IOTC Working Party on Ecosystems and Bycatch; 12-14 October 2009; Mombasa, Kenya.

Decline in CPUE of Oceanic Sharks in the Indian EEZ : Urgent Need for Precautionary Approach

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Abstract

The Catch Per Unit Effort (CPUE) and its variability observed in resources surveys reflect on the standing stock of the resource and the changes in the stock density. Data on the CPUE of sharks obtained in tuna longline survey in the Indian EEZ by Govt. of India survey vessels during 1984 – 2006 were considered in this study. A total effort of 3.092 million hooks yielded 20,884 sharks. 23 species belonging to five families were recorded. Average hooking rate was 0.68 percent which showed high degree of spatio-temporal variability. Sharp decline was observed in the hooking rate from the different regions. The trend in the CPUE is a clear indication of the decline in the abundance of sharks in the different regions of the EEZ, the most alarming scenario being on the west coast as well as the east coast, where the average hooking rate recorded during the last five years was less than 0.1 percent. It is evident from the results of the survey that the standing stock of several species of sharks in the Indian seas has declined to such levels that the sustainability of the resource is under severe stress requiring urgent conservation and management measures.

Introduction

India is the third largest shark producing country in the world contributing about 7.38 percent of the world shark catch (Lack and Sant, 2006). The species diversity is rich and varied. Raje *et al*. (2002) listed 66 species of sharks occurring in the Indian seas, majority of which are pelagic sharks. Pillai and Biju (2000) made a checklist of 49 species of pelagic sharks out of which 19 are oceanic species. These sharks are harvested either in the targeted fishery or as bycatch in the tuna long line fishery. In tuna longline fishery, sharks constitute the most important bycatch component and majority of the species occurring are highly migratory species included in the UNCLOS Annexure I. Following adoption of the UN Convention on Migratory Species (CMS) in the year 2005, the need for a cautious approach with due consideration for conservation of shark resources has been recognized the world over.

In the Indian waters information on species composition, distribution and CPUE of sharks occurring in longline gear have become available from resources surveys (Sudarsan *et al.,* 1988; John and Somvanshi, 2000; Bhargava *et al.,* 2002; John *et al.*,

2006). With due consideration to the fishing effort on the larger oceanic pelagics in the Bay of Bengal and the unusual combination of biological characteristics of the sharks, *viz.*, slow growth rate, delayed maturation, long reproductive cycle, low fecundity and long life span, the need for conservation of the resource with a precautionary approach has been suggested (John and Neelakandan, 2003).

Material and Methods

Data obtained from tuna longline survey undertaken by six survey vessels (OAL 31.5-37.5 m ,GRT 245.8-465.0) of Fishery Survey of India were used in the study. While three vessels operated along the west coast of India, two vessels operated in the east coast and one vessel in the Andaman & Nicobar waters. The survey, commenced in the early eighties in the southwest region with one vessel, was subsequently extended to the other regions of the EEZ with the addition of more longliners to the survey fleet. While conventional multifilament longline with five hooks per basket was used from four vessels, the other two vessels which joined the fleet recently (2004) operated monofilament longline using seven hooks per basket. During the period from 1984 to 2006, a total of 3.092 million hooks were operated in the survey covering the Arabian Sea as well as Bay of Bengal between lat. 05º-23º N and long. 64º-96º E.

The time series CPUE index in terms of hooking rate per 100 hooks was taken to understand the trend in the CPUE in the three geographical segments of the Indian EEZ , viz., the west coast, east coast and Andaman & Nicobar waters.

Results and Discussion

Sharks formed about 45-50% of catch from the different regions. Altogether 20,884 sharks weighing 588.9 tonnes were recorded in the survey. The region-wise time series data on effort and catch is given in Table 1.

Species diversity:

The following 23 species of sharks belonging to five families were recorded in the survey: Pelagic thresher shark (*Alopias pelagicus)*, bigeye thresher shark (*A. superciliosus)*, thresher shark (*A. vulpines)*, blacktip shark (*Carcharhinus limbatus)*, hard-nose shark (*C. macloti)*, spottail shark (*C. sorrah)*, whitecheek shark (*C. dussumieri)*, black reef shark (*C. melanopterus)*, silky shark (*C. falciformis)*, dusky shark (*C.obscurus*), silvertip shark (*C. albimarginatus)*, oceanic whitetip shark (*C. longimanus)*, Pondicherry shark (*C. hemiodon)*, tiger shark (*Galeocerdo cuvieri)*, shortfin mako shark (*Isurus oxyrinchus)*, hammerhad sharks (*Sphyrna lewini, S. zygaena, S. mokarran)*, blue shark (*Prionace glauca)*, milk shark (*Rhizoprionodon acutus)*, broadfin shark (*Lamiopsis temmincki*), spadenose shark (*Scoliodon laticaudus)* and zebra shark (*Stegostoma fasciatum)*. Among these, except three species, *viz., Carcharhinus hemiodon, Scoliodon laticaudus and Stegostoma fasciatum*, which are essentially coastal species, all the other species are migratory / possibly migratory sharks included in the UNCLOS Annexure I. The species composition of sharks from the three oceanic regions showed significant diversity (Table 2). While *A. pelagicus* (26.9%) and *C. sorrah* (25.9%) were predominant in the island archipelago, *C. limbatus* (26.7%), *C.*

melanopterus (8.2%) and *C. falciformis* (6.9%) were dominant along the west coast, and *C. melanopterus* (47.3%), *C. limbatus* (17%) and *A. pelagicus* (10.3%) along the east coast.

Spatial variability in size:

The mean weight of shark obtained in the survey was 28.2 kg, which ranged from 19.7 kg in the east coast to 22.5 kg in the west coast and 40.0 kg in the Andaman & Nicobar waters. Marked difference was observed in the weight of different species of sharks obtained from the three oceanic regions (Table 3). The mean weight was found to be relatively high in the Andaman & Nicobar waters for most of the species compared to that from the west coast as well as the east coast, which is indicative of the high level of exploitation rate in the continental sectors. The tiger shark (*Galeocerdo cuvieri)* was the heaviest shark with an average weight of 116.7 kg in the Andaman & Nicobar waters. While *Sphyrna lewini* (70kg), *S. zygaena* (66.5 kg) and *G. cuvieri* (62.8 kg) recorded highest average weight along the west coast, *G. cuvieri* (51 kg) and *S. lewini* (45.6 kg) weighed more on the east coast.

Trends in CPUE:

The average hooking rate (No. /100 hooks) recorded in the survey, which is considered as the index of abundance, was 0.68%. While the highest average hooking rate was obtained from the Andaman & Nicobar waters (0.75%), the west coast and east coast yielded hooking rates in the range of 0.63-0.65%. The time series catch rates obtained from the different regions (Table 4) indicate annual variability of significantly high magnitude, with extremely low hooking rates in recent years. The trend in the CPUE is a clear indication of the decline in the abundance of sharks in all the three regions (Fig.1), the most alarming scenario being in the west coast as well as the east coast where the average CPUE recorded during the last five years was less than 0.1%. The sharp fall in the CPUE along the east coast occurred in 1990-91 and along the west coast in 1992-93. In the Andaman & Nicobar waters the steep decline was witnessed in the year 1996-97.

Precautionary approach:

It is evident from the results of the survey that the standing stock of several species of pelagic sharks in the Indian waters has declined to such levels that the sustainability of the resource is under severe stress requiring urgent conservation and management measures. Presently, four species of sharks, viz., Pondicherry shark (*Carcharhinus hemiodon*), Ganges shark (*Glyphis gangeticus*), speartooth shark (*G. glyphis*) and whale shark (*Rhiniodon typus*) are protected under Schedule I of the Wildlife (Protection) Act, 1972. But these species, with the exception of whale shark, are of coastal or insular distribution.

In line with the provisions of the UNCLOS and the Convention on International Trade in Endangered Species (CITES), the FAO has developed in 1998, the International Plan of Action for the Conservation and Management of Sharks (IPOA – Sharks) with the objective of ensuring conservation and management of sharks and their long term

sustainable use. The IPOA-Sharks embraces the precautionary approach and calls upon the countries having shark fisheries to develop and implement National Plan of Action (NPOA) to ensure effective conservation and management of sharks that are transboundry, straddling, highly migratory and high sea stocks. India has initiated action for development of a NPOA-Sharks. Further, a Regional Plan of action involving Bengladesh, India, Maldives and Sri Lanka is also envisaged. The survey results presented in this paper point to the urgency with which conservation and management measures should be put in place for ensuring long term sustainability of the shark resources.

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Table 1. Sampling effort (Hooks operated) and catch of sharks obtained in tuna longline survey in the Indian EEZ : 1984-2006

Year	West coast (05-23°N)			East coast (05-20°N)			A & N waters (05-15°N)		
	Hooks	Sharks		Hooks	Sharks		Hooks	Sharks	
		No.	Weight (kg)		No.	Weight (kg)		No.	Weight (kg)
1984	42448	653	13424	28680	209	5113	750	11	315
1985	74750	1042	27075	11900	120	4041	56250	786	14641
1986	75750	1110	20570	32400	182	5792	0	0	0
1987	85350	937	14768	65925	836	18295	0	0	0
1988	14660	137	3825	95400	1785	29660	0	0	0
1989	22250	121	2566	58455	496	8468	30930	276	11087
1990	76650	1296	33282	49425	183	4018	37125	217	6759
1991	32313	796	21449	33570	68	1157	15125	105	3350
1992	75455	488	7639	39225	86	1835	92500	1328	56784
1993	37230	278	5571	1250	16	255	50700	997	48607
1994	44690	159	3269	3000	3	77	93610	1535	68787
1995	64300	274	4080	5625	10	257	62500	382	15999
1996	67150	237	4200	37545	87	1519	57950	208	8142
1997	84325	296	6366	16875	56	975	27870	80	3222
1998	60535	330	12837	24615	39	1099	63282	199	8642
1999	90450	238	6226	33661	51	829	37100	88	3323
2000	38200	231	7974	0	0	0	46265	187	8989
2001	57775	64	1008	16550	2	37	38950	116	4059
2002	52675	24	661	6875	8	272	71875	339	10947
2003	48725	48	1397	9975	10	95	51590	147	5778
2004	48225	26	866	0	0	0	56387	179	7037
2005	84080	119	1690	49220	48	973	57859	212	8181
2006	112076	98	1838	75335	63	1033	57860	132	5965
Total	**1390062**	**9002**	**202581**	**695506**	**4358**	**85800**	**1006478**	**7524**	**300614**

Table 2. Species composition of sharks recorded in tuna longline survey in the Indian EEZ

Species	Percentage		
	West coast	**East coast**	**A & N waters**
Pelagic thresher shark (*Alopias pelagicus)*	5.7	10.3	26.9
Bigeye thresher shark (*Alopias superciliosus)*		4.2	0.6
Thresher shark (*Alopias vulpinus)*	0.5	2.4	11.8
Alopias spp.	0.3		
Blacktip shark (*Carcharhinus limbatus)*	26.7	17.0	5.8
Hard-nose shark (*Carcharhinus macloti)*	1.0		0.1
Spottail shark (*Carcharhinus sorrah)*	5.7		25.9
Whitecheek shark (*Carcharhinus dussumieri)*	4.1		
Black reef shark (*Carcharhinus melanopterus)*	8.2	47.3	0.6
Silky shark (*Carcharhinus falciformis)*	6.9		
Silvertip shark (*Carcharhinus albimarginatus)*	1.3	1.8	4.8
Oceanic whitetip shark (*Carcharhinus longimanus)*		0.6	4.7
Carcharhinus spp.	1.8		
Tiger shark (*Galeocerdo cuvieri)*	1.0	1.2	4.1
Shortfin mako shark (*Isurus oxyrinchus)*	1.8	0.6	1.8
Scalloped hammerhead shark (*Sphyrna lewini)*	0.3	6.1	
Smooth hammerhead shark (*Sphyrna zygaena)*	1.0	0.6	5.0
Great hammerhead shark (*Sphyrna mokarran)* Blue shark (*Prionace glauca*) Milk shark (*Rhizoprionodon acutus)* Broadfin shark (*Lamiopsis temmincki)* Spade-nose shark (*Scoliodion laticaudus)* Zebra shark (*Stegostoma fasciatum)* Unspecified sharks	33.7	7.9	7.9

(Data source : West coast & East coast : 2004-09, A&N : 1989-98, 2004-09)

Table 3. Mean weight of some of the shark species recorded in tuna longline survey in the Indian EEZ

Species	Mean weight (kg)		
	West coast	**East coast**	**A & N waters**
Alopias pelagicus	32.2	38.6	38.1
Alopias superciliosus	-	21.0	49.4
Alopias vulpinus	17.0	39.3	43.3
Carcharhinus limbatus	11.6	16.0	22.8
Carcharhinus macloti	14.3	-	15.3
Carcharhinus melanopterus	10.9	16.9	-
Carcharhinus albimarginatus	7.8	30.0	-
Galeocerdo cuvieri	62.8	51.0	116.7
Isurus oxyrinchus	20.3	25.0	-
Sphyrna lewini	70.0	45.6	-
Sphyrna zygaena	66.5	15.0	-

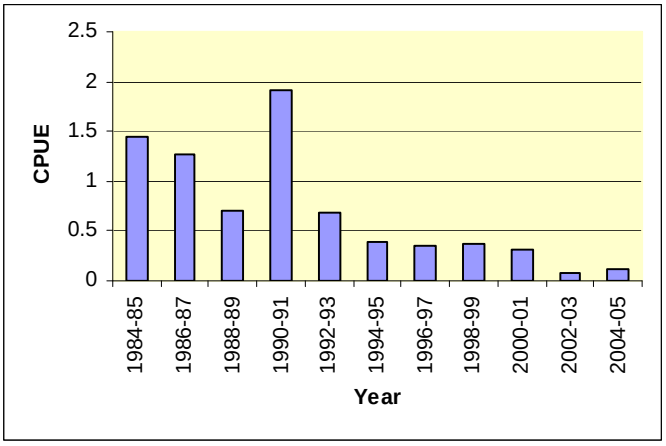
(Data source : 2004-09)

Table 4. CPUE of sharks obtained in tuna longline survey from different regions in the Indian EEZ

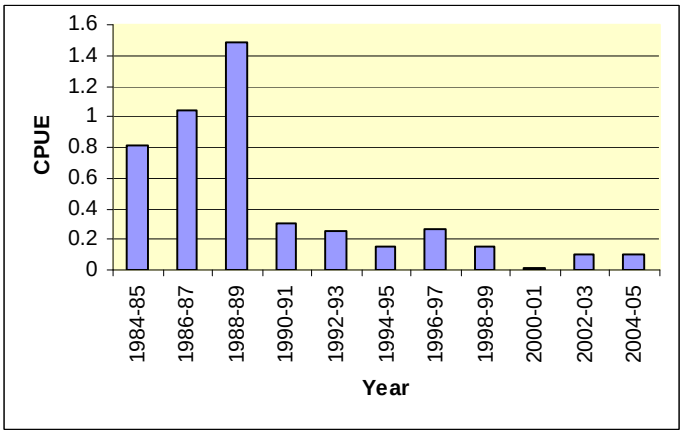
Year	Hooking rate (No. of shark/100 hooks)		
	West coast	**East coast**	**A & N waters**
1984	1.54	0.73	1.47
1985	1.39	1.01	1.40
1986	1.47	0.56	-
1987	1.10	1.27	-
1988	0.93	1.87	-
1989	0.54	0.85	0.89
1990	1.69	0.37	0.58
1991	2.46	0.20	0.69
1992	0.65	0.22	1.44
1993	0.75	1.28	1.97
1994	0.36	0.10	1.64
1995	0.43	0.18	0.61
1996	0.35	0.23	0.36
1997	0.35	0.33	0.29
1998	0.55	0.16	0.31
1999	0.26	0.15	0.24
2000	0.60	-	0.40
2001	0.11	0.01	0.30
2002	0.05	0.12	0.47
2003	0.10	0.10	0.28
2004	0.05	-	0.32
2005	0.14	0.10	0.37
2006	0.09	0.08	0.23

Fig. 1. Trend in CPUE (Hooking rate) of sharks obtained in tuna longline survey from different regions of the Indian EEZ

West coast



East coast



A & N waters