> (Bull shark)	109	193	Single Juvenile specimen was observed during the post monsoon season on Sassoon dock
8.	<i>Carcharhinus amblyrhynchoides</i> (Graceful Shark)	80.7	115	Single Juvenile specimen was observed on Malvan fish landing centre during monsoon season
9.	<i>Carcharhinus macroti</i> (Hard nose shark)	44.7-54.6	62	Immature specimens of the species were observed during monsoon season on Sassoon dock landing centre
10.	<i>Lamiopsis temminkii</i> (Fawn shark)	79.1- 122.7	136.8-143.0	Single juvenile specimen was observed during pre-monsoon season on Sassoon dock landing centre
11.	<i>Aetobatus ocellatus</i> (Spotted Eagle Ray)	57.6- 78.9	99.8	few Juvenile specimen of the species were observed during premonsoon and monsoon season on Versova, Newferry wharf and Harnai centres
12.	<i>Neotrygon kuhlii</i> (Indian Ocean Blue-spotted Maskray)	20-33	Data deficient	Juveniles of the species observed during pre-monsoon period on Malvan landing centre
13.	<i>Maculabatis gerrardi</i> (Whitespotted Whipray)	193.3-32.3	63	Juveniles of the species were observed during all the season from Versova, Malvan, Harnai, New ferry wharf landing centre

14.	<i>Pastinachus sephen</i> (Cowtail Ray)	25.4-55.7	96-100	Juveniles of the species can be observed on Versova and New Ferry wharf
15.	<i>Himantura undulata</i> (Honeycomb Whipray)	74.2- 83.0	85-90	Immature specimen were observed from Harnai landing centre during monsoon season
16.	<i>Glaucostegus granulatus</i> (Sharpnose Guitarfish)	37.4-51.3	-	Juveniles of the species observed during post monsoon season from Harnai, Mirkarwada landing centre
17.	<i>Glaucostegus obtusus</i> (Widenose Guitarfish)	40.8-87.9	-	Juveniles of the species were observed during post monsoon season on Mirkarwada landing centre
18.	<i>Rhynchobatus laevis</i> (Smoothnose Wedgefish)	53.0-93.7	130	Juveniles of the species were observed during pre-monsoon, monsoon and post monsoon season on Versova, Sassoon dock, New ferry wharf landing centre



**Regional IUCN status of observed Juvenile Elasmobranchs species**

- During the survey it was observed that the fins of some sharks species namely Spadenose shark, Bull shark, Broadfin shark, Tiger shark, Black tip shark, Milk dog shark and skin of some rays like Bleeker's Whipray were kept for drying. The dried meat of some sharks like Spadenose shark was stored in huts of traders in the Satpati landing centre. According to FAO following species of sharks are preferred for the **shark fins**.

**Table 6. Preferred shark species for the shark fin**

First Choice	Second Choice	Third choice
Blue shark	Black tip reef shark	Basking shark
Dusky shark	Black tip shark *	Pi ked dogfish
Hammerhead	Great white shark	Whale shark
Mako shark	Lemon shark	
Oceanic white tip shark	Requiem sharks *	
Sand bar shark	Smalltooth sand tiger shark	
	Spadenose shark*	
	Thresher shark	
	Tiger shark*	
	Scalloped hammerhead shark	

Source: FAO

(\* the species of sharks were observed during the study)

- Table 6. Export details of the Shark fins and Shark fin rays from Chennai.

Year	Shark fins		Shark fin rays	
	Quantity (tonnes)	Value (crore ₹)	Quantity (tonnes)	Value (crore ₹)
2008-09	24.02	5.41	4.09	1.75
2009-10	34.74	15.14	13.72	4.51
2010-11	84.75	32.86	9.06	1.74
2011-12	70.32	28.07	3.29	1.69
2012-13	64.28	20.16	1.82	1.19
2013-14	44.6	15.29	1.44	1.11

Source: MPEDA

Source: CMFRI, MPEDA







**Shark fins kept for drying**



**Different Ray's skin kept for drying**

**Salting the meat of sharks**

## **Discussion and Conclusions:**

### **Threats:**

#### **1. Unsustainable fisheries and bycatch:**

Catching Elasmobranchs as both target and bycatch in fisheries made this special group vulnerable. Number of juveniles were captured along with targeted catch in a variety of fishing gears in nearshore coastal waters and adults get caught in gillnets, trawlers and longlines along the offshore in oceanic waters. Mechanised fishing, particularly trawling, has a significant impact on marine ecosystems and species (Kumar and Deepthi, 2006). The species which is particularly susceptible to fishing and aggregating nearshore usually get caught in high numbers which can lead to a rapid decrease in regional stocks. The result of this study shows that, some species of sharks like *Carcharhinus limbatus*, *Carcharhinus sorrah*, *Sphyrna lewini*, *Scoliodon laticaudus* which aggregate in nearshore waters for feeding, mating and breeding [the nurseries are in shallow coastal waters (Castro 1993)] get

caught in high numbers in trawl and gill nets which are majorly operated from the depth of 10 mtr to 70-80 mtr.

2. Juvenile shark bycatch is a major issue:

The Juveniles of few pelagic shark species like *Carcharhinus macroti*, *Carcharhinus limbatus*, *Carcharhinus sorrah*, *Alopias pelagicus*, *Carcharhinus amblyrhinchoides*, *Galeocerdo cuvier*, *Lamiopsis teminckii*, *Sphyrna lewini* with low fecundity and long gestation period have also been exploited by gill nets and long line fishing along the coast of Maharashtra.

3. Illegal Trade of Shark Fin and other parts of Elasmobranchs:

In recent decades, an increasing demand for shark fins from the Asian market stimulated the conversion of many industrial fisheries from bony fishes to sharks (Amorim et al., 1998; Aires-da-Silva et al., 2008). For countries in Central America and in southeastern Asia, shark finning has become an important source of income (Dell'Apa et al., 2014). Among the elasmobranchs group, sharks are considered as “Kalpa Matsya” as every part of the shark can be utilized commercially (S.G. Raje) They are high valued fish group which provide a vast number of products, ranging from food and pharmaceutical to cloth and novelties.

4. Lack of detailed study on biological aspects like gestation period, reproduction cycle, impact of fishing pressure on growth of red listed species of Elasmobranchs.

5. Habitat destruction could be the reason for population decline for elasmobranch species living in estuarine or mangrove habitats and in demersal region which is majorly exploited by trawl fisheries. Trawl gear is considered as one of the most destructive forms of fishing in use (Walting and Norse, 1998).

**Possible conservation measures:**

- Sustainable fishing practices can be practised, which would not allow the juveniles to get caught in the fishing net as bycatch.
- Long term study on the biological aspect of elasmobranchs which are listed under IUCN can be commissioned to understand the growth pattern, gestation period and regional population of the species.
- In August 2013, the Ministry of Environment and Forests (Wildlife Division) approved a policy advisory on shark finning (vide F. No4-36/2013WL, 21 August 2013), prohibiting the removal of shark fins on board a vessel in the sea, and advocates landing of the whole shark. Strictly monitoring the trade of shark fins and other part of elasmobranchs can curb the illegal trading activities. Creating awareness among the stakeholders and traders, suppliers need to be sensitized.

- Out of 155 species of chondrichthyans recorded from Indian waters (Akhilesh K.V. *et.al.* 2014), 10 species of elasmobranchs have been listed in Schedule 1, Part 2 (A) under the Indian Wildlife (Protection) Act 1972 by MoEF in 2001. The listed species have to be identified accurately and regularly assessed to ensure their protection (Akhilesh K.V. *et.al.* 2014).
- Creating awareness among the Fishermen, Stakeholders and traders can make them aware about the importance of sharks in balancing the ecosystem. Active participation of community can bring change in conservation and protection of some vulnerable species of Elasmobranchs.

### Records of elasmobranchs species observed during the study period.



*Carcharhinus limbatus* (Black tip shark)



*Carcharhinus sorrah* (Spot tail shark)



*Maculabatis gerrardi* (Whitespotted Whipray)



*Himantura urnak* (Reticulate Whipray)



Juvenile of *Galeocerdo cuvier* (Tiger shark)



*Alopias pelagicus* (Pelagic thresher)



*Rhynchobatus laevis*  
(Smoothnose Wedgefish)



*Sphyrna lewini*  
(Scalloped Hammerhead shark)



*Chiloscyllium griseum*  
(Grey bamboo shark)



Juvenile of *Carcharcarhinus leucas* (Bull Shark)



Juveniles of *Glaucostegus granulatus* (Sharpnose Guitarfish)



Juvenile of *Aetobatus ocellatus* (Spotted Eagle Ray)



*Aetobatus flagellum* (Longhead Eagle Ray)



*Himantura undulata* (Honeycomb Whipray)



*Lamiopsis teminki* (Fawn shark)



*Mobula Sp.* (Devil ray)



*Cacharhinus macloiti* (Hard nose shark)



*Torpedo sinuspersici* (Gulf Torpedo)



*Rhynchobatus SP.* (Wedgefish)

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