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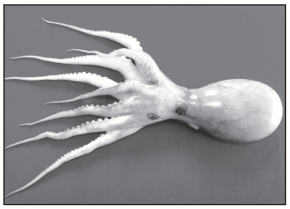

Octopus membranaceus
Quoy and Gaimard, 1832

The Marine Fisheries Information Service : Technical and Extension Series envisages dissemination of information on marine fishery resources based on research results to the planners, industry and fish farmers, and transfer of technology from laboratory to field.

Director's Preface

200th Number of Marine Fisheries Information Service

Dr. G. Syda Rao
Director

The Central Marine Fisheries Research Institute since its inception in 1947, has been collecting considerable amount of information on various aspects of the living resources of our seas and also engaged in developing technologies for coastal aquaculture. The data pertains to major and minor fisheries on regional and all-India basis, biological information on constituent species, environmental features, new and exploitable resources, marine biodiversity, coastal aquaculture, information on fishing villages, landing centres, fishing population, craft and gear, fishing effort and socio-economics. The Fishery Resources Assessment Division receives data on fish and fisheries from a net work of 26 Regional, Research as well as Field Centres of the Institute located along the coastline and also by collaborative arrangements with developmental agencies such as Fisheries Departments of selected maritime states of the country. Rapid dissemination of these data is essential for the benefit of the maritime states and the fishing industry as evidenced from the increasingly large number of enquiries being received by the Institute from fishermen, fish farmers, private entrepreneurs, the industry, administrators and planners concerned with fisheries development. With a view to rapidly disseminate the information available with the Institute and for transfer of technology of tested research results, publication of the *Marine Fisheries Information Service*: *Technical and Extension Series* was initiated in 1978. It is envisaged to provide the various organizations and individuals, synoptic pictures of the different fisheries along the entire coastline of India, both mechanized and non-mechanized, involving total landings, catch rate and various biological parameters such as maturity conditions of constituent species in relation to the environmental features and any other information involving catch statistics of various marine fisheries at regular intervals. It is also intended to include forecasting of the ensuing pattern of the major fisheries and the data relevant to the management and conservation of the resources. National and International Fisheries news as well as data of topical interest and relevance to Indian Fisheries also find a place in this series. The present publication, the 200th number in the series for the period from April to June 2009 highlights an overview of the economic performance of marine fishing methods in India along with significant observations on selected aspects related to the capture fishery scenario of the country. It is felt that the *Marine Fisheries Information Service* is useful to the various sectors of the fishing industry, fishermen, fish farmers, research and development organizations as well as public sector undertakings engaged in the exploitation, development and management of marine fisheries of the country. On this occasion I compliment the entire CMFRI family for the accomplishment.

Marine Fisheries Information Service

Economic performance of marine fishing methods in India

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Introduction

Fishing in India has gradually transformed from subsistence level to the status of a multi-crore industry during the last six decades. The sector has been contributing consistently around 1.0% to the country's GDP during the last five years. In 2005-'06, the sector has contributed 1.07% to the country's GDP and 5.84% to the agricultural GDP (Ministry of Agriculture, 2007). It also provides livelihood security for about 7.6 lakh fishermen households in India. The fishing fleet of the country includes 2.38 lakh crafts, out of which 58,911 (24.67%) are mechanized, 75,591 are motorized (31.66%) and 1,04,270 (43.67%) are artisanal (National Marine Fishery Census, CMFRI, 2005). The number of fishing crafts employed in fishing has been increasing over the years. Between 1960 and 1990, the artisanal crafts have increased by 110% whereas the mechanized crafts have increased by 570% thus resulting in overcapacity of the fleet operating in the inshore waters (Srinath and Pillai, 2006). The increasing fleet strength has led to a decline in catch per unit effort over the years. Declining catch per unit effort and increasing cost of operation have resulted in uneconomical operation of the fishing fleet, even forcing a few fishers out of the business. Under this situation, an insight into the assessment of the economic performance of the fishing fleet will be of much use in resource allocation and the investment decision by the individual and the lending institutions. The economic performance of the fishing method is an important indicator, which decides the operation of the fleet. Fishery resource being open access in nature, any one with a craft and gear can fish in the Indian waters but ultimately the point of intersection of the average cost and revenue per trip of fishing helps in deciding the continuation of operation unlike the equality of marginal cost and marginal revenue – the condition for optimum resource use - for classical production functions. Hence the evaluation of economic performance of the fishing fleets assumes significance from the point of resource allocation - for both the individual and the government to promulgate appropriate supporting policies. In the present study, an attempt was made to evaluate the economic performance of different fishing methods followed in India along the coast under the mechanized, motorized and non-mechanized sector.

Methodology

Data on operating costs and returns from the different fishing craft-gear combinations employed along the east and west coast of India were collected. From the mechanized, motorized and

non-mechanized sample fishing units selected, data were collected based on the random sampling method. Variables included the initial investments, operating costs and returns per trip of the different fishing units in India. From the collected data, the operating cost per trip, gross revenue per trip, net operating income, capital and labour productivities were worked out.

Results and discussion

1. Economic performance of the mechanized fishing

Mechanized fishing contributes to about 71% of the total marine fish landings of the country (CMFRI, 2007). About 59,000 mechanized fleets are deployed in the Exclusive Economic Zone (EEZ) of India to harvest the fishery resources. The economic performance of different mechanized fishing methods like trawl fishing, gill net fishing, purse seine fishing and dol net fishing along the coast of India were evaluated and the salient findings are given below.

1. a. Trawl fishing

Among the different mechanized fishing crafts, trawlers account for about 50% (29,241) of the mechanized crafts in operation. In trawl fishing, both single and multi-day fishing methods (of different days duration) are practised.

1. a. i. Single day trawl fishing

The average operating cost per trip of single day trawling in India during 2001-05 worked out to Rs. 5,907/- per trip with a gross revenue of Rs. 11,589/- per trip. The net operating income worked out to Rs. 5,682/- per trip and the capital productivity was 0.60. The labour productivity was 74 kg per crew per trip. Between the two coasts, the operating cost per trip was higher in east coast (Rs.7,361/-) than that of the west coast (Rs. 4,454/-) with fuel and crew wages accounting for about 78 to 82% of the total operating cost. The gross revenue per trip was also higher in the east coast at Rs. 15,714/- than that of the west coast at Rs.7,465/-. The capital productivity was the same in both the coasts but the labour productivity was higher in the east coast at 86 kg per crew per trip than the west coast at 62kg per crew per trip. (Table 1; Fig. 1 and 11).

1. a. ii. Multi-day trawl fishing (2-5 days)

The average operating cost per trip of the multi-day fishing of 2-5 days duration at national level worked out to Rs. 31,500/- per trip with a gross revenue of Rs. 52,737/-, thus earning a net operating income of Rs. 21,237/-. The capital productivity worked out to 0.60 and the labour productivity was 263 kg per crew per trip. Between the two coasts, the operating cost per trip was higher in the east coast at Rs. 32,207/- than in the west coast at Rs. 30,792/-. Fuel cost alone accounted for more than 55% of the operating costs in both the coasts followed by crew wage, which accounted for about 30%. The gross revenue was also higher in the east coast at Rs. 56,274/- than Rs. 49,199/- in the west coast. The capital productivity was higher in the east coast with a lesser operating ratio of 0.58 than the west coast (0.62). The labour productivity was higher in the west

Table 1. Economic performance of single day trawling in India (2001-2005)

Details	East coast	Percent to total	West coast	Percent to total	All India	Percent to total
Fuel	3327	49.78	2048	59.07	2687	45.49
Wages	2266	38.35	1766	23.39	2016	34.13
Food & bata	134	0.44	30	0.29	82	1.39
Auction charges	1040	1.41	161	5.86	601	10.17
Others	594	0.84	449	1.10	521	8.82
Total operating cost	7361	100.00	4454	100.00	5907	100.00
Gross revenue	15714		7465		11589	
Net operating income	8353		3012		5682	
Capital productivity	0.60		0.60		0.60	
Catch per trip	471		373		422	
Average crew size	6		6		6	
Labour productivity	86		62		74	

(Catch per trip in kg; Labour productivity in kg/crew/trip)

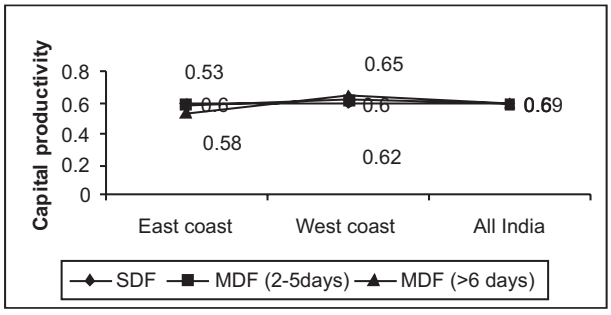

Fig. 1. Capital productivity of trawl fishing in India (2001-05)

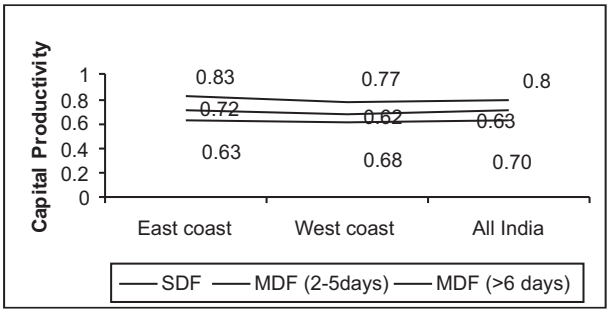

Fig. 2. Capital Productity of gill net fishing in India (2001-05)

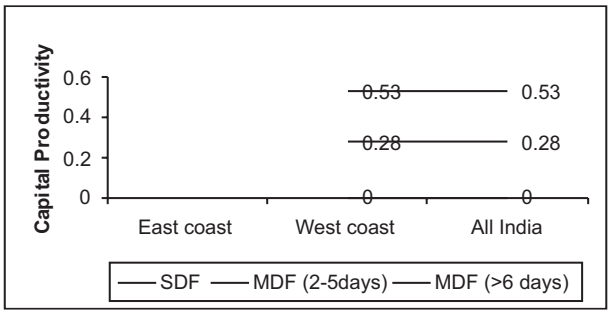

Fig. 3. Capital Productivity of purse seine fishing in India (2001-05)

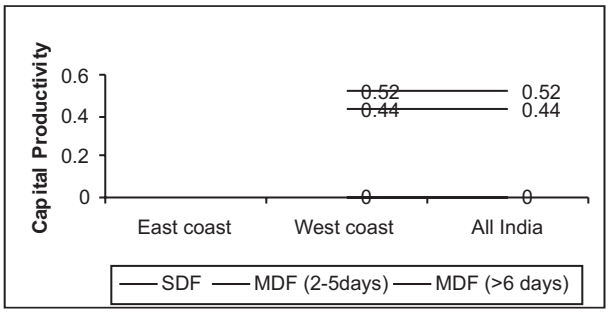

Fig. 4. Capital Productivity of dol net fishing in India (2001-05)

coast (276 kg per crew per trip) than in the east coast (Rs. 251/- kg per crew per trip). (Table 2; Fig. 1 and 11).

1. a. iii. Multi-day trawl fishing (6-10 days duration)

At national level, the average operating cost per trip for multi-day fishing of 6-10 days duration worked out Rs. 56,376/- with a gross revenue of Rs. 97,542/-. The capital productivity worked out to 0.59 and the labour productivity worked out to 389 kg per crew per trip. The average operating cost per trip was higher in the east coast at Rs. 63,607/- than in the west coast at Rs. 49,146/-. The gross revenue per trip was also high in the east coast at Rs. 1,19,718/- in the east coast than in the west coast at Rs. 75,336/-. The capital productivity was more in the east coast with a lower operating ratio of 0.53 than the west coast at 0.65. (Table 3; Fig. 1 and 11).

1. b. Gill net fishing

In gill net fishing, single day and multi-day fishing of different days duration are practised. The economic performances of these different methods are given below:

1. b. i. Single day gill net fishing

The average operating cost per trip of a single day gill net fishing during 2001-05 at national level worked out to Rs. 3,815/- per trip with a gross revenue of Rs. 5,807/- obtained from a catch of 191 kg. per trip. The net operating income worked out to Rs. 1992/- with a capital productivity of 0.70. This indicated that more than 70% of the earning goes towards meeting the operating expenditure only, thus leaving 30% to meet the other expenses thus exerting economic pressure on the fishermen. The labour productivity was 39 kg per crew per trip. Between the two coasts, the operating cost per trip was higher in the east coast at Rs. 5,183/- than in the west coast at Rs. 2,447/-. The capital productivity was better in the west coast with a lower operating ratio of 0.68 than that of the east coast (0.72). The labour productivity was better in the east coast with 50 kg per crew per trip than in the west coast at 28 kg per crew per trip (Table 4; Fig. 2 and 12).

1. b. ii. Multi-day gill net fishing (2-5 days)

At national level, the average operating cost per trip of multi-day gill net fishing of 2-5 days duration worked out to Rs. 22,598/- with a gross revenue of

Table 2. Economic performance of multi-day trawling (2-5 days) in India (2001-05)

Details	East coast	Percent to total	West coast	Percent to total	All India	Percent to total
Fuel	17749	55.11	18392	59.73	18070	57.37
Wages	9416	29.23	6968	22.63	8192	26.01
Food & bata	293	0.91	289	0.94	291	0.92
Auction charges	1160	3.60	1363	4.42	1261	4.00
Others	3591	11.15	3781	12.28	3686	11.70
Total operating cost	32207	100.00	30792	100.00	31500	100.00
Gross revenue	56274		49199		52737	
Net operating income	24067		18407		21237	
Capital productivity	0.58		0.62		0.60	
Catch per trip	1675		1891		1783	
Average crew size	7		7		7	
Labour productivity	251		276		263	

(Catch per trip in kg; Labour productivity in kg/crew/trip)

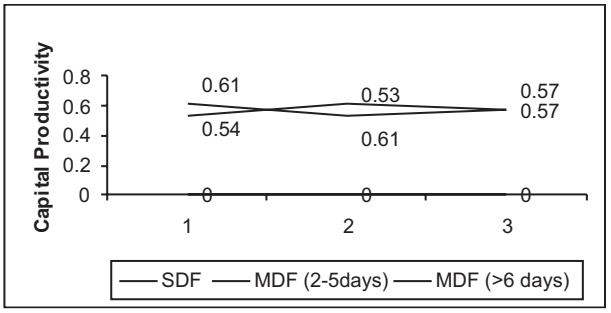

Fig. 5. Capital Productivity of motorised gill net fishing in India (2001-05)

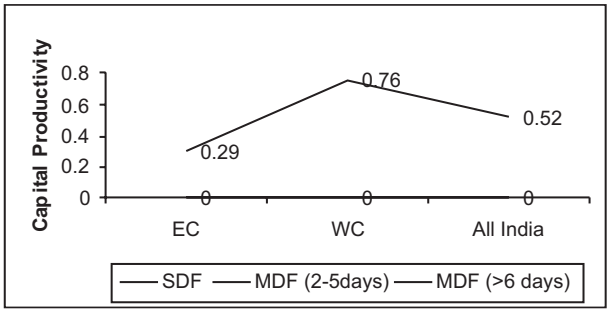

Fig. 6. Capital Productivity of motorised bag net and ring seine (2-5 days) fishing

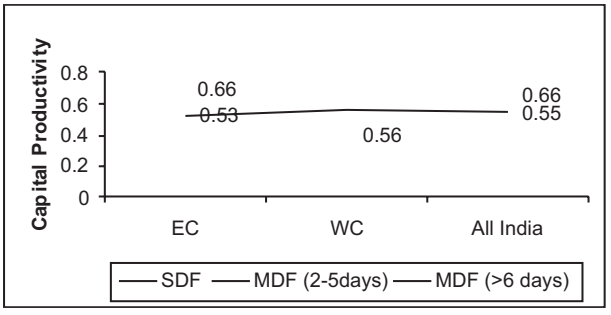

Fig. 7. Capital Productivity of motorised hooks and line fishing (2001-05)

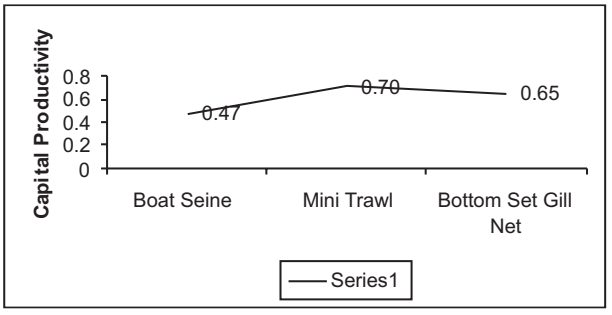

Fig. 8. Capital Productivity of different motorised gears in India (2001-05)

Rs. 36,725/- from the catch of 802 kg. The net operating income worked out to Rs. 14,127/- per trip. The capital productivity was 0.63 indicating that 63% of the earning goes towards operating expenses and only 37% is left for meeting other expenses. Between the two regions, the operating cost per trip was higher in east coast at Rs. 25,579/- than at west coast at Rs. 19,617/-. The capital productivity was marginally lower in the east coast (0.63) than that of the west coast (0.62) (Table 5; Fig. 2 and 12).

1. b. iii. Multi-day gill net fishing (6-10 days)

The average operating cost per trip of multi-day gill net fishing of 6-10 days duration in India during 2001-05 worked out to Rs. 53,612/- per trip with a gross revenue of Rs. 67,235/- from the catch of 2,371 kg. The average net operating income per trip worked out to Rs. 13,623/- with a capital productivity of 0.80. This indicated that this operation has not been economically viable during this period, since 80% of the earnings is spent on meeting the

Table 3. Economic performance of multi-day trawling (6-10 days) in India (2001-05)

Details	East coast	Percent to total	West coast	Percent to total	All India	Percent to total
Fuel	32409	50.95	27613	56.19	30011	53.23
Wages	19925	31.32	11880	24.17	15902	28.21
Food & bata	939	1.48	471	0.96	705	1.25
Auction charges	2938	4.62	2625	5.34	2782	4.93
Others	7396	11.63	6557	13.34	6976	12.37
Total operating cost	63607	100.00	49146	100.00	56376	100.00
Gross revenue	119718		75366		97542	
Net operating income	56112		26220		41166	
Capital productivity	0.53		0.65		0.59	
Catch per trip (kg)	3378		2343		2860	
Average crew size	7		8		7	
Labour productivity	483		302		389	

(Catch per trip in kg; Labour productivity in kg/crew/trip)

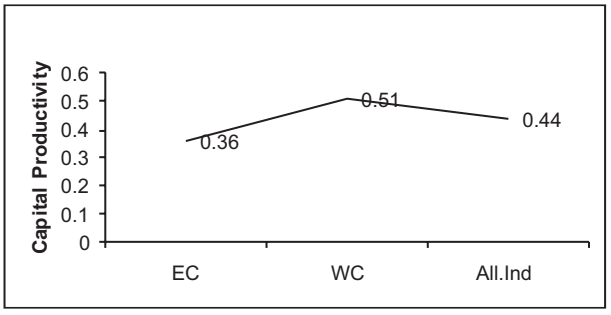

Fig. 9. Capital Productivity of non-mechanised gillnet fishing in India 2001-05

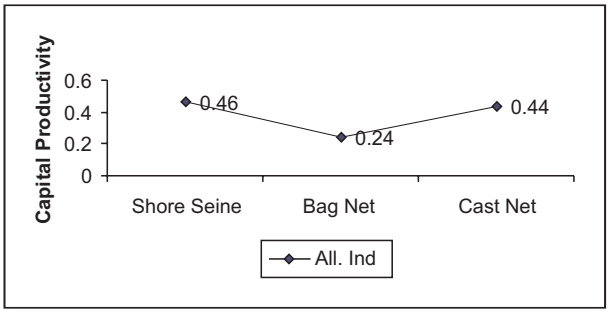

Fig. 10. Capital Productivity of non-mechanized fishing methods

operating expenditure only. Between the two regions, the operating cost per trip was higher in the east coast at Rs. 56,206/- than the west coast at Rs. 51,018/-. However, the net operating income was higher in the west coast (Rs. 14,973/-) than in the east coast (Rs. 12,273/-). The comparatively higher operational surplus (net operating income) is due to the lesser expenses incurred towards other charges like ice, repairing and maintenance and related expenditure in the west coast than in the east coast. The capital productivity was higher with a lower operating ratio in the west coast (0.77) than in the east coast (0.83). The labour productivity was higher in east coast at 387 kg per crew per trip than the west coast at 360 kg per crew per trip (Table 6; Fig. 2 and 12).

1. c. Purse seine fishing

Purse seine fishing was observed from the west coast maritime states only**.** There are two fishing methods namely single day purse seining and multi-day purse seine fishing.

1. c. i. Single day purse seine fishing

The average operating cost per trip of the single day purse seine fishing in India worked out to Rs. 10,615/- with a gross revenue of Rs. 20,140/- from a catch of 1,811 kg. Wages accounted for 54.93% of the total operating cost since the operation is more labour intensive, followed by the cost of fuel (30.54%). The net operating income worked out to Rs. 9,511/- per trip with a capital productivity of 0.53. The labour productivity worked out to 146 kg per crew per trip (Table 7; Fig. 3 and 13).

1. c. ii. Multi-day purse seine fishing (2-5 days)

The average operating cost per trip of the multi-day purse seine fishing at national level worked out to Rs. 39,070/- with the gross revenue of Rs. 1,24,616/- from a harvest of 6,953kg of catch. Crew wage accounted for 49% of the cost as the gear operation is more labour intensive. The net operating income per trip worked out to Rs. 85,546/- with a capital productivity of 0.28. This is a good

Table 4. Economic performance of single day gill net fishing in India (2001-05)

Details	East coast	Percent to total	West coast	Percent to total	All India	Percent to total
Fuel	3146	60.70	856	34.96	2001	52.45
Wages	1364	26.31	929	37.95	1146	30.04
Food & bata	40	0.77	24	0.98	32	0.84
Auction charges	128	2.47	19	0.76	73	1.92
Others	505	9.74	620	25.35	563	14.75
Total operating cost	5183	100.00	2447	100.00	3815	100.00
Gross revenue	8044		3570		5807	
Net operating income	2861		1122		1992	
Operating ratio	0.72		0.68		0.70	
Catch per trip	248		135		191	
Average crew size	5		5		5	
Labour productivity	50		28		39	

(Catch per trip in kg; Labour productivity in kg/crew/trip)

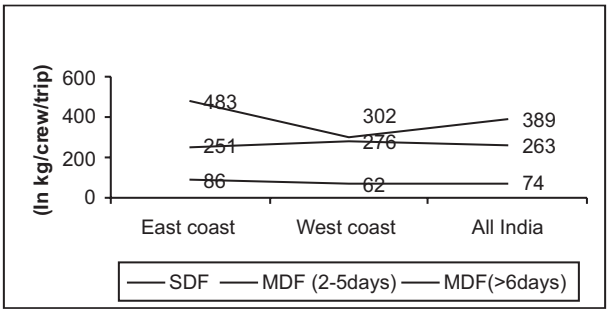

Fig. 11. Labour Productivity of trawl fishing in India 2001-05

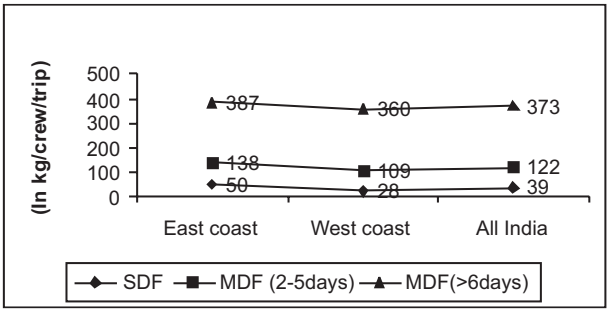

Fig. 12. Labour Productivity of gill net fishing in India 2001-05

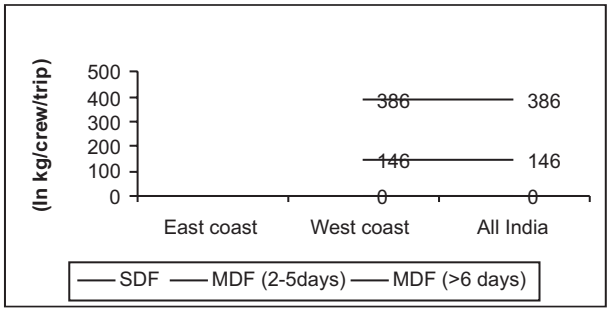

Fig. 13. Labour Productivity of purseine fishing in India 2001-05

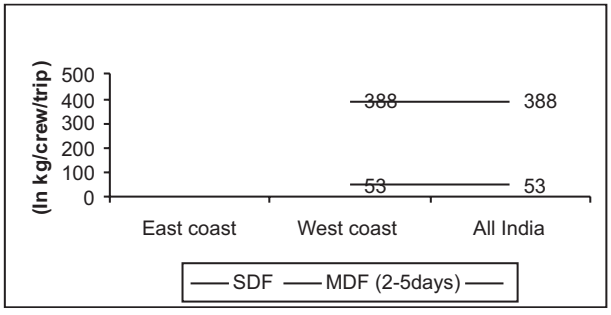

Fig. 14. Labour Productivity of dol net fishing in India 2001-05

indicator of economic performance since only 28% of the gross revenue is utilized for the operating expenses leaving 72% leverage to meet the fixed cost and other expenses. The labour productivity was also higher than the other mechanized gears at 386 kg per crew per trip (Table 7; Fig. 3 and 13).

1. d. Dol net fishing

Dol net fishing was found in operation in the north-west coast. The two fishing methods in dol net fishing include single day and multi-day fishing methods.

1. d. i. Single day dol net fishing

The average operating cost per trip of the dol net fishing in India worked out to Rs. 2,329/- per trip with gross revenue of Rs. 6,689/- per trip from the harvest of 299 kg per trip. Wages shared about 54% of the operating cost followed by fuel (29.05%) and other charges. The net operating income worked out

Table 5. Economic performance of multi-day gill net (2-5 days) fishing in India (2001-05)

Details	East coast	Percent to total	West coast	Percent to total	All India	Percent to total
Fuel	8145	31.84	7719	39.35	7932	35.10
Wages	6638	25.95	7676	39.13	7157	31.67
Food & bata	731	2.86	13	0.06	372	1.65
Auction charges	1924	7.52	1033	5.27	1479	6.54
Others	8142	31.83	3176	16.19	5659	25.04
Total operating cost	25579	100.00	19617	100.00	22598	100.00
Gross revenue	39157		34293		36725	
Net operating income	13579		14676		14127	
Capital productivity	0.63		0.62		0.63	
Catch per trip	908		697		802	
Average crew size	7		7		7	
Labour productivity	138		109		124	

(Catch per trip in kg; Labour productivity in kg/crew/trip)

to Rs. 4,091% per trip with a capital productivity of 0.44. This indicates a good economic indicator since 56% of the gross revenue is available for meeting the fixed cost and other expenses. The labour productivity worked out to 53 kg per crew per trip (Table 8; Fig. 4 and 14).

1. d. ii. Multi-day dol net fishing (2-5 days)

The average operating cost per trip of the multi-day dol net fishing (2-5 days) worked out to Rs. 53,519/- per trip with gross revenue of Rs. 91,282/- from the harvest of 2,715 kg of catch. Crew wages accounted for a major share of the operating cost at 90.03%. The capital productivity worked out to 0.52 and the labour productivity worked out to 388 kg per crew per trip. (Table 8; Fig. 4 and 14).

2. Motorized fishing methods

The motorized fishing has contributed 24% of the total marine fish landings in 2006 (CMFRI Annual report, 2006-07). Presently 75,591 motorized crafts are in operation accounting for 28.57% of the total marine fishing fleet size in India (CMFRI Census, 2005). In motorized fishing methods, many craft-gear combinations were observed. The economic performance of these craft-gear combinations have been evaluated and presented below:

2. a. Motorized gill net fishing

The average operating cost per trip of the single day motorized gill net fishing worked out to Rs. 2,434/- at the national level with a gross revenue of Rs. 4,220/- from the harvest of 206 kg of catch.

Table 6. Economic performance of multi-day gill net (6-10 days) fishing in India (2001-05)

Details	East coast	Percent to total	West coast	Percent to total	All India	Percent to total
Fuel	13184	51.92	28949	36.83	21067	39.29
Wages	16786	25.39	10258	25.85	13522	25.22
Food & bata	8654	1.97	1384	7.06	5019	9.36
Auction charges	3177	6.74	3732	6.61	3454	6.44
Others	14406	40.73	6696	23.65	10551	19.68
Total operating cost	56206	100.00	51018	100.00	53612	100.00
Gross revenue	68479		65991		67235	
Net operating income	12273		14973		13623	
Capital productivity	0.83		0.77		0.80	
Catch per trip	2446		2297		2371	
Average crew size	7		7		7	
Labour productivity	387		360		373	

(Catch per trip in kg; Labour productivity in kg/crew/trip)

Table 7. Economic performance of single and multi-day day purse seine fishing in west coast of India (2001-05)

Details	Single day fishing		Multi-day fishing	
	All India	Percent to total	All India	Percent to total
Fuel	3242	30.54	11809	30.23
Wages	5831	54.93	19049	48.76
Food & bata	287	2.70	1817	4.65
Auction charges	872	8.21	1380	3.53
Others	384	3.62	5016	12.84
Total operating cost	10615	100.00	39070	100.00
Gross revenue	20140		124616	
Net operating income	9511		85546	
Capital productivity	0.53		0.28	
Catch per trip	1811		6953	
Average crew size	16		18	
Labour productivity	146		386	

The net operating income worked out to Rs. 1,786/- per trip with a capital productivity of 0.57. The labour productivity worked out to 44 kg per trip. Between the regions, the operating cost per trip was higher in the west coast at Rs. 3,071/- than in the east coast at Rs. 2,087/-. The crew wages accounted for the maximum share of 61% of the operating cost in the east coast while fuel cost accounted for the maximum share of 47% in the west coast. The capital productivity was efficient in the east coast with a lower operating ratio of 0.54 than in the west coast (0.61). The labour productivity was higher in the west coast (60 kg per crew per trip) than in the east coast (33 kg) (Table 9; Fig. 5 and 15).

In multi-day motorized gill net fishing, the average operating cost per trip worked out to Rs. 4130/- at national level with a gross revenue of Rs. 7,020/- from the harvest of 196 kg of catch. The net operating income worked out to Rs. 2,890/- with a capital productivity of 0.57. The labour productivity worked out to 46 kg per crew per trip. The operating cost was higher in the east coast (6,083) than the west coast (2,178). This is due to the higher crew wage (52.57% of the operating cost) and fuel consumption (31.04%) in the east coast than in the west. The capital productivity (0.53) and labour productivity (51 kg per crew per trip) were more efficient in west coast than that of the east coast (Table 10; Fig. 5 and 15).

2. b. Motorized bag net fishery

The operation of this gear was observed from the east coast. The average operating cost per trip of the bag net fishery worked out to Rs. 693/- with a gross revenue of Rs. 2383/- from the harvest of 362 kg. The net operating income was Rs. 1691/-. The capital productivity worked out to 0.29 with a labour productivity of 72 kg per crew per trip (Table 11; Fig. 6 and 16).

2. c. Motorized ring seine

The operation of this gear is mostly confined to the west coast. The average operating cost per trip at national level worked out to Rs. 8,611/- with a gross revenue of Rs. 11,236/- from the harvest of 1,097 kg of the catch. The net operating income per trip worked out to Rs. 2,625/- with a capital productivity of 0.76. This indicated that more than 75% of the gross revenue is spent on meeting the operating cost only. The labour productivity worked out to 180 kg per trip per crew (Table 11; Fig. 6 and 16).

2. d. Motorized hooks and line

At national level, the average operating cost per trip worked out to Rs. 4,291/- with a gross revenue of Rs. 7,354/- from the harvest of 170 kg of catch. The average net operating income per trip worked out to Rs. 3,063/- with a capital productivity of 0.55. This indicated a good sign of economic return since 45% of the gross revenue is left to meet the fixed cost and other expenses. The labour productivity worked out to 43 kg per crew per trip. Between the coasts, the operating cost was higher in the west coast at Rs. 6,284/- per trip than in the east coast at Rs. 2,298/- per trip. The gross revenue was also higher in the west cost (Rs. 10,867/-) than in the east coast (Rs. 3,841/-). The capital productivity was higher in the east coast (0.53) than the west coast (0.56). The labour productivity was higher in the west coast with 63 kg per crew per trip than the east coast at 23 kg per crew per trip (Table 12; Fig. 7 and 17).

Table 8. Economic performances of single and multi-day day dol net fishing in west coast of India (2001-05)

Details	Single day fishing		Multi-day fishing	
	All India	Percent to total	All India	Percent to total
Fuel	677	29.05	2233	4.17
Wages	1248	53.56	48185	90.03
Food & bata	59	2.51	213	0.40
Auction charges	12	0.52	0	0.00
Others	334.5	14.36	2889	5.40
Total operating cost	2329	100.00	53519	100.00
Gross revenue	6689		91282	
Net operating income	4091		37761	
Capital productivity	0.44		0.52	
Catch per trip	299		2715	
Average crew size	6		7	
Labour productivity	53		388	

2. e. Motorized boat seine

The average operating cost per trip of the motorized boat seine fishing worked out to Rs. 1,355/- with a gross revenue of Rs. 2,892/- from the harvest of 206 kg. The operation of this gear was observed in the west coast. The net operating income per trip worked out to Rs.1,557/- with a capital productivity of 0.47. The labour productivity worked out to 35 kg per crew per trip (Table 13; Fig. 8 and 18).

2. f. Motorized mini trawl fishing

The operation of the mini trawl was observed in the west coast. The average operating cost per trip worked out to Rs. 3,126/- with a gross revenue of Rs. 4,704/- from the catch of 241 kg. The net operating income was worked at Rs. 1,578/- with a capital productivity of 0.70. This indicated that a very high proportion of over 70% of the gross earnings is spent on operating expenses only, which is not welcoming from the economic point of view. The labour productivity worked out to 60 kg per crew per trip (Table 13; Fig. 8 and 18).

2. g. Motorized bottom set gill net fishing

The operation of this craft-gear combination was observed in the east coast. The average operating cost per trip worked out to Rs. 1,743/- with a gross revenue of Rs. 2,685/- and capital productivity of 0.65. Here also the operating ratio is comparatively high indicating that nearly 65% of the gross earnings is required to meet the operating expenses leaving only 35% to meet the fixed cost and other expenses. The labour productivity was worked at 51 kg per crew per trip (Table 13; Fig. 8 and 18).

3. Non-mechanized fishing methods

The non-mechanized fishing was the mainstay of our fishing community right from time immemorial.

Table 9. Economic performance of motorized single day gill net fishing in India (2001-05)

Details	East coast	Percent to total	West coast	Percent to total	All India	Percent to total
Fuel	507	24.27	1433	46.65	875	35.96
Wages	1280	61.33	1258	40.98	1235	50.75
Food & bata	34	1.62	0	0.00	17	0.69
Auction charges	129	6.18	162	5.26	132	5.43
Others	138	6.60	218	7.11	174	7.16
Total operating cost	2087	100.00	3071	100.00	2434	100.00
Gross revenue	3844		4902		4220	
Net operating income	1757		1831		1786	
Capital productivity	0.54		0.61		0.57	
Catch per trip	129		295		206	
Average crew size	4		5		4	
Labour productivity	33		60		44	

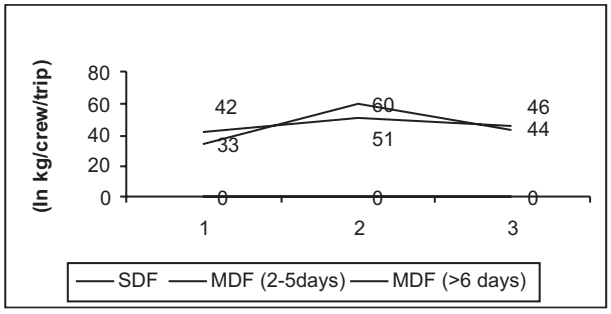

Fig. 15. Labour Productivity of motorized gill net fishing in India (2001-05)

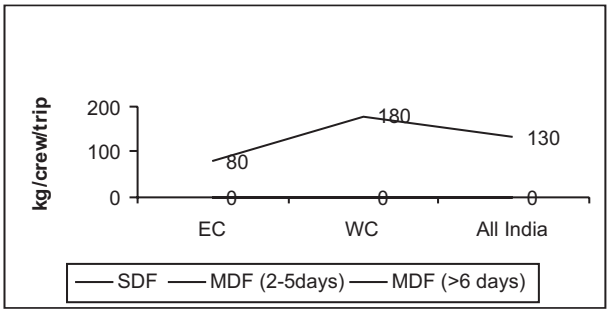

Fig. 16. Labour Productivity of motorized bag net and ring seine fishing (2001-05)

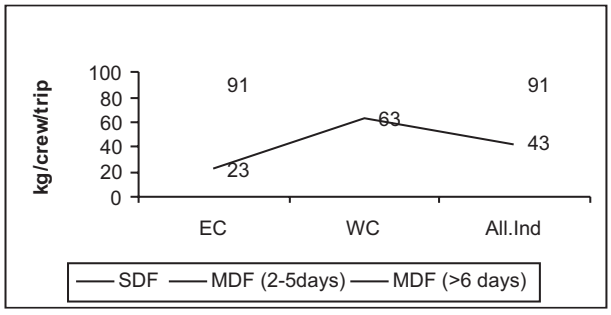

Fig. 17. Labour Productivity of motorized hooks and line fishing (2001-05)

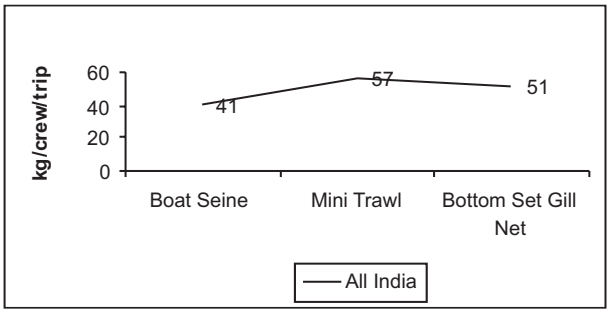

Fig. 18. Labour Productivity of different motorised gears in India (2001-05)

With the introduction of mechanized crafts and motorized crafts at a later date, their share in the total marine fish landings of the country reduced gradually, which now stands at 5% (CMFRI, 2007) though their number is high. Presently there are 1,04,270 fishing units accounting for 43.67% of the marine fishing fleet in India. The economic evaluation of the different non-mechanized craft-gear combinations of fishing is given below.

3. a. Non-mechanized gill net fishing

The average operating cost per trip of the non-mechanized gill net fishing worked out to Rs. 400/- with a gross revenue of Rs. 927/- obtained from the harvest of 97 kg. of fish. Crew wages is the important component of the operating cost accounting for about 83% of the operating cost. The net operating income was Rs. 523/- per trip, with a capital productivity of

Table 10. Economic performance of motorized multi- day gill net fishing (2-5 days) in India (2001-05)

Details	East coast	Percent to total	West coast	Percent to total	All India	Percent to total
Fuel	1888	31.04	658	30.21	1273	30.82
Wages	3198	52.57	1020	46.83	2109	51.06
Food & bata	0	0.00	0	0.00	0	0.00
Auction charges	364	5.98	0	0.00	182	4.41
Others	633	10.41	500	22.96	567	13.72
Total operating cost	6083	100.00	2178	100.00	4130	100.00
Gross revenue	9957		4083		7020	
Net operating income	3875		1905		2890	
Capital productivity	0.61		0.53		0.57	
Catch per trip	188		204		196	
Average crew size	5		4		4	
Labour productivity	42		51		46	

Table 11. Economic performance of motorized bag net and ring seine fishing (2-5 days) in India (2001-05)

Details	Bag net (East coast)		Ring seine (West coast)	
	All India	Percent to total	All India	Percent to total
Fuel	209	30.11	1079	12.53
Wages	361	52.06	3846	44.66
Food & bata	90	13.00	87	1.01
Auction charges	0	0.00	559	6.49
Others	34	4.84	3041	35.31
Total operating cost	693	100.00	8611	100.00
Gross revenue	2383		11236	
Net operating income	1691		2625	
Capital productivity	0.29		0.76	
Catch per trip	362		1097	
Average crew size	5		6	
Labour productivity	80		180	

Table 12. Economic performance of motorized hooks and line fishing in India (2001-05)

Details	East coast	Percent to total	West coast	Percent to total	All India	Percent to total
Fuel	327	14.23	1601	25.48	964	22.47
Wages	1725	75.06	4002	63.69	2864	66.74
Food & bata	0	0.00	0	0.00	0	0.00
Auction charges	153	6.64	523	8.32	338	7.87
Others	93	4.06	157	2.50	125	2.92
Total operating cost	2298	100.00	6284	100.00	4291	100.00
Gross revenue	3841		10867		7354	
Net operating income	1543		4583		3063	
Capital productivity	0.53		0.56		0.55	
Catch per trip	89		251		170	
Average crew size	4		4		4	
Labour productivity	23		63		43	

Table 13. Economic performance of motorized boat seine, mini trawl and bottom set gill net fishing in India (2001-05)

Details	Boat seine		Mini trawl		Bottom set gill net	
	All India	Percent to total	All India	Percent to total	All India	Percent to total
Fuel	210	15.50	1569	50.20	240	13.77
Wages	1045	77.12	1029	32.91	1343	77.07
Food & bata	0	0.00	28	0.88	0	0.00
Auction charges	85	6.27	244	7.81	160	9.18
Others	15	1.11	281	8.99	0	0.00
Total operating cost	1355	100.00	3126	100.00	1743	100.00
Gross revenue	2892		4704		2685	
Net operating income	1557		1578		942	
Capital productivity	0.47		0.70		0.65	
Catch per trip	206		241		255	
Average crew size	6		4		5	
Labour productivity	35		60		51	

Table 14. Economic performance of non-mechanized gill net fishing in India (2001-05)

Details	East coast	Percent to total	West coast	Percent to total	All India	Percent to total
Fuel	0	0.00	22	4.49	11	2.69
Wages	279	86.65	384	80.30	332	82.85
Food & bata	11	3.26	0	0.00	5	1.31
Auction charges	5	1.55	11	2.35	8	2.03
Others	28	8.54	62	12.90	45	11.15
Total operating cost	322	100.00	479	100.00	400	100.00
Gross revenue	868		987		927	
Net operating income	539		508		523	
Capital productivity	0.36		0.51		0.44	
Catch per trip	138		57		97	
Average crew size	3		3		3	
Labour productivity	43		20		31	

Table 15. Economic performances of shores seine, bag net and cast net fishing in India (2001-05)

Details	Shore seine		Bag net		Cast net	
	All India	Percent to total	All India	Percent to total	All India	Percent to total
Fuel	0	0.00	0	0.00	0	0.00
Wages	3266	91.63	408	79.53	193	65.53
Food & bata	110	3.09	80	15.59	55	18.51
Auction charges	0	0.00	0	0.00	9	3.06
Others	188	5.28	25	4.87	38	12.90
Total operating cost	3564	100.00	513	100.00	295	100.00
Gross revenue	6486		2086		669	
Net operating income	2922		1573		374	
Capital productivity	0.46		0.25		0.44	
Catch per trip	698		152		27	
Average crew size	24		5		2	
Labour productivity	28		36		14	

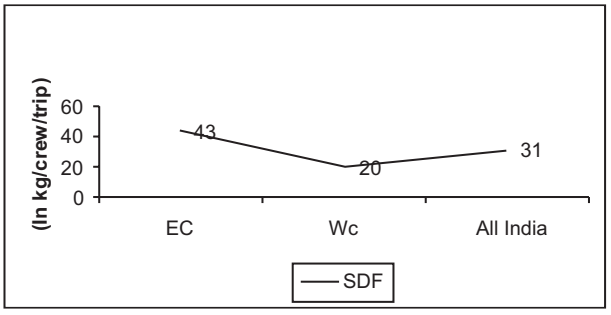

Fig. 19. Labour Productivity of gill net non-mechanised single day fishing 2001-05

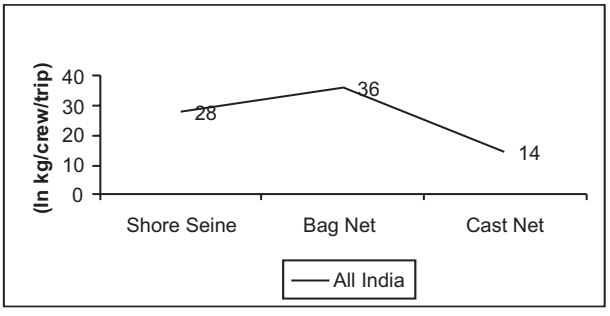

Fig. 20. Labour Productivity of non-mechanised gears in India 2001-05

0.44. The labour productivity worked out to 31 kg per crew per trip. Between the two regions, the cost of operation was higher in the west coast (Rs. 479/-) than the east coast (Rs. 322/-). The capital productivity was higher in the east coast (effective) with an operating ratio of 0.36 than in the west coast

(0.51). The labour productivity was also higher in the east coast (43 kg. per crew per trip) than the west coast (20 kg.) (Table 14; Fig. 9 and 19).

3. b. Non-mechanized shore seine fishing

The operating cost per trip of the shore seine worked out to Rs. 3,564/- with a gross revenue of Rs. 6,486/- and a net operating income of Rs. 2,922/-. The capital productivity worked out at 0.46, which indicated that more than 50% of the gross revenue is available for meeting the operating expenses. The labour productivity worked out to 28 kg. per crew per trip (Table 15; Fig. 10 and 20).

3. c. Non-mechanized bag net fishing

The average operating cost per trip of non-mechanized bag net fishing worked out to Rs. 513/- with a gross revenue of Rs. 2,086/- from the harvest of 152 kg. The net operating income worked out to Rs. 1573/- with a capital productivity of 0.25. This indicated the most efficient use of capital resource as 75% of the gross revenue is available to meet the other expenditures. The labour productivity worked out to 36 kg. per crew per trip (Table 15; Fig. 10 and 20).

3. d. Non-mechanized cast net fishing

The average operating cost per trip of the non-mechanized cast net fishing worked out to Rs. 295/- with a gross revenue of Rs. 669/- from the catch of 27 kg. The net operating income worked out to Rs. 374/- with a capital productivity of 0.44. In this fishing method also the capital resource was efficient as indicated by the comparatively lesser operating ratio of 0.44. The labour productivity worked out to 14 kg. per crew per trip (Table 15; Fig. 10 and 20).

Conclusion

In fishing operations, the increased cost of fishing per trip, the reduced catch and subsequent decline in the returns per trip have become important constraints affecting the economic returns from different fishing crafts.

In the mechanized trawl fishing, the multi-day fishing (MDF) of 6-10 days duration earned higher returns than the other two methods in the east coast, while the MDF of 2-5 days duration performed better than the other two in the west coast. In the mechanized gill net operation also, the economic performance of multi-day gillnet fishing of 2-5 days duration was better than the other two methods of fishing in both the east and west coasts. Regarding the purse seine and dol net fishing, multi-day fishing of 2-5 days duration earned higher returns than the other methods of fishing in both the coasts. Thus in mechanized fishing, among all the fishing methods, the multi-day fishing (3-5days) earned comparatively higher returns than the other fishing methods.

In the motorized craft-gear combinations, the multi-day gill net fishing provided a better use of capital and labour productivity in the west coast while in the east coast, the single day gill net fishing method proved to be economical over the multi-day operation. In all the motorized craft-gear combinations, the capital productivity was high with the operating ratio ranging between 0.50 and 0.55 and only the labour productivity decided the economic supremacy of one combination over the other. Among the different motorized craft-gear combinations, the motorized ring seine performed better with higher net operating income than the other gears like bag net, hooks and line, mini-trawl and boat seine.

In case of the non-mechanized fishing methods, the capital productivity was high with a lower operating ratio ranging from 0.36 for the gill net operation in the east coast to 0.51 for the same in the west coast. In terms of labour productivity also, the non-mechanized gill net fishing recorded the highest productivity of 43 kg per crew per trip among all the craft–gear combinations at national level.

The above conclusions indicate that the multi-day operations (of about 3-5 days duration) of different fishing methods gave the economic benefits wherever they are operated due to the economies of scale. However, in these cases the fuel consumption is very high and it accounts for about 50-60% of the operating cost. Thus there is an urgent need to optimize this fuel resource in the preset scenario of an impending oil crisis. The possibility of alternative fuel like bio-diesel should also be explored to substitute the fossil fuel. Above all, the simple conservation methods needs to be followed and the fishers can follow the Potential Fishing Zone (PFZ) data supplied by the Indian National Centre for Ocean Information (INCOIS) to reach the fishing ground directly instead of spending time and fuel on searching for the shoals. The reduction in searching

time can be expected to reduce the fuel consumption per trip of the crafts. In the PFZ Validation Project Review Meeting, held at INCOIS, Hyderabad during April 2007, it was reported that in Kerala, a reduction in searching time to an extent of 60-70% for oil sardines and 30-40% for mackerels was observed after following the PFZ advisories. The validation experiments also indicated that the catches in PFZ area gave more CPUE and net profit compared to the results of the operation in non-PFZ (INCOIS, 2007). Thus the PFZ information can be utilized to reduce the searching time as well as cost of fuel. These recommendations based on the economic parameters should also be viewed from the stock assessment side also so that an appropriate fishery management measure can be formulated.

Record of *Octopus membranaceus* Quoy and Gaimard, 1832 in Maharashtra waters

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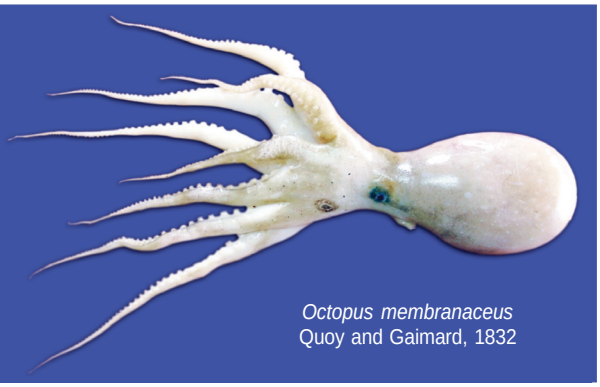

Octopus membranaceus
Quoy and Gaimard, 1832

Cephalopods have good export demand, therefore it is the second most sought commodity next to prawns by trawl operators. Octopus, popularly known as “devil fish” were earlier discarded as it did not fetch any price, but in recent years, these are being exploited in commercial quantities. The major species of octopus which contributed to the world fishery, come under the genera *Octopus, Cistopus* and *Eledone.* Octopus in the continental shelf and oceanic region are caught mainly as by-catch in the bottom trawl.

Due to the growing demand for octopus in the international market, octopus fishery is catching up in the north-west region, especially along Maharashtra coast. The main fish landing centres for octopus at Mumabi are New Ferry Wharf, Sassoon Docks and Versova. Cephalopods form about 10.5% in trawl landings off Maharashtra with octopus dominated by the species *Cistopus indicus* contributing 7.1% towards the cephalopod catch.

With the increased exploitation and expansion of fishing grounds, new records of cephalopods are reported from various places all along the Indian coast. Thirty eight species of octopods belonging to the family Octopodidae, Thermoctopodidae and Argonautidae abound the Indian seas including Andaman and Lakshadweep.

A new entrant to the octopus fishery is *Octopus membranaceus* Quoy and Gaimard, 1832 at New Ferry Wharf, Maharashtra. The species is present in the fishery during December - February. This species is commonly known as ‘webfoot octopus’ and locally all octopuses are known as ‘jeevrae makul’. They are known as ‘jidako’ in Japan, where it supports a minor fishery and in China they are called as ‘four eyed bird’. The mantle length of the species landed at New Ferry Wharf ranged from 50-80 mm. The depth of operation was about 30-40 m at 70-80 km off north-west coast. The occurrence of *O. membranaceus* is reported for the first time from this region.

Some of the important distinguishing characters of *O. membranaceus* are a saccular to elongate mantle with small, close-set tubercles over head, mantle and arms. Two cirri or warts observed over each eye, arms moderately long, robust and the web low. The right arm III is hectacotylised in males. Lingul is slender and long with 4 to 6% of arm length. The most important identification character is the presence of a conspicuous dark ringed ocellus on the web base of arm II, antero-ventral to the eyes.

O. membranaceus is a benthic shallow water species occurring down to about 60 m depth. It shows a strong cryptic behaviour and usually hides in holes

on flat bottoms. The spawning season extends from December to February. It is an Indo-Pacific species extending from the Indian Ocean to Japan, China, Philippines and southward to Australia.

The major octopus species landed in Kerala is *O. membranaceous* contributing about 82% towards the octopus catch. There seems to be no reference about this species from Maharashtra waters. The length range of the species landed at Cochin is 20 to 90 mm in mantle length. According to FAO, the maximum mantle length of the species is 80 mm and maximum total length is 300 mm in Mumbai waters, the size range of this species is smaller ranging between 30 and 80 mm and the landings comparatively of lesser magnitude.

Separate catch statistics are not available for this species. Nine specimens were analysed for their gut contents. Majority of the gut was empty and food if present could not be identified as they were in finely macerated condition. In general, octopuses that are landed are taken to the processing unit within 4-6 h, where they are degutted and processed. The cost of octopus (*Cistopus indicus)* at Mumbai in 1999 was Rs 10/- per kg which has now increased to Rs. 60/- per kg at the landing centre. But *O. membranaceous* fetches a lower price due to to its smaller size, seasonal occurrence and less demand.

Targeted trawl fishery for moontail bullseye, *Priacanthus hamrur* off Mangalore for surumi production


A view of transportaton of bullseye from Mangalore Fisheries Harbour

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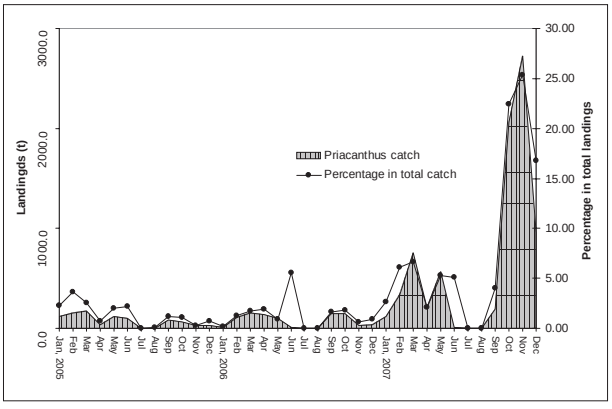
Moontail bullseye, *Priacanthus hamrur* has been forming a part of the trawl fishery off Mangalore, caught from a depth beyond 100 m ever since deepsea trawling started off the coast. This is not a preferred edible species in Karnataka and was not a species considered for targeted fishery. In 2005 and 2006, the bullseye landing was forming 1.48% and 1.31% of the trawl landing of Mangalore Fisheries Harbour, with 907 t and 884 t respectively. In 2007, the landing of the species increased almost nearly ten times of that of previous year (7,946 t) forming 10.8% of the total trawl landings. Last quarter of the year recorded the heaviest landing of the species and during October-December, 5,750 t were landed (Fig. 1).

It was understood that sudden increase in landing of this species was mainly due to the targeted fishery by the trawlers for the species due to heavy market demand from processing industries. The species is targeted for surumi preparation and is procured by the surumi plants @ Rs. 8/kg. This sudden rise in demand for the species is also an after effect of reduction in the availability of threadfin breams of required size, which is considered as the priority species for surumi preparation which was procured by the industry @ Rs. 12/kg on an average. Threadfin

Fig. 1. Landings of *Priacanthus hamrur* during 2006-'07 at Mangalore Fisheries Harbour



breams became targeted fishery ever since surumi plant was established in the state, leading to heavy exploitation of juveniles . It was observed that, in 2006, threadfin bream catch especially that of *Nemipterus mesoprion,* juvenile composition was 10% by number which increased to 51% in 2007 and the mean size of the species came down from 148 mm in 2006 to 136 mm in 2007. This situation lead the industries to go for bullseye for continuing surumi production and trawlers started targeting the species, since there was a regular demand.

During the study in 2007, the size range of *P. hamrur* was found to be between 105 and 410 mm and majority of the of the catch was in the size range of 140 -170 mm which were juveniles. The current trend shows that this resource showing symptoms of over-exploitation of juveniles which is not a good sign for future fishery.

Bumper catch of sea bass, *Lates calcarifer* (Bloch, 1790) by gill netters in Mumbai waters

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Lates calcarifer (Bloch, 1790)

Lates calcarifer is commonly called as giant sea bass, sea perch or giant brackish water perch and in Maharastra, locally known as 'Khajura' (Waghmare and Sawant, 1994). Sea bass is considered as a valuable seafood delicacy with good demand in market. They are found in coastal waters, estuaries and lagoons usually at a depth of 40 m and mainly feed on fishes and crustaceans. They are distributed around Sri Lanka extending to Arabian Sea, Eastern India Ocean and the Western Central Pacific (Fischer and Bianchi, 1984).

The species is observed in the fish catch throughout the year but in very few numbers with large sized fishes caught during April - June. An unprecedented high catch of this species was landed at Sassoon Dock on 25-04-08. Thirteen gill netters landed about 80-100 kg of sea bass per boat using wagra jal of mesh size 120 mm after fishing for a day. The fishing ground was off Worli at a depth range of 15-20 m. The boats were plank built fitted with 15 HP 3-cylinder engine. These boats are basically from Cuffe parade and they unload their catch at Sassoon Dock. The catch was sold at the rate of Rs. 1,380 to 2,200 per fish as each fish approximately weighed between 5.5 kg to 8.5 kg. Other species landed included *Protonibea diacanthus*, *Otolithoides biauratus* and *Eleutheronema tetradactylum.*

Landings of this species in such a magnitude are rare and hence the present observation gains importance. A total of 52 specimens were measured and it was observed that the total length ranged between 80-121 cm with a mode in the length group 90-99 cm (Fig. 1). It was observed that this species is generally caught in good numbers during full moon and new moon days. The present catch also followed the same phenomenon. From this, it can be inferred that for the maximum exploitation of this species lunar cycle may be followed.

A similar high catch was recorded by Subbrao (2002) from Orissa in the month of February. A total of 192 numbers of sea bass with a total weight of

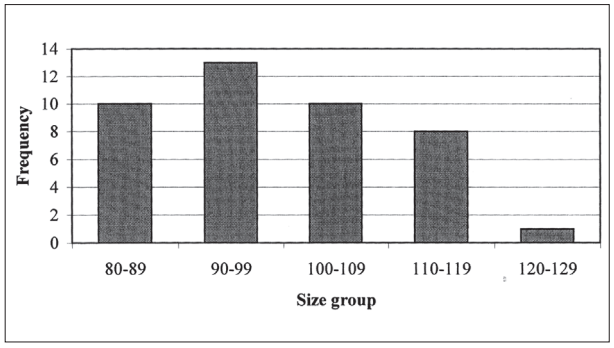

Fig. 1. Legth-frequency of *Lates calcarifer* landed at Sassoon Dock

4,816 kg was caught by two operations of shore seine. According to Fisher and Bianchi (1984), the fishery of sea bass is seasonal and the maximum length of the species in 200 cm. A large sized sea bass measuring 106 cm and weighing 7.5 kg was caught from Karwar coast by shore seine (Dharchwar, 1998). In the present catch, the maximum size recorded was 121 cm.

In view of its easy adaptability to low saline waters, this fish has assumed great value for culture in recent years. Owing to its fast growth, high quality flesh, high market value and export potential, sea bass is an important species cultured in Thailand, Singapore and Philippines. Bensam and Nammalwar (1991) reported on the potential for commercial culture of the species in Indian waters. Cage culture of sea bass was initiated at Visakhapatnam wherein about 550 kg was successfully harvested. Majority of the harvested fishes were above 300 g and about 10% were about 1 kg (Anon, 2008). The availability of this species in such a magnitude from Mumbai waters suggests that sea bass culture can be taken up in Maharastra waters.

Enhalus acoroides (L.f.) Royle fruits observed in Gulf of Mannar


E. acoroides growing among *C. serrulata* and *H. pinifolia*

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Seagrass are angiospermous plants adapted to grow in marine environment. Seagrass meadows are the nursery ground for many commercially important shrimps, crabs and fishes. Its root mat adds stability to the sediments of coastal zone and the leaves help filter the water of suspended particles. There are 13 genera and about 52 species of seagrass distributed throughout the world.

The Gulf of Mannar Marine Biosphere Reserve (GOMBR) harbours 12 species of seagrass namely *Cymodocea rotundata*, *C. serrulata*, *Enhalus acoroides*, *Halodule pinifolia*, *H. uninervis* (broad and narrow leaved forms), *H. beccarii*, *H. decipiens*, *H. ovalis*, *H. ovata*, *H. stipulacea*, *Thalassia hemprichii* and *Syringodium isoetifolium*.

Of these, *Enhalus acoroides* (L. f.) Royle is the largest seagrass species in the Gulf of Mannar reaching to a height of more than a meter. This seagrass prefers sheltered marine environment where substratum is fine sand to clay. Normally it occurs in the tidal and subtidal zones. Some of the plants are seen established in Thonithurai (Gulf of Mannar) among *Cymodocea serrulata* and *Halodule pinifolia* seagrass species in depth of 40 cm during low tide. It is the only species which shows aerial

surface pollination. It has 3 - 4 linear leaf blades produced directly from the rhizome, although shoots with 7 - 9 leaves were also observed. Its leaf tips are rounded and with minute serrate projections when young. The underground rhizomes are stout (1-2 cm diameter) and branched which can penetrate up to 50 cm deep. The roots are also well developed, both of which provide concrete anchoring system. The *E. acoroides* male flower is small, contains large pollen grains and has pendunculate spathe consisting of two connate blades, the inner and the outer. The female flower has ovary rostrate, six parietal placentas protruding far towards the centre and with long pendunculate spathe consisting also of two free blades.The fruit of *E. acoroides* (Fig. 1) is ovoid or globular in shape with acuminate tips and the entire surface is covered by dense bifid projections.

Large number of the fruits of this plant was observed in Thonithurai, Pamban and Kundugal point in Gulf of Mannar during June 2008 (south-west monsoon season). During this season the Gulf of Mannar current is in the direction of south-east and south-west. The average wind velocity during June was 13.12 km/hr. This causes the fruits to dislodge from the plants in Pamban and Krusadai Island to reach the shores of Kundugal point in Rameswaram Island and Thonithurai in Mandapam mainland. The fruits collected from the shores openend after 4-5 h. in the laboratory due to the rise in temperature (Fig. 2). The length of the fruits varied between 5.7 to 6.5 cm and diameter 8.9 to 12.3 cm. The number of seeds per fruit varied between 4 to 11. Seeds were in the length range of 0.6 to 1.3 cm and diameter 0.6 to 1.5 cm (Fig. 3). The seeds are edible and are eaten by the local people at Pamban. Some of the seeds were observed to be germinating within the fruit.

Fig. 1. *Enhalus acoroides* fruit

The seeds of *E. acoroides* are more viable when compared to other seagrass species; seed production, seed dispersal and seedling recruitment serve as important mechanism in maintaining the genetic

Fig. 2. Open fruit of *E. acoroides*

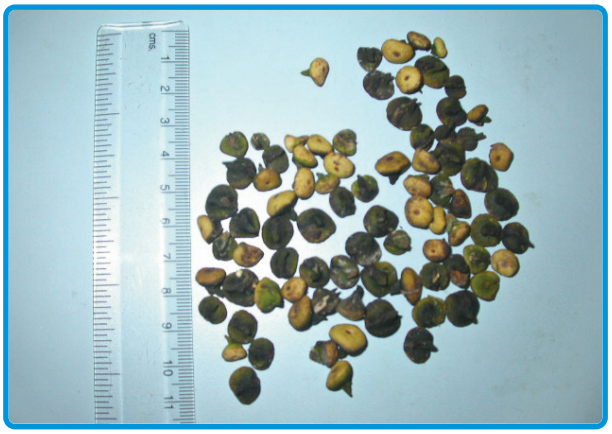

Fig. 3. Seeds of *E. acoroides*

diversity of the plant. Dispersal distances of seagrass seeds are usually limited to a few meters and seeds settle rapidly into the sediment surface except during seasons of high wind velocity and consequent tidal current. Seed deposition is more advantageous over vegetative propagation of new shoots for maintenance of seagrass meadows frequently subjected to environmental stress.

Occurrence of humpback whale at Thrissur

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Humpback whale stranded at Thaikulam landing centre, Thrissur

On 18th May 2008, a humpback whale in decayed condition was stranded at Thalikulam landing centre in Thrissur District of Kerala State. The whale was taken to the shore (using a poclain) and buried on the next day. The measurement of the species landed is given below:

Species name	*Megaptera novaengliae*
Common name	Humpback whale
Total length	9.8 m
Width	3.45 m
Flipper length	2.6 m
Fluke	2.4 m
Approximate weight	2 t

Bumper landing of giant sea catfish *Arius thalassinus* by purse seiners at Malpe Fisheries Harbour, Karnataka

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Catfishes being landed at Malpe fisheries harbour.

The fishing season resumed on11th August 2008 after 57 days ban for mechanized fishing with an encouraging note of good fishing along the coast. On 25.08.2008, bumper landing of catfishes were observed at the Malpe harbour by purse seiners. Heavy landings of catfishes were observed in 1980's after which catch showed a sharp decline raising concern about extinction of the spices along the coast. On 25th August 2008, three purse seiners in Malpe caught about 59 t of catfishes in a single day operation. The depth of operation was about 54 m. The size ranged from 97-122 mm and the majority of the fishes were mature. The catfishes were sold at the rate of Rs. 20-30 per kg which was procured for sale in Maharashtra market.

Recovery of an injured hawksbill turtle in Sindhudurg, Ratnagiri

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Hawksbill turtle

A turtle in moribund state was drifted ashore at Dabholi-Waingani landing centre in Sindhudurg District of Maharashtra on 02.05.2008 at about 1600 hrs. It was covered with algae and showed very feeble movements. On cleaning, it was found that the turtle had many injuries, probably due to drifting in rocky intertidal area where it was tossed and trapped among the boulders. A local fisherman brought the turtle to the protected part of the shore and nursed it for 20 days. The turtle was fed with hen's egg and glucose solution using syringe in the beginning and later with chopped pieces of fish. After full recovery, the turtle was handed over to the forest department personnel and released back to the sea.

Morphological characters showing oval carapace with imbricate scutes and head with 2 pairs of prefrontal scutes and strong horny beak made it easy to identify the turtle as hawksbill, *Eretmochelys imbricata*. The carapace length was 36 cm and it weighed about 5 kg. Generally along the sandy beaches of Sindhudurg Districts, olive ridley turtles and their nestings are seen but the occurrence of hawksbill is rare.

Unusual heavy landing of *Otolithoides biauritus* and *Protonibea diacanthus* at Salaya Landing Centre, Jamnagar, Gujarat

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Heavy night landings of *Otolithoides biauritus* and *Protonibea diacanthus* were observed on the 27th of March, 2008 in which about 275 nos. (3,300 kg) of *Otolithoides biauritus* locally known as 'Koth' were landed by a multiday trawler operating 35-40 km offshore Salaya in the Bay of Kutch at depth of 25-30 m. The length of *O. biauritus* landed was between 76 cm and 136.8 cm. A lionshare of the catch (70%) belonged to length around 120 cm. The average weight of the fish landed was 12 kg. Their price ranged from Rs. 90 to Rs. 100/kg. The total value of the catch amounted to Rs. 3 lakhs. On the previous day night, 28 nos. (560 kg) of *Protonibea diacanthus,* locally known as Ghol was landed by a multiday trawler operating in the same ground at the same depth. Their length ranged from 91.2 cm to 152 cm. Majority of the catch belonged to the higher length classes. On an average each fish weighed 20 kg. The total value of the catch was Rs. 2.85 lakhs.

A note on the leatherback turtle *Dermochelys coriacea* (Vandelli, 1761) rescued at Vizhinjam, Kerala

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A large leather back turtle was rescued on 17th June 2008 from fishermen at Vizhinjam landing centre. It was entangled in a gill net and was brought to the landing centre for handing over the same to illegal traders. However, the forest officials along with police personnel intervened and the turtle was released back. The turtle was identified as *Dermochelys coriacea* (Vandelli) of the family Dermochelyideae which measured 195 cm in total length and weighed about 350 kg. Morphpometric measurements of the turtle is given in Table 1.

Table 1. Morphometric measurements of *D. coriacea* rescued at Vizhinjam

Total length	195 cm
Carapace length	170 cm
Carapace width	80 cm
Flipper length	89 cm
Head length	25 cm

Leatherback turtles are not commonly caught at Vizhinjam. Leatherback is the largest living turtle which reaches a size of 270 cm in adult stage. The largest leatherback on record is a male stranded on the west coast of Wales in 1988 weighing 16 kg. The leatherback is composed of a leather like smooth covering and hence the common name. The head of the adult leatherback is small, round and scaleless. Dorsal side is essentially black with scattered white blotches that are usually arranged along the keels and with pinkish blotches on neck and shoulder. All marine turtles of our waters especially leatherbacks are included in the schedule I of the Indian Wild Life Protection Act, 1972.

Pufferfish *Lagocephalus inermis* - an emerging fishery along Mangalore coast of Karnataka

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Lagocephalus inermis (Temminck & Schlegel, 1850) commonly known as smooth blaasop, belongs to the family Tetraodontidae and order Tetraodontiformes. This fish was considered as a menace by fishermen during the previous year (2006) as it caused damage to other species landed and the net. In 2007, this fish gained attention as a new fishery resource along the coast. An estimated

landing of 74 t was recored in 2006 which increased to 488 t in 2007. The fish is caught by multiday trawlers going for fishing for 8-10 days from a depth range of 20-100 m. The fish is caught during night trawling and is said to be moving in shoals. The peak fishery was in December 2007 with a landing of 222 t.

Investigations were carried out on the biology of the fish. The length of the fish ranged from 27 to 420 mm with modes between 340 and 360 mm and weight ranged from 260 to 760 g with an average weight of 510 g. All the fishes examined were in mature condition. Largest size recorded for the fish was 90 cm (SL).

Pufferfishes are sold at the harbour at the rate of Rs. 8-10 per kg. The fish is beheaded, viscera removed , the skin peeled off and then cured in salt (ratio 3:1) for one week. It is then dried in the sun for a day and is transported to Kerala as cured and dried product. After processing the fish fetch a price of Rs. 30 - 45 per kg. The head and the viscera together form about 60% of the fish weight.

Pufferfishes are known for its poison tetradotoxin (TTX), which is neurotoxic and considered to be the most toxic poision found in nature. It is generally known that liver and ovary are the organs where the toxin is concentrated in most cases, but lesser amount could also be found in skin, muscle and blood. Although the fish is poisonous, Japanese prepare a dish from the pufferfish which is called “Fugu”. Despite the risk involved, if prepared properly, “Fugu”remains a Japanese delicacy and is the most popular dish in Japanese cusine.

Detailed investigations on the biology, food and feeding and toxicity are being carried out at the centre.

A new gear ‘mini purse seine’ in MH-1 zone of Maharastra coast

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In the 2nd week of August 2008, a new gear named “Mini purse seine” was operated at some centres of MH-1 zone such as Nivati, Kochara, Navabag - Dabhojwada and Shiroda along Maharashtra coast. The details of the gear are as follows:

Mesh size	-	16 to 18 mm
Height of net	-	18 to 21 m
Length of net	-	162 to 198 m
Crew required	-	6 to 9
Actual fishing hour	-	1 to 1½ h

Operated only for prawns especially *Metapenaeus dobsoni, Parapenaeopsis stylifera, Penaeus merguiensis.*

Fibre boat is used for this gear

Depth of fishing ground - 7 to 12 m

The net is manufactured using Nylon and provided with floats and weights.

This gear was operated in the beginning of the season *i.e.*, during August.