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Indian marine fishery resources: optimistic present, challenging future

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ABSTRACT

Marine fish production from capture fisheries in India has increased by about six fold during the past six decades. Export earnings from the marine sector crossed 12,000 crores in 2010-11 and gross revenue through marine fish landings at the point of first sales was about 20,000 crores. Marine products are now exported from India to nearly 100 countries. Monitoring the harvest of different marine fishery resources is very much essential for planning and implementing policies for sustained production from the sea. The dynamic changes in the landings of marine fishery resources over the last six decades were examined after classifying them into 26 different resource groups. Decadal averages of landings of different resource groups were compared using Student's *t* test and coefficient of variation was worked out for each decade. Present status of each resource group was examined separately based on a simple criterion. Out of the 26 groups examined, 18 were found to be under the 'abundant class, 5 under 'less abundant' class and one each under 'declining', 'depleted' and 'collapsed' classes. Elasmobranchs, threadfins, ribbonfishes, mullets and flatfishes are the five resource groups falling under 'less abundant' class. White fish falls under 'declining' class, flying fishes under 'depleted' class and unicorn cod under 'collapsed' class. All the other groups fall under the 'abundant' class indicating that most of the resources (73%) are in healthy condition. The 'depleted' and 'collapsed' classes require management interventions for the recovery of the resources and the group falling under 'declining' class needs caution and care to prevent further reduction in the stock.

Keywords: Decadal averages, Exploited stocks, Indian marine fisheries, Resource abundance, Status of resources, Trends in landings

Introduction

The fisheries sector plays an important role in Indian economy contributing about 1% to the Gross Domestic Product (GDP). The marine fish production in the country gradually increased from mere 5.8 lakh t in 1950 to 3.32 million t in 2010, registering about six fold increase. The development of fisheries sector in India can be classified into three phases (Srinath, 2003). During the first phase (1950 – 66), landings was mainly by non-mechanized indigenous crafts and gears and remained below one million t. The second phase spanning from 1967 - 86 featured increased mechanization, improved gear materials, introduction of motorized country crafts, expansion in export trade *etc*. The last phase during 1987 – 2010 witnessed intensification of mechanization as well as motorization of country crafts, modification of gears, multi-day voyage fishing and expansion of fishing grounds. Export earnings from marine sector increased from Rs. 3.92 crores in 1961-62 to Rs. 12,901.47 crores in 2010-11 registering 11.8% growth during 2009-10 (www.mpeda.com). The gross revenue from the marine fish landings during 2009-10 in terms of landing centre price was estimated as Rs.19,753 crores (CMFRI, 2011). The total fisherfolk population of the country is 3.52 million having 0.72million active fishermen (CMFRI, 2005). There are about 2,39,000 fishing crafts engaged in marine capture fisheries, of which 59,000 are mechanized crafts, 76,000 motorized and the rest non-mechanized. In mechanized sector, there are about 29,000 trawlers. Though fishing is concentrated mainly in the depth zone up to 100 m, deep sea trawlers operate up to 400 m depth zone.

Monitoring and assessment of the exploited marine fishery resources of India is one of the important mandate of Central Marine Fisheries Research Institute (CMFRI). With this in view, CMFRI has developed a sampling design for collection, classification and estimation of marine fish landings along with the effort expended. The sampling design adopted is based on stratified multi-stage random sampling technique, with stratification over space and time (Srinath *et al*., 2005). Several researchers have dealt with

the estimates of marine fish production in the country under various perspectives. The status of marine fishery resources of India based on the estimates of CMFRI has been analysed extensively (Silas *et al*., 1976, 1986; Alagaraja *et al*., 1982, 1987; George *et al.,* 1983; James *et al*., 1987; Srinath, 1987, 2003; Devaraj and Vivekanandan, 1999; Srinath *et al*., 2003, 2006; Srinath and Pillai, 2008; Srinivasan *et al*., 2009; Ramani *et al*., 2010). The trend in the landings of marine fish and shellfish resources along the different coasts were examined by Dharmaraja and Philipose (1975), Alagaraja *et al*. (1992), Sathianandan *et al*. (2010), Jayasankar *et al*. (2010), Somy *et al*. (2010) and Mini *et al*. (2010) for different periods. The status of marine fish landings along the various maritime states were evaluated by Dan (1985), Philipose *et al*. (1987), Scariah *et al*. (1987, 2000a, 2000b), Alagaraja (1987), Dharmaraja *et al*. (1987), Jacob *et al*. (1987), Kurup *et al*. (1987), Srinath *et al*. (1987), Balan *et al*. (1987), Pillai *et al*. (1994), Balan (1998), Ammini (1999), Yohannan *et al*. (1999), Ammini *et al*. (2004, 2010), Annam *et al*. (2004) and Sivakami and Somy (2009). As marine fishery resources are renewable and exhaustible, management and conservation of these resources are essential for sustained production from the seas. However, status of commercially important marine fishery resources needs periodical assessment. With this objective, the dynamics of marine fish landings over the past six decades were analysed and presented.

Materials and methods

The data on marine fish landings generated through the sample survey scheme of CMFRI during last sixty years (1950-2010) for the country, collected from the National Marine Fishery Resources Data Centre (NMFDC) of CMFRI, Kochi, were used for the study. The marine fish species were classified into 26 resource groups and one miscellaneous group. The decade-wise landings of each group were analysed by comparing consecutive decadal averages using Student's *t* test. Coefficient of Variation (CV) was worked out for each decade and decadal averages and annual landings of each resource were plotted to see the trend over the period 1950-2010. The simple criterion proposed by Mohamed *et al*. (2010) was used to assess the present status of different resources by classifying them in to 5 groups *viz*., abundant, less abundant, declining, depleted and collapsed (Table 1). For each resource group, the average growth percentage over decades and the average percentage contribution were also worked out.

Table 1. Criteria used for fish stock classification (Mohamed *et al*., 2010)

Stock classification	Recent average catch in historical maximum (%)
Abundant	> 70
Less abundant	50 – 69
Declining	11 – 49
Depleted	6 – 10
Collapsed	< 5

Results and discussion

All India marine fish landings

Over the past 6 decades, Indian marine capture fisheries witnessed a tremendous growth with the average landings increasing from 0.66 million t during 1950-60 to 3.06 million t in 2006-10 (Fig. 1). The results of statistical tests carried out to compare consecutive decadal averages, coefficient of variations and percentage growth are summarized in Table 2. Over decades, the average landings have increased significantly with maximum growth

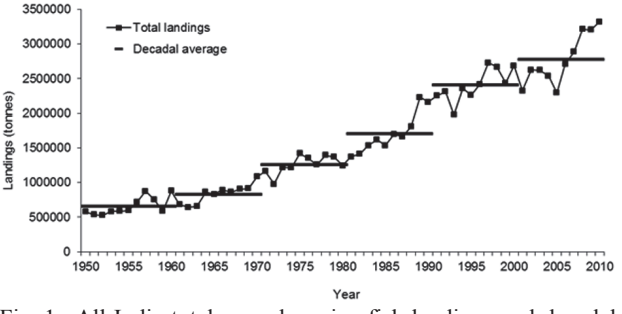

Fig. 1. All India total annual marine fish landings and decadal averages (1950-2010)

Table 2. Decadal average, coefficient of variation (CV), growth percentage and p value of Student's *t* test for total marine fish landings (1950- 2010)

Period	Average landings (t)	CV (%)	Growth (%)	p value
1950-1960	656844	18.84	-	-
1961-1970	832426	15.62	26.73	0.007250
1971-1980	1259624	9.91	51.32	0.000001
1981-1990	1702478	16.17	35.16	0.000723
1991-2000	2408741	9.22	41.48	0.000015
2001-2010	2773996	12.61	15.16	0.018358
2001-2005	2480890	5.74	-	-
2006-2010	3067101	7.47	23.63	0.003367

percentage observed during 1971-80, which could be attributed to introduction of motorized country crafts. The increase in average landings was also significantly different during the five year periods, 2001-05 and 2006-10.

Clupeids

Clupeids represent an important group of pelagic food fishes comprising oilsardine (*Sardinella longiceps*), lesser sardines (*Sardinella albella*, *Sardinella gibbosa*, *Sardinella fimbriata* and *Sardinella sirm*), white baits (*Stolephorus* spp., *Enchrasicholina* spp.) and anchovies (*Thryssa* spp., *Setipinna* spp. and *Coilia* spp.). Clupeids formed more than 20% of marine fish landings in India throughout the period with maximum contribution during 1961-70 (38%) (Table 3). The decadal average landings of clupeids increased from 1,73,299 t in 1950-60 to 7,39,135 t during 2001-10. The average landings showed significant increase ($p<0.01$) over decades except between the periods 1961-70 and 1971-80. It was observed that the average landings of clupeids significantly increased ($p<0.01$) from 6,42,389 t during the first half of 2001-10 to 8,35,882 t in the second half recording 30% increase (Fig.2). The coefficient of variation in landings was high in the early decades but has reduced to about 16% in the last three decades indicating comparatively less variability in the landings as compared to earlier years. The maximum landings of clupeids (9,29,404 t) was recorded in 2010 and the average landings during 2008-10 was 8,77,576 t which is 94.42% of the maximum landings. Hence clupeids can be included under the class 'abundant' with respect to its status of exploitation. Percentage growth in landings of clupeids was high during 1961-70 and 2001-10.

Mackerel

Fishery of mackerels is supported by three species, *Rastrelliger kanagurta, Rastrelliger brachysoma* and *Rastrelliger faughni* with major contribution by the Indian mackerel (*Rastrelliger kanagurta*). During 2008-10, the

Table 3. Decadal averages, coefficient of variation (CV), growth percentage and percentage contribution towards total landings for clupeids, mackerel, seerfish and tuna landings (1950- 2010)

Period	Clupeids				Mackerel				Seerfish				Tuna			
	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings
1950-1960	173299	38.06		26.38	74405	50.60		11.33	7403	26.24		1.13	2854	51.98		0.43
1961-1970	318657	27.18	83.88	38.28	52035	70.38	-30.07	6.25	10937	12.04	47.74	1.31	3607	37.31	26.38	0.43
1971-1980	338016	11.76	6.08	26.84	81515	55.63	56.65	6.47	21412	15.47	95.78	1.70	11813	51.85	227.50	0.94
1981-1990	435283	16.18	28.78	25.57	95175	82.50	16.76	5.59	33844	10.86	58.06	1.99	28562	43.58	141.78	1.68
1991-2000	507660	16.33	16.63	21.08	170468	35.57	79.11	7.08	43847	11.76	29.56	1.82	42915	12.54	50.25	1.78
2001-2010	739135	16.62	45.60	26.65	150063	33.08	-11.97	5.41	49351	12.72	12.55	1.78	55198	21.82	28.62	1.99
2001-2005	642389	10.40		25.89	113274	16.79		4.57	46577	9.55		1.88	45665	12.43		1.84
2006-2010	835882	10.01	30.12	27.25	186853	23.08	64.96	6.09	52124	12.67	11.91	1.70	64731	13.48	41.75	2.11
2008-2010	877576			27.04	204077			6.29	50260			1.55	64462			1.99

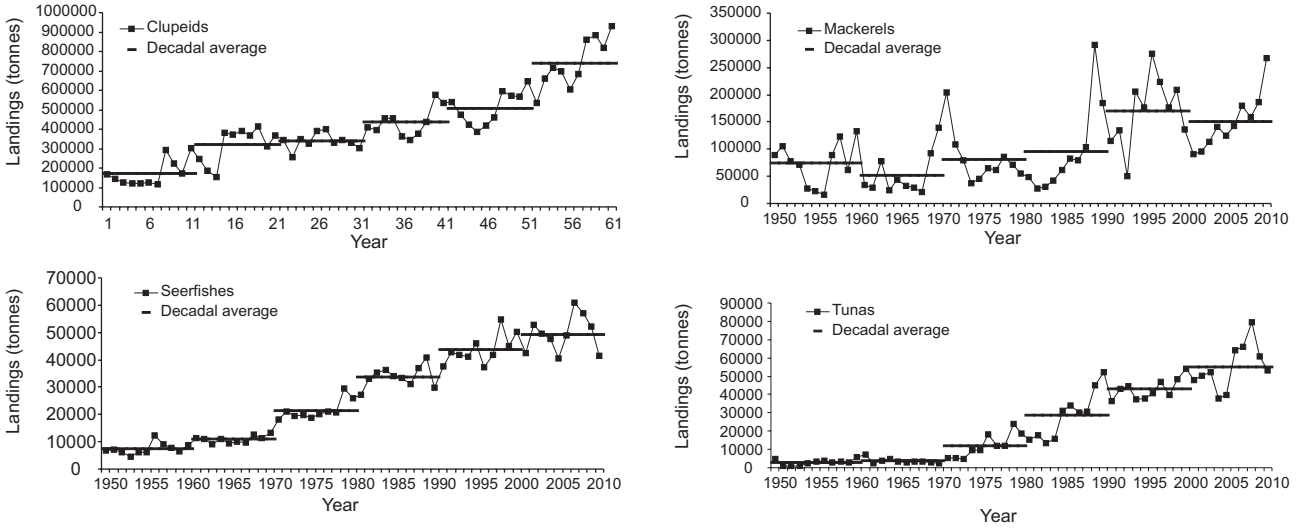

Fig. 2. All India annual landings of clupeids, mackerels, seerfishes and tunas along with decadal averages (1950-2010)

average annual landings of Indian mackerel in the country was 2,04,077 t which accounted for 6.3% of the total landings (Table 3; Fig. 2). The decadal average of mackerel landings increased from 74,405 t during 1950-60 to 1,70,468 t during 1991-2000 and then reduced to 1,50,063 t during 2001-10. The consecutive decadal averages of mackerel landings showed significant variation only between 1981-90 and 1991-2000 ($p<0.01$). Though the average landings over decades increased, the percentage contribution of mackerel towards total landings reduced from 11.33% during 1950-60 to 5.41% during 2001-10. During the last decade, average mackerel landings significantly increased from 1,13,274 t in the first half to 1,86,853 t in the second half ($p<0.01$). The CV in landings of mackerel was high in the initial decades and during the last two decades it has reduced, showing less fluctuation in landings. The maximum landings of mackerel was 2,91,077 t in 1989 and the average landings during 2008-10 formed 70.11% of the maximum landings suggesting the exploitation status of mackerels under the 'abundant' category.

Seerfishes

Seerfishes are one of the commercially important and high valued marine pelagic finfish of India. The important species contributing to the seerfish landings are king seer (*Scomberomorus commerson*), spotted seer (*Scomberomorus guttatus*), streaked seer (*Scomberomorus lineolatus*) and wahoo (*Acanthocybium solandri*) of which the first two species form more than 90% of the landings. Over the years, their average decadal landings increased from 7,403 t during 1950-60 period to 49,351 t during 2001-10, registering six fold increase (Table 3; Fig. 2). The average landings did not show much variation between the first half and the second half during the last decade. The percentage contribution of seerfishes towards total landings varied between 1.13% during 1950-60 and 1.99% during 1981-90. The coefficient of variations were high during the first decade and low afterwards. The average landings during 2008-10 was 50,260 t which formed 82.66% of the maximum landings of 60,801 t in 2007, indicating the present exploited status as 'abundant' in case of seerfishes.

Tunas

The tuna fishery in Indian waters is supported by eight species *viz*., little tuna (*Euthynnus affinis)*, frigate tuna *(Auxis thazard)*, bullet tuna *(Auxis rochei*), skipjack tuna (*Katsuwonus pelamis*), longtail tuna (*Thunnus tonggol*), yellowfin tuna (*Thunnus albacares*), striped bonito *(Sarda orientalis*) and dogtooth tuna (*Gymnosarda unicolor*). The decadal average of tuna increased from 2,854 t in 1950-60 and to 55,198 t during 2001-10 (Table 3; Fig. 2). The consecutive decadal averages have shown significant increase over decades except for the initial two decades ($p< 0.01$). The average tuna landings have increased rapidly in the second half of last decade (2001-10) compared to the first half. The percentage contribution of tunas in the total marine fish landings increased from 0.43% in 1950-60 to 1.99% during 2001-10. Fluctuations in landing was high during the first four decades as indicated by the CV and it has reduced considerably in the last two decades. The average landings of tuna during the last three years (2008-10) was 64,462 t which accounted to 80.89% of the maximum landings of 79,687 t observed in 2008, indicating the present status of tuna as 'abundant'.

Bombay duck

Bombay duck (*Harpadon nehereus*) formed 3.33% of the total all India marine fish landings during 2008-10. From the average landing of 64,698 t during 1950-60, it increased to 1,12,967 t during 2001-10 (Fig. 3). Though the average landings increased over decades, it was not in proportion to the increase in total landings (Table 4). Percentage contribution during 1950-60 was 9.85% which reduced to 4.07% during 2001-10. The increase in average landings in consecutive decades were not significant. The CV in landings also reduced over decades indicating stability in landings of Bombay duck in the recent years. No significant difference was noticed in the average landings between first and second halves of the last decade. The present status of Bombay duck can be classified as 'abundant' as the maximum observed landings of Bombay duck was 1,37,790 t in 1981 and the average landings during the last three years was 1,08,110 t which was 78.46% of the maximum landings.

Carangids

About 62 species of carangids are present along the Indian coast but commercial fishery is sustained mainly by horse mackerel, scads, leather jackets, moonfish, rainbow runner, cobia, trevallies, queen fishes, dolphin fishes and pompanos. The average decadal landings of carangids increased from 18,254 t during 1950-60 to 1,49,604 during 1991-2000 (Table 4; Fig. 3). Contribution to the total landings also increased from 2.78% during 1950-60 to 6.21% during 1991-2000. The variation in the average catches over the consequent decades was not significant except between 1971-80 and 1981-90. The CV was high (75.24%) in the first decade and it decreased over decades to reach 12.94% in the last decade. The maximum annual landings during the period was 1,96,868 t in 1995 and the average annual landings during 2008-10 was 1,64,066 t which formed 83.34% of the maximum landings, indicating the present status as 'abundant'. From the decadal averages, it can be seen that there was almost three fold increase in landings during 1981-90 and it further doubled during 1991-2000.

Table 4. Decadal averages, coefficient of variation (CV), growth percentage and percentage contribution towards total landings for Bombay duck, carangids, silverbellies and white fish landings (1950- 2010)

Period	Bombay duck				Carangids				Silverbellies				Whitefish			
	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings
1950-1960	64698	64.52		9.85	18254	75.24		2.78	15505	20.68		2.36	5725	115.16		0.87
1961-1970	81438	7.98	25.87	9.78	22785	20.96	24.82	2.74	31930	36.10	105.93	3.84	6678	23.81	14.27	0.80
1971-1980	86752	28.04	6.53	6.89	28552	15.46	25.31	2.27	43385	19.02	35.88	3.44	9037	32.29	26.10	0.72
1981-1990	103929	21.64	19.80	6.10	85916	47.85	200.91	5.05	64719	18.27	49.17	3.80	13785	39.01	34.45	0.81
1991-2000	106337	14.29	2.32	4.41	149604	17.57	74.13	6.21	58918	11.34	-8.96	2.45	6769	24.06	-103.63	0.28
2001-2010	112967	10.32	6.23	4.07	140468	12.94	-6.11	5.06	62116	14.27	5.43	2.24	6392	55.71	-5.91	0.23
2001-2005	114913	13.54		4.63	129852	6.42		5.23	54295	8.69		2.19	3716	18.00		0.15
2006-2010	111022	4.25	-3.39	3.62	151085	12.66	16.35	4.93	69937	5.07	28.81	2.28	9067	35.89	28.81	0.30
2008-2010	108110			3.33	164066			5.06	71360			2.20	11363			0.35

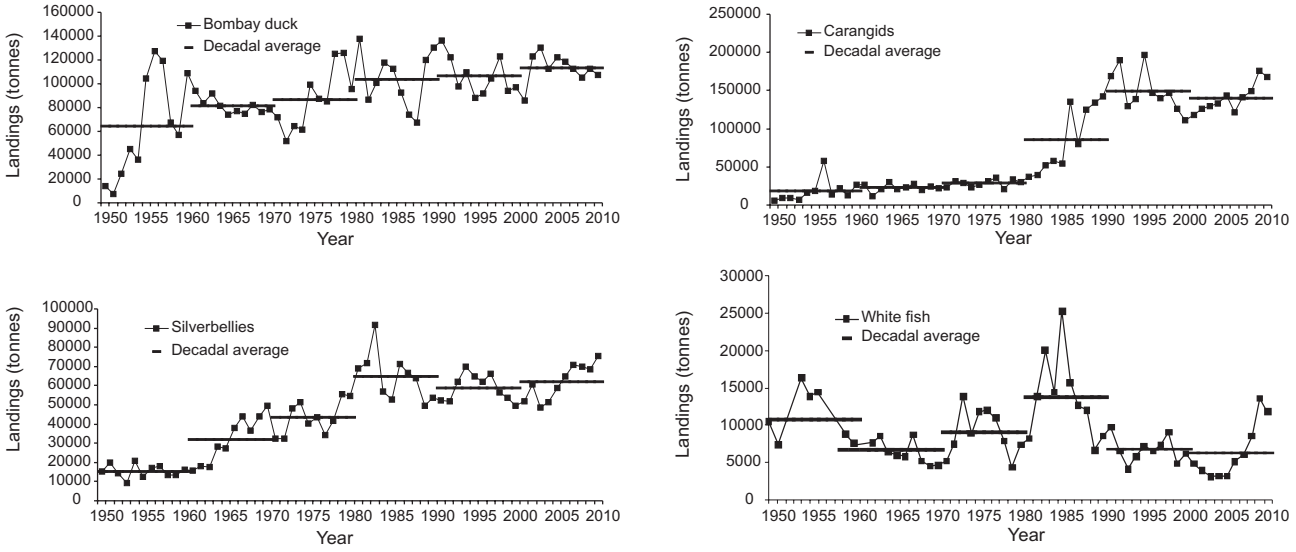

Fig. 3. All India annual landings of Bombay duck, carangids, silverbellies and white fish along with decadal averages (1950-2010)

Silverbellies

The fishery of silverbellies is supported by the fishes of the family Leiognathidae *viz*., *Leiognathus bindus*, *Leiognathus brevirostris*, *Leiognathus splendens, Leiognathus dussumieri, Gazza minuta* and *Secutor insidiator*. The percentage contribution of silverbellies towards all India total landings during 2008-10 was 2.2% (Table 4). The decadal average of annual landings increased from 15,505 t during 1950-60 to 62,116 t in 2001-10 (Fig. 3). The percentage contribution did not change much and it remained at 2.24% during 2001-10 against 2.36% during 1950-60. Statistical analysis showed that there were significant differences between consecutive decadal averages up to 1981-90 only ($p<0.01$). During the last decade, there was significant increase in average landings from 54,295 t in the first half to 69,937 t during the second half ($p<0.01$). The CV in the landings was high only during 1961-70 and it was below 20% for other decades. The maximum landings observed during the entire period was 91,538 t in 1983 and 71,360 t was the average landings during 2008-10. The present status of silverbellies can be classified as 'abundant' as the average landings formed 77.96% of the maximum landings.

White fish (Big jawed jumber)

The fishery is supported by single species, *Lactarius lactarius*, also known as false trevallies. The average landings during 2008-10 was 11,363 t which was 0.35% of the total landings (Table 4). The CV in landings reduced from 115.16% during 1950-60 to 55.71% during 2001-10. Even though the growth showed a positive trend during the initial decades, the last two decades witnessed a declining trend (Fig. 3). There was significant difference in decadal landings except between 1950-60 and 1961-70 ($p<0.01$). In the last decade, there was significant difference in the average landings between the first half and the second half ($p<0.05$). The maximum observed landings was 25,337 t in 1985 and the average landings during 2008-10

was 44.85% of the maximum landings which indicated that the present status of this resource is in the declining phase.

Ribbonfishes

Trichiurus lepturus is the dominant species under this group which forms more than 90% of the ribbonfish landings. Other ribbonfishes present in the catches are *Eupleurogrammus glossodon, Eupleurogrammus muticus* and *Lepturacanthus savala*. The decadal average landings increased from 31,215 t in 1950-60 to 1,58,751 t during 2001-10 realizing almost five fold increase (Table 5; Fig.4). The average landings over consecutive decades showed significant increase except between the first two decades and between 1971-80 and 1981-90 ($p<0.01$). Though, there was increase in the average landings in the second half of the last decade compared to the first half, it was not statistically significant. The CV in annual landings reduced from 36.53% during 1950-60 to 21.72% during 2001-10, indicating more stability during recent years. The maximum annual landings realized was 2,35,045 t in 2006 and the average during 2008-10 was 1,51,399 t which formed 64.41% of the maximum landings. This indicated that status of ribbonfishes at present is 'less abundant'.

Half beaks and full beaks

Half beaks belong to the family Hemirhamphidae and species contributing to the fishery are *Hemirhamphus far*, *Hemirhamphus marginatus* and *Rhynchorhamphus georgi*. Species contributing to the landings of full beaks (family Belonidae) are *Ablennes hians*, *Strongylura leiura, Tylosurus acus melonatus* and *Tylosurus crocodilus*. Consecutive decadal averages were significantly different ($p< 0.01$) between 1950-60 and 1961-70 and also between the decades 1981-90 and 1991-2000 (Table 5; Fig. 4). During the last decade, the average landings was not significantly different between 2001-05 and 2006-10. The decadal CVs have reduced from 120% during 1950-60 to

Table 5. Decadal averages, coefficient of variation (CV), growth percentage and percentage contribution towards total landings for ribbonfish, half beaks and full beaks, flying fishes and threadfin landings (1950- 2010)

Period	Ribbonfishs				Half beaks and full beaks				Flying fish				Threadfins			
	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings
1950-1960	31215	36.53		4.75	177	120.78		0.03	2116	75.51		0.32	5551	85.43		0.85
1961-1970	28326	31.05	-9.26	3.40	1387	61.47	683.62	0.17	2506	55.60	18.43	0.30	3736	44.74	-32.70	0.45
1971-1980	57315	21.89	102.34	4.55	1660	63.48	19.68	0.13	2710	97.61	8.14	0.22	8412	41.09	125.16	0.67
1981-1990	65326	28.14	13.98	3.84	2309	24.98	39.10	0.14	3158	109.37	16.53	0.19	6717	20.63	-20.15	0.39
1991-2000	121261	26.92	85.62	5.03	4201	39.35	81.94	0.17	2646	69.73	-16.21	0.11	8742	16.00	30.15	0.36
2001-2010	158751	21.72	30.92	5.72	4889	26.86	16.38	0.18	2684	75.45	1.44	0.10	9209	13.16	5.34	0.33
2001-2005	153306	19.53		6.18	4375	29.53		0.18	4065	49.56		0.16	8869	11.91		0.36
2006-2010	164195	22.97	7.10	5.35	5403	20.70	23.50	0.18	1303	43.96	-67.95	0.04	9549	13.22	7.67	0.31
2008-2010	151399			4.67	5628			0.17				0.04	10075			0.31

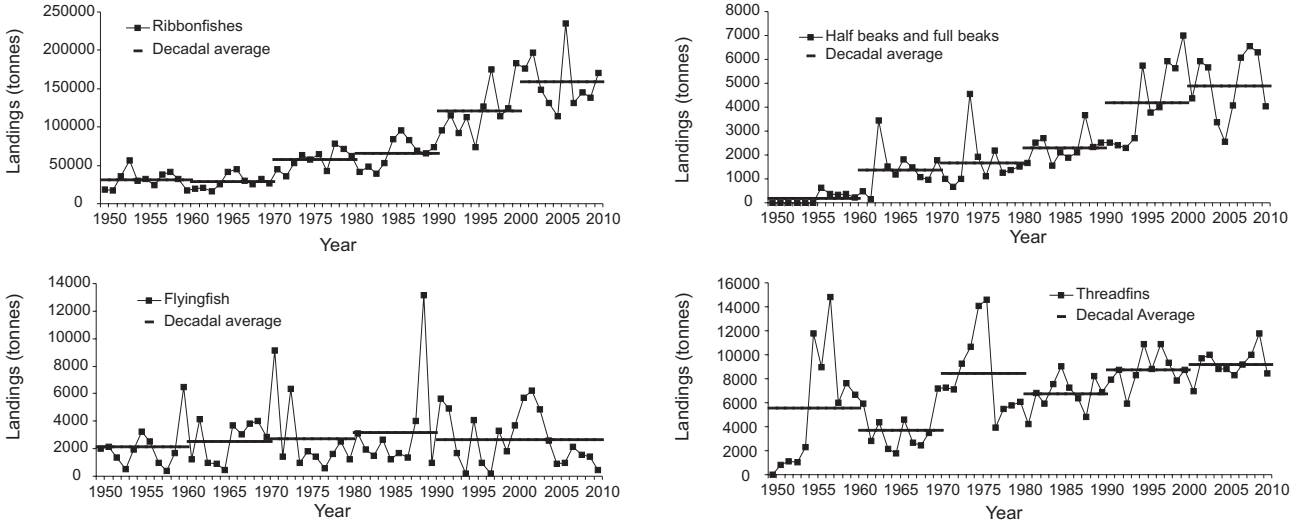

Fig. 4. All India annual landings of ribbonfish, half beaks and full beaks, flying fish and threadfins along with decadal averages (1950-2010)

26% during 2001-10. The average landings during 2008-10 was 5,628 t accounting for 0.18% of the total landings and it was 80.48% of the maximum landings observed so far (6,993 t in 2000), classifying half beaks as well as full beaks under the class 'abundant'.

Flying fishes

Cheilopogon furcatus, *Cheilopogon spilopterus, Cypselurus oligolepis*, *Exocoetus* volitans, *Hirundichthys oxycephalus*, *Parexocoetus brachypterus* and *Prognichthys brevipinnis* are the major species contributing to fishery of flying fishes. The consecutive decadal average in landings of flying fishes have not shown any significant difference over the last six decades (Table 5; Fig. 4). The average landings during 2001-05 and 2006-10 were significantly different ($p<0.05$) showing decrease in the last five years. Average landings of flying fishes during 2008-10 was 1,149 t and the observed maximum during the last six decades was 13,163 t in 1989. The average during 2008-10 was only 8.73% of the observed maximum landings suggesting their present status as 'depleted'. The CV for different decades vary between 43.96% and 109.37% showing highly fluctuating nature of flying fish landings.

Threadfins

Threadfins in the fishery was supported by *Polynemus* spp. and *Eleutheronema tetradactylum*. The decadal average of annual landings increased from 5,551 t during 1950-60 to 9,209 t during 2001-10 (Table 5; Fig. 4). During 2008-10, threadfins contributed 0.31% to the marine fish landings in India. Significant difference in average landings was observed between 1961-70 and 1971-80 and also between 1981-90 and 1991-2000 ($p<0.01$). The CV in annual landings reduced from 85.43% during 1950-60 to 13.16% during 2001-10 showing less variability during the last decade. Annual average of threadfin landings during 2008-10 was 10,075 t and the maximum landings observed was 14,846 t in 1957. The average landings during 2008-10 was 67.86% of the maximum annual landings, indicating their present status as 'less abundant'.

Barracudas

The barracudas also known as sea-pikes, are pelagic in habitat and are caught at varying depths along the Indian coast. Several species constituted the fishery dominated by *Sphyraena obtusata, Sphyraena barracuda, Sphyraena picuda, Sphyraena jello, Sphyraena flavicauda* and *Sphyraena forsteri*. The percentage contribution of barracudas towards marine fish landings in the country improved over decades to 0.67% during 2001-10 (Table 6). The decadal average of landings also improved over years and reached 18,501 t during 2001-10 from 1,280 t during 1950-60 (Fig. 5). Their consecutive decadal average landings did not vary significantly up to 1971-80, but increased significantly thereafter ($p<0.05$). In the second half of the last decade, there was significant improvement in average landings of barracudas compared to the first half ($p<0.05$). The CV in landings reduced over decades to 17.58% during 2001-10 from 100.20% during 1950-60, indicating stability in landings during the last decade. During 2008-10 their contribution towards marine fish landings was 0.69% with average landings of 22,330 t. The maximum observed landings was 24,782 t in 2010 and the last three years accounted for 90.11% of the observed maximum, suggesting to include barracudas under the 'abundant' category.

Perches

Perches comprise of diverse group of fishes *viz*., rock cods, snappers, pig face breams, threadfin breams and other perch resources. The average contribution of perches towards the total landings in the country have increased from 1.45% during 1950-60 to 7.22% during 2001-10. It can be observed that until 1970 there was no increase in landings of perches and shown growth from 1970 onwards (Table 6; Fig. 5). The average annual landings of perches during 1950-60 was 9,504 t which increased to 2,00,369 t during 2001-10. Significant differences were noticed between average landings of perches in the consecutive decades with an increasing trend over decades ($p<0.01$). But there was no significant difference between average landings of first and second half of the last decade. The maximum annual landings of perches obtained so far was 2,51,740 t in the year 2008 and the average annual landings of perches during 2008-10 was 2,29,906 t which formed 91.33% of maximum observed landings, suggesting their present status as 'abundant'. The CV in their landings reduced from 62.51% during 1950-60 to 12.33% during 2001-10 showing more stability in landings in the recent years.

Croakers

Dominant species in landings of croakers are *Johnius belangerii, Johnius carutta, Nibea soldado, Nibea maculata, Johnieops vogleri, Johnieops sina, Otolithes ruber, Kathala axillaris, Otolithoides biauritus, Protonibea dicanthus, Pennahia macrophthalmus* and *Dendrophysa russelli.* The landings of croakers have increased over decades and reached an average of 1,59,835 t during 1991-2000 from 37,255 t during 1950-60 (Table 6; Fig.5). Croakers accounted for 5.81% of the total landings during 2008-10. Significant differences ($p<0.05$) were noticed in the decadal average landings during 1961-70 to 1991-2000 while there was no significant difference between the landings of 1991-2000 and 2001-10. The

Table 6. Decadal averages, coefficient of variation (CV), growth percentage and percentage contribution towards total landings for barracudas, perches, croakers and lizard fish landings (1950- 2010)

Period	Barracudas				Perches				Croakers				Lizard fish			
	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings
1950-1960	1280	100.20		0.19	9504	62.51		1.45	37255	39.97		5.67	245	145.11		0.04
1961-1970	1783	51.51	39.30	0.21	10935	22.69	15.06	1.31	28865	19.83	-22.52	3.47	1674	48.84	583.27	0.20
1971-1980	2603	38.16	45.99	0.21	29189	38.29	166.93	2.32	82476	28.73	185.73	6.55	8644	42.91	416.37	0.69
1981-1990	5336	50.91	104.99	0.31	77039	34.38	163.93	4.53	101635	9.92	23.23	5.97	16957	28.92	96.17	1.00
1991-2000	14482	21.62	171.40	0.60	149278	19.19	93.77	6.20	159835	23.31	57.26	6.64	26723	17.62	57.59	1.11
2001-2010	18501	17.58	27.75	0.67	200369	12.33	34.23	7.22	145738	21.71	-8.82	5.25	37581	34.28	40.63	1.35
2001-2005	16159	11.14		0.65	186823	9.40		7.53	120651	2.30		4.86	29428	13.43		1.19
2006-2010	20844	12.63	28.99	0.68	213914	10.91	14.50	6.97	170826	15.87	41.59	5.57	45735	29.60	55.41	1.49
2008-2010	22330			0.69	229906			7.08	188410			5.81	56612			1.74

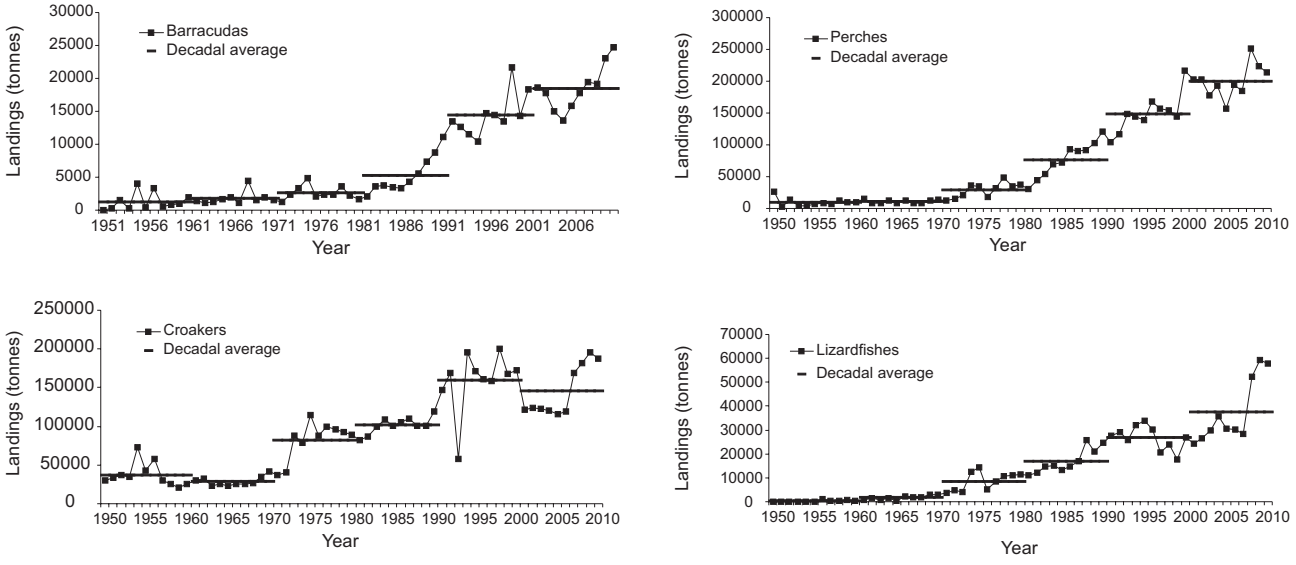

Fig. 5. All India annual landings of barracudas, perches, croakers and lizard fishes along with decadal averages (1950-2010)

average landings during first half and second half of the last decade also recorded significant different ($p<0.05$). The average annual landings reached a maximum of 1,70,826 t during the second half of the last decade. The CV in landings of croakers during 1950-60 was 39.97% which reduced to 9.92% during 1981-90 and increased thereafter to reach 21.71% during 2001-10. The annual average landings during 2008-10 was 1,88,410 t which is 94.33% of the maximum landings of 1,99,740 t recorded in 1998, indicating the present stock status of croakers as 'abundant'.

Lizardfishes

Lizardfish fishery is supported mainly by the species *Saurida tumbil, Saurida undosquamis*, *Synodus indicus* and *Trachinocephalus myops*. The average landings of lizardfishes during 2008-10 was 56,612 t contributing 1.35% to the total landings (Table 6). The average landings increased significantly ($p< 0.01$) over decades (Fig. 5). The CV in landings reduced over decades and during the last decade it increased to 34%. The maximum annual landings observed so far was 59,497 t in 2009 and the average landings during 2008-10 was 95.15% of the maximum landings, ranking its present status as 'abundant'. In the last decade the average landings during 2001-05 and 2006-10 were not significantly different.

Goatfishes

Parupeneus indicus, *Parupeneus barberinus, Upeneus moluccensis, Upeneus sulphureus, Upeneus tragula, Upeneus vittatus* and *Mulloides flavolineatus* are the major species of goatfishes in the landings. The decadal averages in landings of goatfishes were not significantly different up to 1971-80. However, significant difference ($p<0.05$) was observed in the averages between decades 1971-80 and 1981-90 and the increase in average landings for 1981-90 was almost three times (Table 7). Thereafter there was no significant difference in the landings. In the

last decade, the average annual landings in the second half increased significantly ($p<0.05$) compared to the first half (Fig.6). Coefficient of variation in landings of goatfishes reduced from 103.55% during 1950-60 to 38.7% during 2001-10 indicating more stability in the quantity landed in the last decade. The average annual landings during 2008-10 was 28,498 t forming 0.88% of the total landings. The maximum landings of goatfishes observed was 33,298 t in 1991 and the average for 2008-10 was 85.59% of the maximum landings, suggesting the present status of the group as 'abundant'.

Pomfrets

Pomfret fishery is supported by the silver pomfret (*Pampus argenteus*) and Chinese pomfret (*Pampus chinensis*) of the family Stromateidae and black pomfret (*Parastromateus niger*) of the family Carangidae. Silver pomfret support major share of the catch. The contribution of pomfrets towards marine fish landings during 1950-60 was 2.18% and it reduced to 1.63% during 2001-10, though the average landings increased from 14,328 t during 1950-60 to 45,114 t during 2001-10 (Table 7; Fig.6). Consecutive decadal averages of pomfret landings were significantly different ($p<0.05$) up to 1981-90 and thereafter no significant difference was noticed. The CV in landings of promfrets decreased from 37.65% during 1950-60 to 12.09% during 2001-10. The observed maximum landings of pomfrets was 54,217 t in 1983 and the average landings of 52,173 t during 2008-10 which formed 96.23% of the maximum landings classifying this resource as 'abundant'.

Catfishes

Landings of catfishes are supported mainly by fishes of the family Aridae (=Tachysuridae). Dominant species in the landings are *Arius arius*, *Arius thalassinns*, *Arius dussumieri*, *Arius sona*, *Tachysurus serratus*, *Tachysurus tenuispinis*, *Osteogeneiosus militanis* and *Plotosus canius*. During 2008-10, catfishes formed 2.91% of the total landings in the country. Though the decadal average landings showed increasing trend (Fig. 6; Table 7),

Table 7. Decadal averages, coefficient of variation (CV), growth percentage and percentage contribution towards total landings for goatfish, pomfret, catfish and flatfish landings (1950- 2010)

Period	Goatfishes				Pomfrets				Catfishes				Flatfishes			
	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings
1950-1960	2526	103.55		0.38	14328	37.65		2.18	21585	22.20		3.29	9167	84.42		1.40
1961-1970	2646	46.25	4.75	0.32	21188	20.52	47.88	2.55	23759	41.67	10.07	2.85	10021	34.35	9.32	1.20
1971-1980	3933	38.70	48.64	0.31	30221	28.43	42.63	2.40	51743	21.88	117.78	4.11	12706	20.20	26.79	1.01
1981-1990	11429	75.43	190.59	0.67	42992	17.37	42.26	2.53	53952	16.79	4.27	3.17	28631	21.26	125.33	1.68
1991-2000	15982	41.37	39.84	0.66	40563	12.03	-5.65	1.68	44128	15.11	-18.21	1.83	46859	15.54	63.67	1.95
2001-2010	18668	38.70	16.81	0.67	45114	12.09	11.22	1.63	66455	29.68	50.60	2.40	41181	8.98	-12.12	1.48
2001-2005	13659	18.78		0.55	40422	5.44		1.63	51910	8.22		2.09	39782	9.27		1.60
2006-2010	23677	29.14	73.34	0.77	49806	6.56	23.22	1.62	81001	22.65	56.04	2.64	42581	7.36	7.04	1.39
2008-2010	28498			0.88	52173			1.61	94376			2.91	43970			1.35

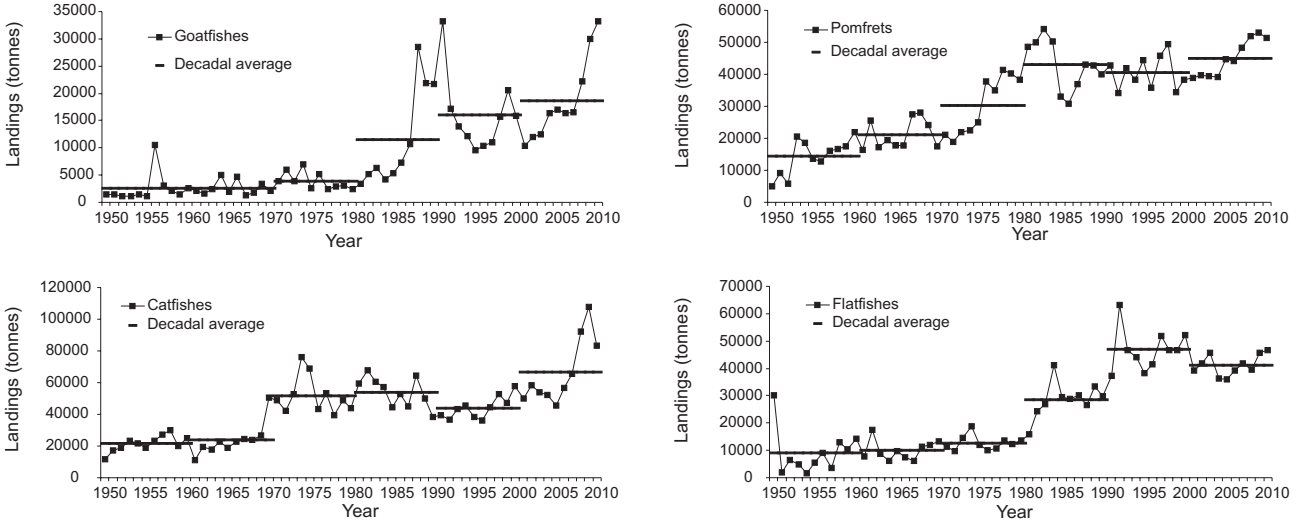

Fig. 6. All India annual landings of goatfishes, pomfrets, catfishes and flatfishes along with decadal averages (1950-2010)

statistical tests indicated that there is no significant difference in average landings between the periods 1950-60 and 1961-70 and also between 1971-80 and 1981-90. Since the average landings during 2008-10 formed 87.73% of the maximum annual landings (1,07,573 t in 2009), this resource falls under the 'abundant' category. Though the decadal average catch increased from 21,585 t during 1950-60 to 66,455 t during 2001-10, the percentage contribution reduced from 3.29% to 2.40%. The CV in landings of catfishes were high during 1961-70 (41.67%) and it reduced thereafter showing more stability in landings.

Flatfishes

The fishery of flatfishes is supported by halibut, flounders and soles, with more than 95% being contributed by soles. Dominant species in landings of flatfishes are *Cynoglossus macrostomus*, *Cynoglossus macrolepidotus* and *Psettodes erumei*. The decadal average landings increased from 9,167 t in 1950-60 to 46,859 t in 1991-2000 (Table 7; Fig. 6). As indicated by the CV, the fluctuation was high during 1950-60 (84%) and it reduced to 8.98% during 2001-10. The decadal average landings differ significantly between 1971-80 and 1981-90, so also between 1981-90 and 1991-2000 ($p<0.01$). Though the average annual landings increased over the decades, their percentage contribution to the total landings showed no significant variation. The average annual landing during 2008-10 was 43,970 t which formed 69.41% of the maximum landings of 63,344 t observed in 1992, suggesting the present status of flatfishes as 'less abundant'.

Elasmobranchs

Elasmobranchs form an important group comprising sharks, skates and rays, having diverse commercial use for their body parts. During 2008-10, elasmobranchs formed 1.49% of all India total marine fish landings. Average landings of elasmobranchs in consecutive decades were found to be significantly different ($p < 0.01$) except between 1971-80 and 1981-90 and positive growth was registered in the decadal averages except in 2001-10 (Table 8; Fig. 7). During 2001-10 the difference between first and last five years' average landings was not significant indicating that the decrease in landings in the last decade is continuous over the ten year period and not restricted to recent years. The average landings during 2008-10 was 48,355 t which formed 64% of the maximum observed landings (75,304 t in 1997) indicating that this resource is under 'less abundant' category.

Eels

Dominant species in the landings of eels belong to the genera *Congresox, Anguilla, Nemichthys, Gymnothorax, Conger* and *Uroconger*. The landings of eels showed positive growth throughout the period, except during 1981-90. The annual average eel landings in India during 2008-10 was 11,462 t. The decadal average landings of eels were found to be significantly different only between the decades 1991-2000 and 2001-10 ($p<0.05$) (Table 8). The average landings during the first and second half of the last decade were also significantly different ($p<0.05$). There is an increasing trend in annual landings from 1980 onwards, though the increase in decadal averages were not significant (Fig. 7). The maximum observed annual landings of eels was 12,997 t in 1977 and the average landings during 2008-10 was 88.19 % of the observed maximum. This suggests that, the present status of eels is under 'abundant' class.

Mullets

The fishery of mullets is supported by several species dominated by *Mugil cephalus, Mugil cunnesius, Liza macrolepis, Liza parsia, Liza tade, Ellochelon vaigiensis, Valamugil seheli* and *Rhinomugil corsula*. The decadal average of annual landings of mullets increased from 380 t during 1950-60 to 6,369 t during 2001-10 (Table 8; Fig. 7). The percentage contribution of mullets towards total landings increased from 0.06% during 1950-60 to 0.31% during 1981-90. Fluctuations in landings of mullets were high during the period up to 1990 as indicated by the CV which was 20.22% and 14.62% respectively for the last two decades. Significant differences in their decadal average landings were observed between 1950-60 and 1961-70 and also between 1971-80 and 1981-90 ($p<0.05$). The average landings during 2008-10 was 6,880 t which formed 68.97% of the maximum observed landings (9,976 t) and therefore the present status of the group falls under 'less abundant' category.

Unicorn cod

Fishery of unicorn cod is mainly confined to Gujarat state and supported by single species, *Bregmaceros macclellandi* which is also known as spotted codlet. Their average contribution in the total landings during 1950-60 was 0.75% which decreased to 0.02% during 2001-10 (Table 8). Over the decades, the average annual landings also registered decline from 4,909 t in 1950-60 to 686 t in 2001-10 (Fig. 7). The average landings showed no significant difference between consecutive decades indicating gradual decline in landings. Fluctuation in their annual landings was indicated by high CV values in all decades except in 2001-10. The average landings during 2008-10 was 621 t which was only 4.26% of the maximum landings of 14,566 t in 1953 indicating present status as 'collapsed'.

Table 8. Decadal averages, coefficient of variation (CV), growth percentage and percentage contribution towards total landings for elasmobranchs, eels, mullets and unicorn cod landings (1950- 2010)

Period	Elasmobranchs				Eels				Mullets				Unicorn cod			
	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings
1950-1960	24141	29.37		3.68	3947	105.70		0.60	380	95.16		0.06	4909	77.87		0.75
1961-1970	36100	13.16	49.54	4.34	5201	62.59	24.11	0.62	2037	42.24	436.05	0.24	3216	41.25	-34.49	0.39
1971-1980	54987	15.10	52.32	4.37	7147	44.63	27.23	0.57	2643	36.03	29.75	0.21	1911	99.63	-40.58	0.15
1981-1990	56723	9.86	3.16	3.33	6274	24.79	-13.91	0.37	5210	51.69	97.12	0.31	742	94.90	-61.17	0.04
1991-2000	65728	11.49	15.88	2.73	7656	22.59	18.05	0.32	6584	20.22	26.37	0.27	616	67.60	-16.98	0.03
2001-2010	52176	10.78	-20.62	1.88	10167	15.67	24.70	0.37	6369	14.62	-3.27	0.23	686	25.16	11.36	0.02
2001-2005	55980	8.80			8845	9.20		0.36	5921	9.41		0.24	759	20.25		0.03
2006-2010	48372	6.57	-13.59	1.58	11488	8.35	23.01	0.37	6817	14.82	15.13	0.22	613	25.93	-19.24	0.02
2008-2010	48355				11462				6880			0.21	621			0.02

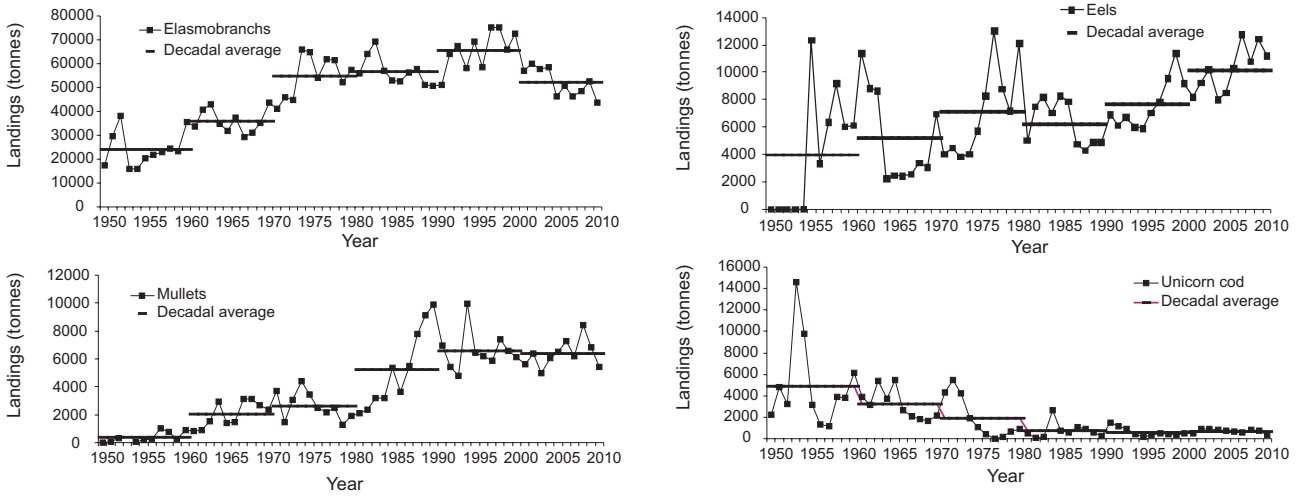

Fig. 7. All India annual landings of elasmobranchs, eels, mullets and unicorn cod along with decadal averages (1950-2010)

Crustaceans

Crustacean fishery was supported by penaeid and non-penaeid shrimps, lobsters, crabs and stomatopods. The landings of penaeid shrimps were constituted mainly by *Parapenaeopsis stylifera*, *Metapenaeus dobsoni*, *Metapenaeus monoceros, Metapenaeus affinis*, *Solenocera crassicornis* and *Penaeus indicus*. The most abundant non-penaeid shrimps are *Acetes* spp., *Nematopalaemon tenuipes* and *Exhippolysmata ensirostris*. Crabs in the landings were dominated by *Portunus pelagicus* and *Portunus sanguinolentus*. Lobsters are widely distributed along the Indian coast and the fishery is supported mainly by *Panulirus homarus*, *Panulirus ornatus*, *Panulirus penicillatus*, *Panulirus polyphagus*, *Panulirus versicolor, Thenus orientalis* and *Puerulus sewelli*. The contribution of crustaceans towards marine fish landings in India during 1950-60 was 15.24% and it continued to contribute at the same proportion over the decades (Table 9). The decadal average of annual landings increased from 1,00,128 t during 1950-60 to 4,23,374 t during 2001-10 (Fig. 8). The CV reduced from 32.66% of 1950-60 to 10.82% during 2001-10 showing less fluctuations during the last decade. Though the average landings of consecutive decades increased significantly ($p<0.01$) during 1971-2000, there was no significant difference between the last two decades. During the last decade, the average landings in the second half is significantly higher than that in the first half ($p<0.05$). The average annual landings of 2008-10 was 4,80,547 t which formed 95.6% of the maximum landings of 5,02,806 t observed in 1997 categorizing the present status as 'abundant'.

Molluscs

Bivalves, gastropods, squids, cuttlefishes and octopus are the major contributors to the molluscan fishery of India. The decadal averages registered a steady growth during the period (Table 9; Fig. 8). From an average of 74 t per year in 1950-60, the landings have gone up to 1,26,168 t during 2001-10. Contribution of molluscs increased from 0.01% during 1950-60 to 4.55% during 2001-10. Significant increase was noticed in consecutive decadal landings throughout the period ($p<0.05$). Though the average landings in the second half of the last decade

Table 9. Decadal averages, coefficient of variation (CV), growth percentage and percentage contribution towards total landings for crustacean and molluscan landings (1950- 2010)

Period	Crustaceans				Molluscs			
	Average landings (t)	CV (%)	Growth (%)	% of total landings	Average landings (t)	CV (%)	Growth (%)	% of total landings
1950-1960	100128	32.66		15.24	74	213.87		0.01
1961-1970	95442	18.49	-4.68	11.47	610	74.74	724.32	0.07
1971-1980	197592	11.21	107.03	15.69	7843	68.46	1185.74	0.62
1981-1990	264958	17.77	34.09	15.56	32847	48.86	318.81	1.93
1991-2000	415857	12.25	56.95	17.26	103133	14.51	213.98	4.28
2001-2010	423374	10.82	1.81	15.26	126168	20.88	22.34	4.55
2001-2005	392798	8.37		15.83	108898	6.82		4.39
2006-2010	453949	7.79	15.57	14.80	143437	18.93	31.72	4.68
2008-2010	480547			14.81	157603			4.86

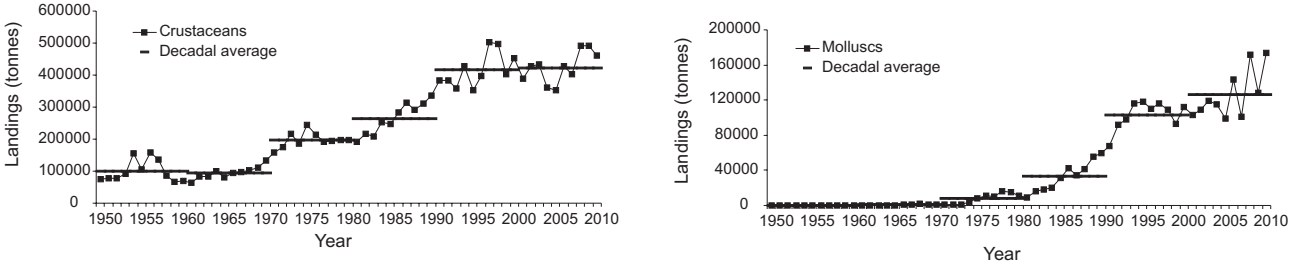

Fig. 8. All India annual landings of crustaceans and molluscs along with decadal averages (1950-2010)

reached 1,43,437 t compared to 1,08,898 t in the first half, the difference is not significant due to high variability in the annual landings during the second half. The average annual landings during 2008-10 was 1,57,603 t which formed 99.9% of observed maximum landings of 1,73,365 t in 2010. The results indicate that presently the stock is under the 'abundant' class.

Present status of stocks

The marine fish landings in India recorded a steady growth since 1950 with comparatively less fluctuations. The landings of clupeids showed positive growth throughout the period with its peak during the last decade (2001-10). This is mainly due to the increased landings of oilsardine, the major contributor of this group, by extending its areas of intensive harvest to the entire south region both on east and west coasts. Apart from this, the introduction of new gears like purseseines and ringseines augmented the exploitation of pelagic shoals like sardines and anchovies. In case of mackerel landings, fluctuations were high during the first four decades with maximum growth rate during 1991-2000 and showed negative growth during the last decade. The seerfish landings showed positive growth throughout the period with maximum growth during 1991-2000 and minimum during the last decade. Steady growth was observed in the landings of tuna from 1975 onwards and the growth rate gradually reduced over decades. Bombay duck landings registered positive growth throughout the period, though the growth rate was slow in the later periods. The landings of silverbellies have shown upward growth from 1965 to 1990 and remained steady thereafter. Similarly, landings of barracudas have shown steady growth from 1981 onwards. Except for the period 1991-2000, the landings of pomfrets showed positive growth trend. Catfish landings fluctuated in an oscillatory manner and have shown high growth rate in the last decade. The status of catfishes (*Arius* spp.) along the Kerala and Karnataka coasts was classified under the 'collapsed' category (Mohamed *et al*., 2010), but in the present study, at the national level, catfishes come under 'abundant' class. This could be attributed to the fact that the drastic reduction in the landings of catfishes in Kerala and Karnataka in the later decades might have been compensated by the increased landings in other states. Landings of flatfishes remained low until 1980, showed increasing trend during the susequent two decades and the catch slightly reduced during the last decade. Elasmobranch landings recorded fast growth initially, declined later and exhibited negative growth in the last decade. In the later half of the last decade there was slight increase in elasmobranch landings, though statistically not significant. The landings of mullets have shown increase up to 2000 and slightly declined in the last decade. Unicorn cod landings declined over the decades and the landings was less during the last decade. An increasing trend was observed in the crustacean landings from 1970. This could be attributed to the extension of

fishing ground beyond 100 m depth zone to exploit deep sea crustacean resources. A consistent growth was observed in molluscs landings from 1975 onwards mainly because of the targeted fishing and the maximum growth was observed during 1971-80. The growth was comparatively low during 2001-10.

The total marine fish landings crossed 3 million t in 2008 and it remained above this level in the subsequent years. The Working Group constituted in the year 2000 by the Government of India for revalidating the potential of marine fishery resources of the country's Exclusive Economic Zone (EEZ) estimated the potential yield as 3.93 million tonnes (Anon, 2000). Resources that have shown improvement in percentage contribution towards total landings during the last decade compared to 1950-60 period are clupeids, lizard fishes, perches, goatfishes, ribbonfish, carangids, seerfishes, tunas, barracudas, mullets, flatfishes and molluscs. For crustaceans, the percentage contribution was maintained in the same level. When the average annual landings of the different resources in the last decade were compared with that of 1950-60, it was found that the average landings has come down only in the case of unicorn cod. Comparing the average landings in the last five years (2006-10) with that during 1950-60, the resources which have come down are flying fishes and unicorn cod. When the average landings in the last five years were compared with that of 1981-90 period (first decade in phase three), the landings have come down in the case of elasmobranchs, flying fishes, white fish and unicorn cod.

The resources that have shown increase in average decadal landings throughout the period are clupeids, Bombay duck, lizard fishes, half beaks and full beaks, perches, goatfishes, seer fishes, tunas, barracudas and molluscs. In the last decade, the resources that have showed decline in average landings in the second half compared to the first half are elasmobranchs, Bombay duck, flying fishes and unicorn cod. However, these reductions in landings were not statistically significant. Resources that have shown significant increase in average annual landings in the second half of last decade compared to the first half are that of eels, clupeids, silverbellies, pomfrets and tunas.

While attempting to classify the 26 resource groups following the method suggested by Mohamed *et al*. (2010), it was found that 18 resources groups fall under 'abundant' class, 5 groups under 'less abundant' class and 1 group each under 'declining', 'depleted' and 'collapsed' classes (Table 10). All the important resource groups fall either under 'abundant' or 'less abundant' class. The groups

Table 10. Classification of different resource groups based on last three years (2008-10) average landings

Resource group	Average landings (t) during 2008-10	Maximum annual landings (t) during 1950-10	Year	Percentage of total landings	Status
Clupeids	877576	929404	2010	94.42	Abundant
Mackerels	204077	291077	1989	70.11	Abundant
Seerfishes	50260	60801	2007	82.66	Abundant
Tunas	64462	79687	2008	80.89	Abundant
Bombayduck	108110	137790	1981	78.46	Abundant
Carangids	164066	196868	1995	83.34	Abundant
Silverbellies	71360	91538	1983	77.96	Abundant
White fish	11363	25337	1985	44.85	Declining
Ribbon fishes	151399	235045	2006	64.41	Less abundant
Half beaks and full beaks	5628	6993	2000	80.48	Abundant
Flying fishes	1149	13163	1989	8.73	Depleted
Threadfins	10075	14846	1957	67.86	Less abundant
Barracudas	22330	24782	2010	90.11	Abundant
Perches	229906	251740	2008	91.33	Abundant
Croakers	188410	199740	1998	94.33	Abundant
Lizard fishes	56612	59497	2009	95.15	Abundant
Goatfishes	28498	33298	1991	85.58	Abundant
Pomfrets	52173	54217	1983	96.23	Abundant
Catfishes	94376	107573	2009	87.73	Abundant
Flat fishes	43970	63344	1992	69.41	Less abundant
Elasmobranchs	48355	75304	1997	64.21	Less abundant
Eels	11462	12997	1977	88.19	Abundant
Mullets	6880	9976	1994	68.97	Less abundant
Unicorn cod	621	14566	1953	4.26	Collapsed
Crustaceans	480547	502806	1997	95.57	Abundant
Mollucs	157603	173365	2010	90.91	Abundant

classified under 'less abundant' are elasmobranchs, threadfins, ribbon fishes, mullets and flat fishes. White fish falls under 'declining' flying fishes under 'depleted' and unicorn cod under 'collapsed' class. The two groups falling under 'depleted' and 'collapsed' classes require immediate management interventions for their recovery. Also, the one falling under 'declining' class need caution and care to prevent further reduction and to improve the stock.

Commercial fisheries are species specific and depends on several factors such as craft, gear, effort and deployment depth. The landings data represents only those resources exploited by the commercial fisheries. Fish production in the sea depends on various factors *viz*., the productivity of the sea, the availability of fish at a given point of time, accessibility as well as vulnerability of the resources and a number of other aspects and is easily affected by the changes in the sea and hence difficult to monitor and manage. Different models and methods including biological, ecological and environmental factors are available to assess the status of the resources. However, these tools are very complex and data intensive. Until such models are available, the present results can be taken as precautionary indicators for assessment of the resources. The results obtained in the present study are from the marine fish landing data and the classification was attempted on the different groups of resources only. The results give an indication of the status of different resources in the present fishing grounds exploited by targeted/non-targeted gears.

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