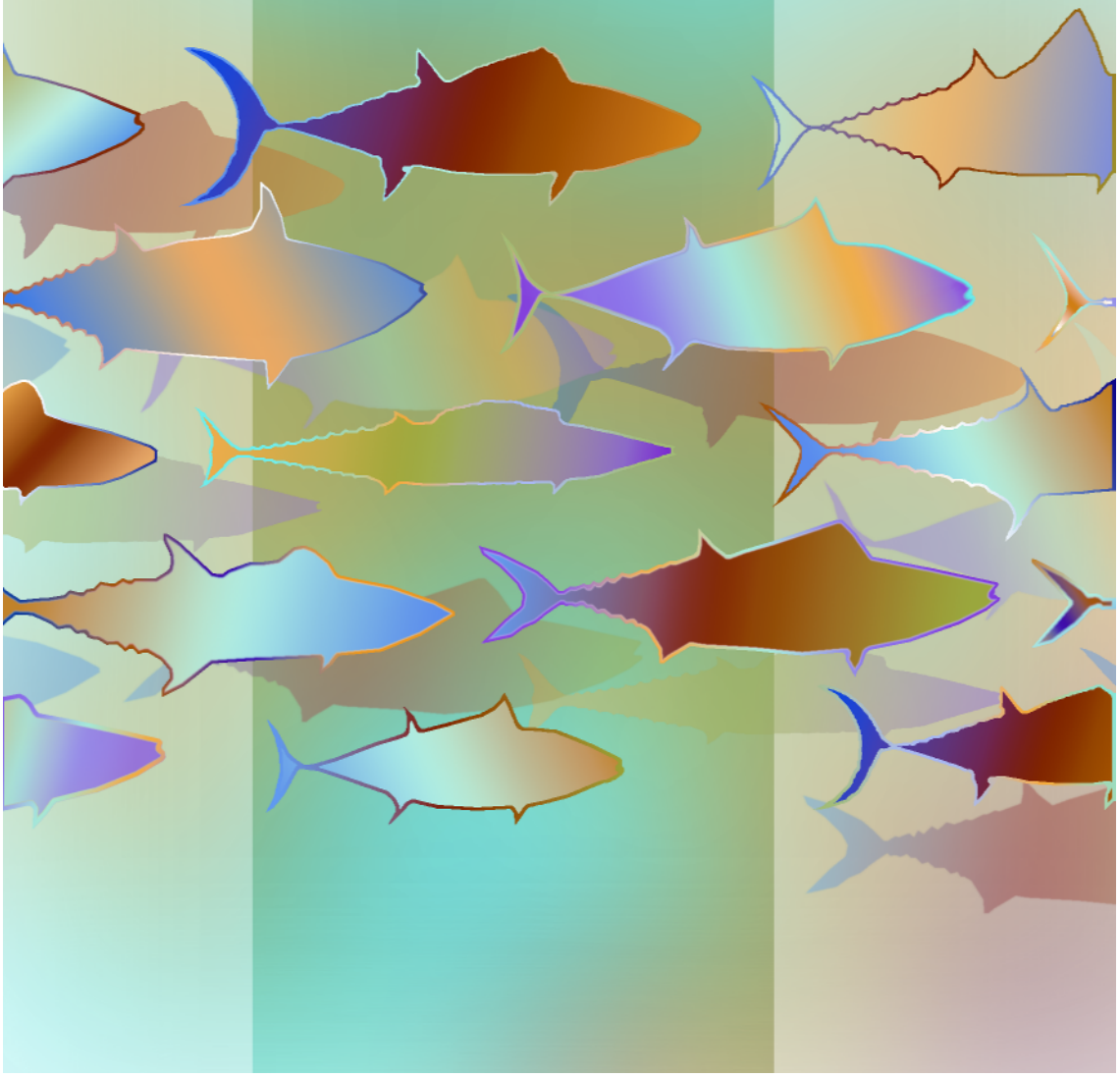
Status of Exploited Marine Fishery Resources of India



STATUS OF EXPLOITED MARINE FISHERY RESOURCES OF INDIA

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Elasmobranchs

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1. Introduction

Elasmobranch resource, comprised of sharks, skates and rays, has assumed commercial importance in India only recently. During the past 40 years the average annual landing of the resource was 53,546 tonnes, which constituted 2.5% to the total marine fish production of the country. But in the past decade, because of increasing demand for shark's fins in the southeast Asian countries, the catch is showing progressive trend reaching a maximum of 75,623 t in 1998.

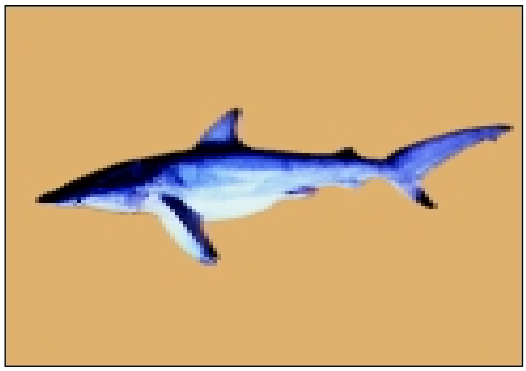

Fig. 1. Carcharhinus limbatus

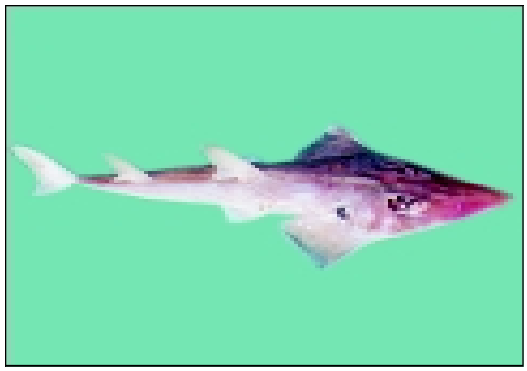

Fig. 2. Rhynchobatus djiddensis

Sharks are known as Magra in Gujarati; Mari/Mushi in Marathi; Sravu in Malayalam; Magar in Oriya ; Hangur /Magar in Bengali (Fig.1). The skates are called Dhos /Churi in

Gujarati; Lanja Pok in Marathi; Kalpoonthi,Varithala in Malayalam ; Sisna, Yahlva in Oriya; Slate, Raban, Harna in Bengali (Fig. 2). The vernacular term for rays is Varala, Timri, Boor in Gujarati; Pakat, Bolal, Wagali in Marathi; Thirandi in Malayalam; Miththi,Mach in Oriya; Sankar in Bengali (Fig. 3).

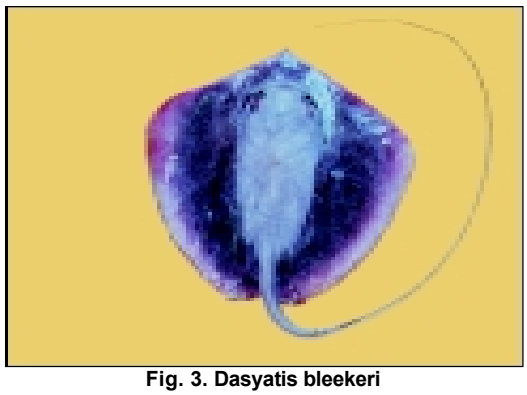

Fig. 3. Dasyatis bleekeri

2. Production trends

The average annual catch of the resource during 1961-2000 periods was 53,546 tonne of which the west coast contributed 54% and the east coast 46%. The annual landings averaged for the five-yearly periods from 1961 to 2000 are given in Figure 4. It is seen that progressive increasing trend in the elasmobranch catch was recorded from 1971-75 (52,757 t) to 1996-2000 (69,618 t). Increased exploitation is evident during 1996 - 2000. However, the production in Maharashtra, Kerala and Karnataka indicated a decrease in trend.

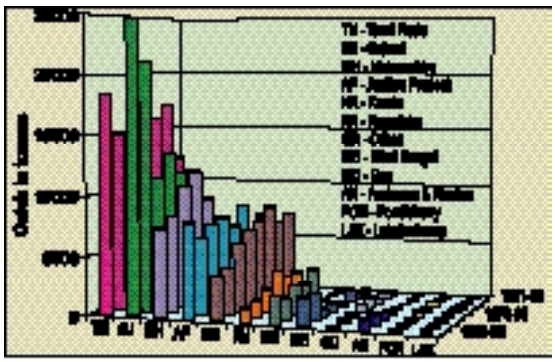

Fig. 4. Five yearly average catch (t) of elasmobranchs during 1961-2000

Statewise contribution

The elasmobranchs are caught in all the maritime states of India. The statewise percentage contribution during 1961-2000 showed that Tamil Nadu ranked first (27%), followed by Gujarat (23%), Maharashtra (14%), Andhra Pradesh (13%), Kerala (12%), Karnataka (4%), Orissa (3%), West Bengal (2%), Goa (0.6%), Andaman and Nicobar (0.6%), Pondicherry (0.4%) and Lakshadweep (0.4%) (Fig.4).

Gearwise contribution

The elasmobranchs are mainly exploited by shrimp trawlers (42%) followed by gill net (26%), hooks and line (16%), dol net (3%) and others (11%). Sharks are exploited by trawl net (32%), gill net (31%) and hooks and line (20%), but shrimp trawl chiefly exploits skates (86%) and rays (67%).

Exploratory survey conducted by M.T.Murena along the northwest coast has shown that sharks are abundant in the depth range of 55-125 m. The potential of the resource upto 50 m depth has been estimated at 64,934 t based on the survey

conducted by FORV Sagar Sampada. The results of the surveys indicated catch rates of 625 kg/hr from the southwest coast and 600 kg/hr from Anadaman region in the 51-1000 m zone.

Species composition

Of the total elasmobranches exploited in the country, the sharks constituted 62% followed by rays (34%) and skates (4%) during 1981-2000 (Fig.5). The sharks are also predominant along the west coast (76%) while rays along the east coast (52%). The sharks in Gujarat contributed to 78%, Maharashtra 74%, Goa 83%, Karanataka

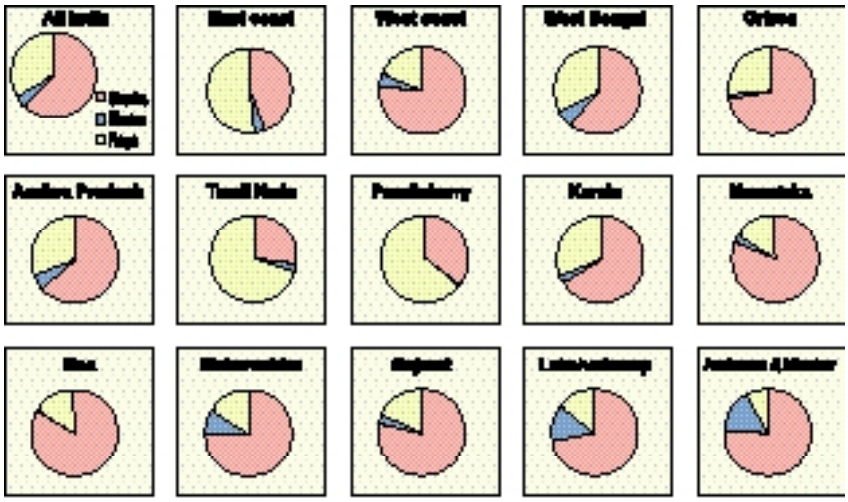

Fig. 5. Percentage composition of sharks, skates and rays - All India, east and west coasts and statewise during 1981-2000.

80%, Kerala 66%, Andhra Pradesh 63%, and West Bengal 61%. The rays, which dominated in the east coast, constituted 69% in Tami Nadu and 64% in Pondichery. The dominant species of sharks are Chiloscyllium indicum (slender bamboo shark), C.griseum (grey bamboo shark), Rhincodon typus (whale shark), Stegostoma fasciatum (zebra shark), Carcharhinus brevipinna (spinner shark), C.dussumieri (white cheek shark), C.limbatus (black-tip shark), C.macloti (hard-nose shark), C.melanopterus (blackfin reef shark), C.sorrah (spot-tail shark), Galeocerdo cuvieri (tiger shark), Rhizoprionodon acutus (milk shark), Scoliodon laticaudus (spade-nose shark), Eusphyra blochii (wing-head shark), Sphyrna mokarran (great hammer-head) and S.zygaena (smooth hammer-head). Important species among skates are Rhina ancylostoma (bow-mouthed angel fish), Rhinobatos granulatus (granulated shovel-nose ray), Rhynchobatus djiddensis (white spotted shovel-nose ray), Anoxypristis cuspidata (pointed saw-fish) and Pristis microdon (small-tooth saw fish). Among rays, the important species are Aetobatus narinari (spotted eagle ray), Aetomylaeus nichofii (Nieuhof's eagle ray), Rhinoptera javanica (Javanese

cow-ray), Himantura uarnak (honey combed sting ray) H.bleekeri (whiptail sting ray), Dasyatis zugei (pale edged sting ray), D.imbricatus (Schneider's scaly sting ray), Amphotistius kuhlii (blue spotted sting ray), Pastinachus sephen (drab sting ray/cow-tail ray), Gymnura poecilura (long tail butterfly ray), G.micrura (short tail butterfly ray) and Mobula diabolus (horny ray).

Size range

The dominant and commercially important species of elasmobranchs, which support the fisheries with their size range are given below:

Sharks: Scoliodon laticaudus (14-64cm), Rhizoprionodon acutus (14-84cm), Carcharhinus sorrah (56-164 cm), C. macloti (33-98 cm), C. melanopterus (80-250 cm), C. hemiodon (70-150 cm), Rhincodon typus (3.93-20.75 m). Galeocerdo cuvieri (70-740 cm), Eusphyra blochii (20-160 cm), Sphyrna lewini (50-295 cm).

Skates: Rhynchobatus djiddensis (44 -229 cm) and Rhinobatos granulatus (36-153 cm).

Rays: Dasyatis bleekeri (24 -101 cm), D.kuhlii (14 -52 cm), D.uarnak (18-160), D.sephen (20-89 cm), D.zugie (25-102 cm), D.imbricatus (13-36 cm), Aetobatus narinari (30-150 cm), Rhinoptera javanica (35-125 cm), Gymnura poecilura (40-108 cm) and Mobula diabolus (40-130 cm).

Utilization

Elasmobranchs are valuable fish as almost every part of body viz, liver oil (source of vitamins A and D, used in textile, tanning, sanitary, cosmetic, etc.as ingredients in shoe-polish, French perfumery, pharmaceuticals, as lubricant, for preserving boats, and in street lamps), cartilages (fish meal, in medicine for cancer, burn victims, eye fatigue treatments), fins (soup, glue), skin (used for making a variety of leather products such as hand bags, belts, shoes, sanding the wooden boats, etc.), teeth (in ornaments), jaws (tourist trade), meat (eaten in fresh or cured) and viscera (fish meal) is utilized.

Export

The products obtained from the sharks are valued in international trade. The products exported from India are frozen shark meat, gutted finless sharks, shark tails, dried shark fins, shark fin rays, and shark bones. In view of 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 heavy fishing pressure. But for the ban on fishing (Schedule 1 of Wild life (Protection) Act, 1972) the species would have been completely wiped out from the area.

Export of shark products increased from 386 tonnes to 1,508 tonnes and the value from Rs.9.5 to Rs.35.49 crores during 1996-97 to 2000-01. Shark fins and fin

rays are traditionally consumed in Hong Kong, Singapore, Taiwan, China and other countries. Sri Lanka, Taiwan, Korea and Singapore import shark meat from India. The biggest market for shark liver oil and skin is Japan and Nepal.

3. Biology

The information on the biology of different species of elasmobrachs from the Indian seas is summarized in Table 1. Sharks feed on pelagic, shoaling and fast moving teleosts like sardine, mackerel, scad, Bombay-duck and golden anchovy, in addition to squids probably due to pelagic nature of the group. Rays and skates feed mostly on bottom dwelling organisms viz. crustaceans (prawns, crabs, squilla, and lobsters), molluscs (clams, oysters, bivalves and gastropods) and teleosts (Apogon spp, Nemipterus spp, sciaenids), polychaetes and amphipods.

Breeding

Elasmobranchs show distinct dimorphic characters with presence of claspers in males. The majority of species of elasmobranchs in the Indian seas are viviparous, some are oviparous and few are ovo-viviparous. The breeding season of various species belonging to sharks, skates and rays vary. However, the majority of species breed during pre-monsoon (January-May) and post-monsoon (September-December) and few in monsoon (June-August) period.

Fecundity

All the species of elasmobranchs have low fecundity. The number of young ones (pups) in shark species ranges from 1-2 in Scoliodon walbeehmi, 26-44 in G. cuvieri, in rays it is 1 in Dasyatis walga, 1-4 in Gymnura poecilura and in skates 6 (Pristis cuspidatus) to 12 (Rhinobatos granulatus). Fertilization and development in these species take place inside the body and so there is a tendency in this group to limit the number of offsprings.

Growth and lifespan

Age and growth of S.laticaudus and R.acutus have been reported from different regions. The males and females of S. laticaudus attain 64.5 cm and 66.7 cm at the end of 7 years and the fishable life-span of the species is 3-5 years. In the case of R. acutus the fishable life-span is 5-10 years.

4. Stock assessment

The length based stock assessment of S.laticaudus in Maharashtra indicated that the species is overexploited. The MSY of the total elasmobranch resource in different states estimated by Schaefer's surplus production model is given in Table 2. The model assumes that the catch rate declines with increasing fishing effort, but wherever this assumption is not met with, the MSY not attained.

Table 1. Information on the biology of important species of elasmobranchs

Species	Size at first maturity in Female(cm)	Breeding period	Maximum size (cm)	Fecundity (No. pups)	Fertilization	Locality	Food
1	2	3	4	5	6	7	8
Chiloscyllium griseum	53	Throughout	74	2	Oviparous	Calicut	Invertebrates,fishes and crustceans
C.griseum		Jan -Mar				Bombay	
Hemigaleus balfouri	58	Feb - Mar	90	1- 4	Viviparous	Bombay	
Carcharhinus limbatus	155	Jan -Mar	180	6	Viviparous	Bombay	Sardines, mackerel, croackers, crustaceans and cephalopods
C. limbatus	165	Apr - May	250			Porto Novo	
C. dussumieri	76	Throughout	100	2	Viviparous	East	Small fishes, squids and crustaceans.
C. menisorrah	73	Nov - Apr		2	Viviparous	Bombay	
C. sorrah	120	Mar - May	150	6	Viviparous	Bombay	Mackerels, flying fishes, sardines, squids and prawns.
C. melanopterus		Dec - Mar	200	12	Viviparous	Bombay	Mullets, silver bellies, anchovies, Hilsa , Skates,prawns and squilla.
C. melanopterus			250			Bombay	
C. macloti	70	Nov - Mar	90	2	Viviparous	Bombay	Small fishes, squids and crustaceans.
C. temminckii	128	Apr - May	168	4 - 8	Viviparous	Bombay	
Galeocerdo tigrinus			393	27-44	Viviparous	Bombay	Eels,pomfrets,ribbonfish,mullets,prawns, crabs, carcass,sea snake, and turtle.
G.cuvieri		Nov - Jan	740	26-44	Ovoviviparous	Bombay	All kinds of eels, catfishes,parrotfishes, flatfishes, flatheads, flying fishes, porcupine fishes, puffers, skates, rays, marine reptiles, turtles,green and logger head,

Continued

Table 1. Continued

1	2	3	4	5	6	7	8
							sea birds, sea lions, seals, dolphins, terrestrial birds and mammals.
Rhizoprionodon acutus	65	Mar - May	101	2 - 6	Viviparous	Porto Novo	Silver bellies, squids,cuttlefish,crabs and shrimps.
Scoliodon palasorrah		Jan -Feb	68	3 -5	Viviparous	Bombay	Pelagic fishes,crustaceans and cephalopods.
S. welbeehmi		Nov -Dec	93	1 -2	Viviparous	Bombay	
S. laticaudus	35	Throughout	65	1 -13	Viviparous	Bombay	Sciaenids, Bombay-duck, threadfins, Nemipterus spp, Platycephalus spp, prawns, squilla , polychaetes and mud.
Sphyrna blochii	120	May - Jun	163	6 -14	Viviparous	Porto Novo	
S. blochii		Apr - May	150			Bombay	
S. lewini	180	Aug - Oct	295		Viviparous	Porto Novo	Sardines, anchovies, mackerels, eels, milkfish, soles, sharks and rays.
Aetobatus narinari		Apr - May	150	3		Calicut	Clams, oysters, bivalves,crabs and prawns.
A. flagellum		Aug - Sept	158			Cuddlaore	
Aetomylaeus nichofii		Dec - Apr	69				Thenus s pp; Acetes s pp., prawns, crabs, Apogo spp . Nemipterus spp . sole fish,squids and gastropods.
Rhinoptera javanica		July - Sept	120			Calicut	Molluscs,crabs,prawns and fishes.
R. javanica			150			Cuddalore	
Dasyatis uarnak		Jan - Mar	150	2	Viviparous	Calicut	Fishes, molluscs,crustaceans, polychaetes and jelly fish.
D. uarnak		Oct - Nov	160			Bombay	
D. zugei		Feb - Mar		2	Viviparous	Bombay	Prawns, crabs, squilla, fishes and molluscs.
D. zugei		Prolonged	102			Bombay	

Continued

Table 1. Continued

1	2	3	4	5	6	7	8
D. bleekeri		Dec - Feb	85	2	Viviparous	Cuddalore	Molluscs, crustaceans, polychaetes and ascidians.
D. sephen		Post- monsoon	180	2	Viviparous	Cuddalore	Fishes, molluscs, crustaceans, polychaetes and prochordates.
D. sephen		Prolonged	180			Calicut	
D. sephen	50	Peak in Jun	89			Bombay	
D. imbricatus	17	Prolonged	22	2	Ovoviviparous	Porto Novo	Crustaceans, molluscs and polychaetes.
		Dec - Jan	25	1	Viviparous	Bombay	Crustaceans and teleosts.
D. walga	30	Prolonged	40.5			Bombay	
D. jenkinsii		Jan -Nov	100		Viviparous	Calicut	Fishes, prawns, crabs, squilla, Thenus spp. and polychaetes.
Trygon kuhlii				2	Viviparous	Bombay	
Gymnura poecilura		Prolonged	108	1 -4	Viviparous	Bombay	
G. micrura		Prolonged	104	2	Viviparous	Bombay	Teleost and crustaceans.
Mobula diabolus		Apr - May	112	1	Viviparous	Calicut	Fishes.
Pristis microdon		May - July	312.5		Ovoviviparous	Cuddalore	Seerfish, mackerel, pomfrets, small sharks, sciaenids, ribbonfishes,
P. microdon		May -July	750			East coast	crustaceans and molluscs.
P. cuspidatus		March - May	300	6	Ovoviviparous	Bombay	
Rhynchobatus djiddensis			202.1	12	Ovoviviparous	Cuddalore	Bottom fishes, squids, prawns, crabs, squilla, apogonids, juvenile eels,
R. djiddensis			194			Calicut	threadfins , flatheads and lobsters.
R. djiddensis	210	July - Oct	297			Bombay	
Rhinobatos granulatus		Sep - Oct	147.5	12	Ovoviviparous	Cuddalore	Small crustaceans like amphipods, squilla, small crabs and prawns.

Table 2. Statewise average annual catch (t), effort (No. of units) of elasmobranchs and estimates of a, b, r, MSY and F_{msy}.

Maritime states	Average catch (tonnes)	Average effort (No. of units)	a	b	r	MSY (t)	F_{msy}
West Bengal	720	184458	50.2148	-0.0001998	0.72	3155	125663
Orissa	1066	586851	-2.396	+ 0.000001711	0.07	–	–
Andhra Pradesh	3694	1877611	4.4264	-0.000000528	0.03	9277	4191667
Tamil Nadu	7501	4055157	-6.3719	+ 0.000002613	0.47	–	–
Pondicherry	139	280071	4.026	-0.00001188	0.39	343	169444
Kerala	6034	2961155	3.1738	-0.000000594	0.51	4239	2671549
Karnataka	1940	468427	7.9077	-0.00001094	0.53	1429	36142
Goa	408	142802	0.6286	+ 0.0000006399	0.03	–	–
Maharashtra	7715	783178	18.506	-0.00001053	0.73	8149	882243
Gujarat	12432	891787	37.6106	-0.00001319	0.3	26803	1425292
All India	63799	12212541	-0.51589	+ 0.000000469	0.12	–	–

In Orissa, Tamil Nadu and Goa, the catch rate of elasmobranchs increased with increasing effort, which indicated that the present level of fishing does not have pronounced influence on the stock and therefore the catch could be safely increased by increasing the fishing effort. In Kerala and Karnataka the MSY is lower than the present average yield, therefore, it is recommended that the effort for exploitation of elasmobrachs should be reduced, while for Gujarat and West Bengal it can be further increased. In Maharashtra, although MSY is only 5.3% higher than the present yield, it is recommended that status quo in fishing effort can be maintained.

On an average 500 numbers of giant sized whale shark, Rhincodon typus were caught annually off Gujarat for their fins, liver, meat and other products for export. In order to protect this gentle giant creature from extinction their exploitation has to be totally banned as done recently. The abundance has come down during past few years. Species, which require protection, are the tiger shark (Galeocerdo cuvieri), hammer-headed sharks (Eusphyra blochii, Sphyrna lewini, S. mokarran), thresher sharks (Alopias vulpinis, A. pelagicus), all species of the genus Pristis, the skates Rhynchobatus djiddensis and R. halavi; and rays such as Mobula diabolus and Manta birostris.

5. Management

The biological studies on various species of elasmobranchs along the Indian coast showed that most of them are slow growing, viviparous, with long gestation period and limited fecundity. The size at first maturity is also high. Further, to maintain regular fishery and to avoid over exploitation of elasmobranchs certain management interventions are essential.

The stocks of various species offer very limited scope for long-term exploitation. Majority are slower to recover compared to other oviparous teleosts having high fecundity. To avoid adverse effect on recruitment of elasmobranchs the female part of the stock must be given considerable protection. Many species of sharks and rays use the bays and estuaries, as nursery for early growth of their young ones and hence fishing has to be regulated in these areas. Since the peak period of spawning in elasmobranchs coincides with the monsoon season a restriction on trawling during such times would prevent recruitment overfishing and growth overfishing. Some species of elasmobranchs school by age, sex and reproductive state. They should be protected from intense fishing. As the rate of reproduction in rays is extremely low, precaution should be taken to prevent overexploitation.Whale sharks are few in numbers. The ban on fishing should be continued to help resuscitation of the stock. Above all development of a sound database on fishery and various biological aspects merit serious consideration for evolving management measures for sustainable production.

6. Suggested reading

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