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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)

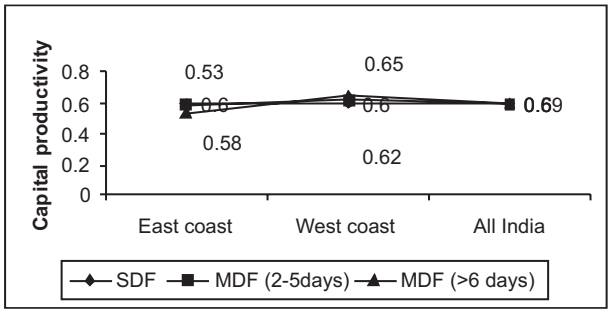

Fig. 1. Capital productivity of trawl fishing in India (2001-05)

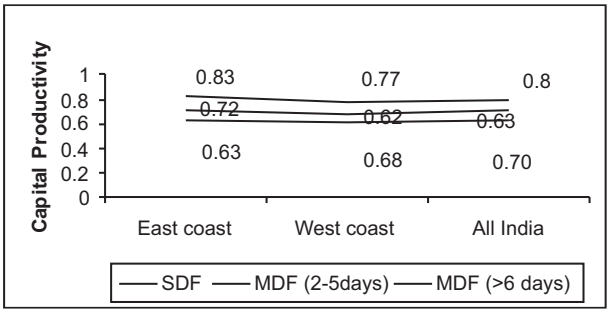

Fig. 2. Capital Productity of gill net fishing in India (2001-05)

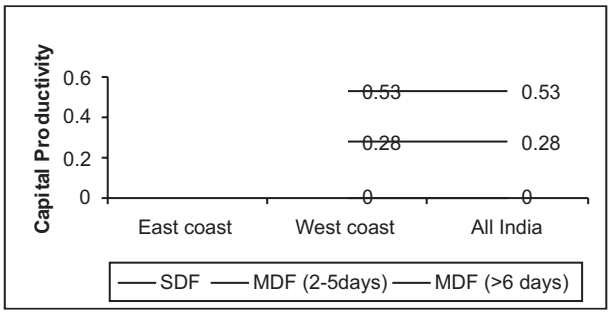

Fig. 3. Capital Productivity of purse seine fishing in India (2001-05)

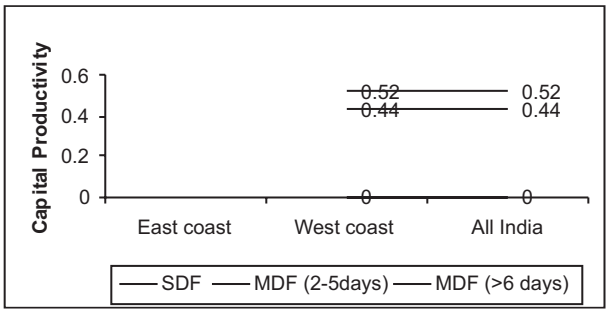

Fig. 4. Capital Productivity of dol net fishing in India (2001-05)

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)

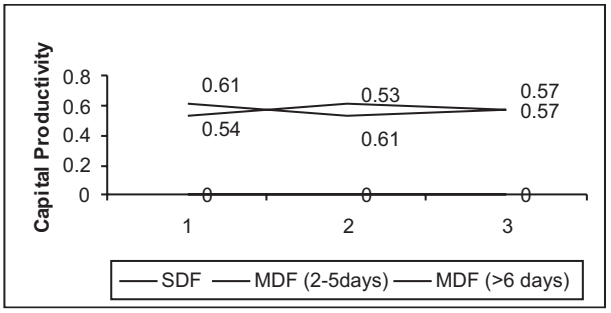

Fig. 5. Capital Productivity of motorised gill net fishing in India (2001-05)

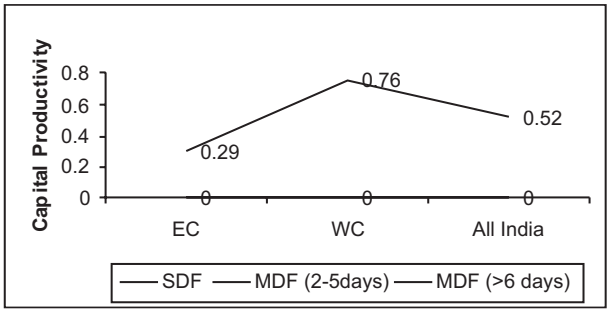

Fig. 6. Capital Productivity of motorised bag net and ring seine (2-5 days) fishing

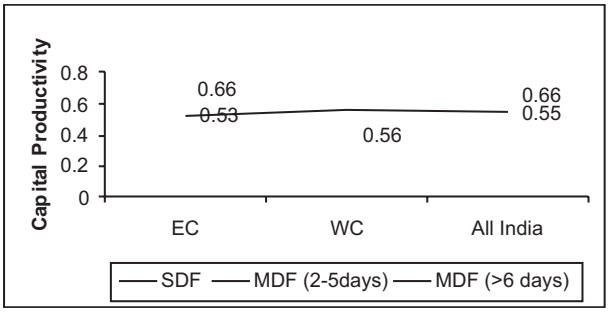

Fig. 7. Capital Productivity of motorised hooks and line fishing (2001-05)

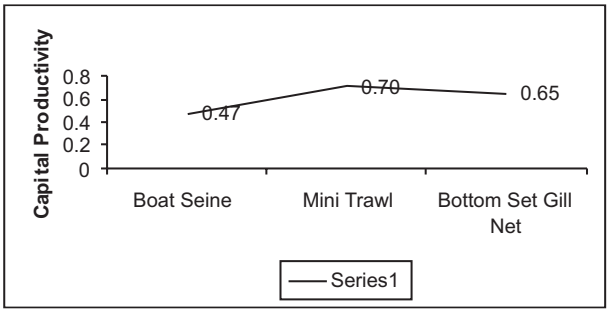

Fig. 8. Capital Productivity of different motorised gears in India (2001-05)

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)

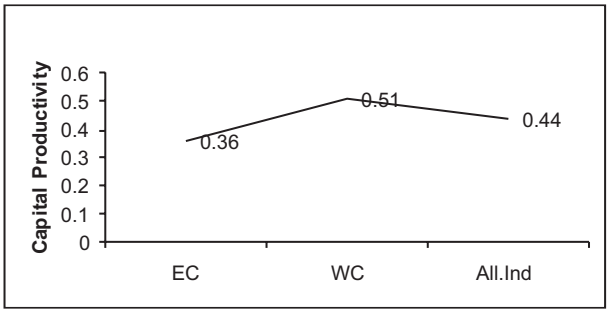

Fig. 9. Capital Productivity of non-mechanised gillnet fishing in India 2001-05

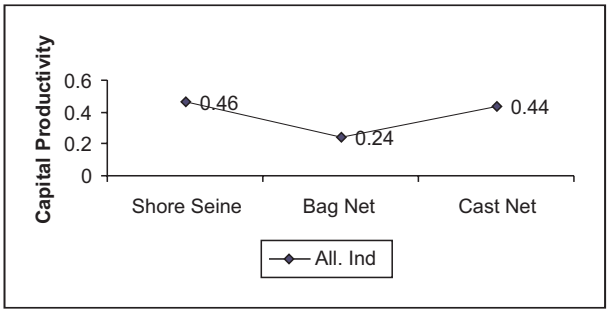

Fig. 10. Capital Productivity of non-mechanized fishing methods

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)

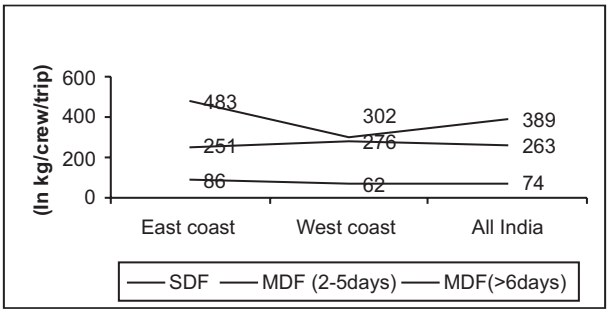

Fig. 11. Labour Productivity of trawl fishing in India 2001-05

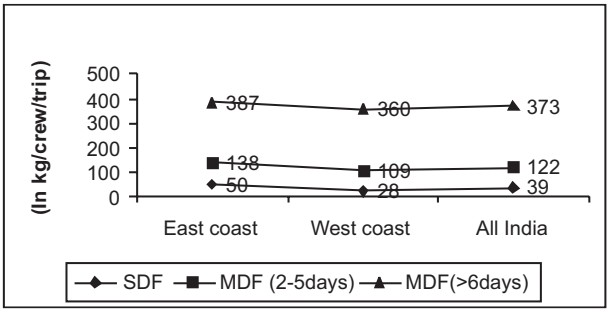

Fig. 12. Labour Productivity of gill net fishing in India 2001-05

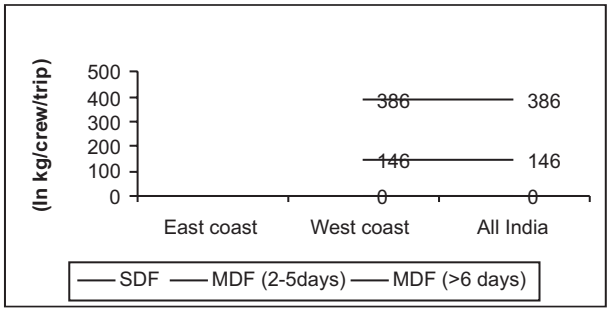

Fig. 13. Labour Productivity of purseine fishing in India 2001-05

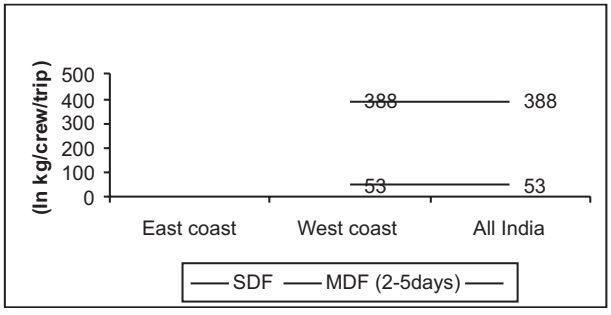

Fig. 14. Labour Productivity of dol net fishing in India 2001-05

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	

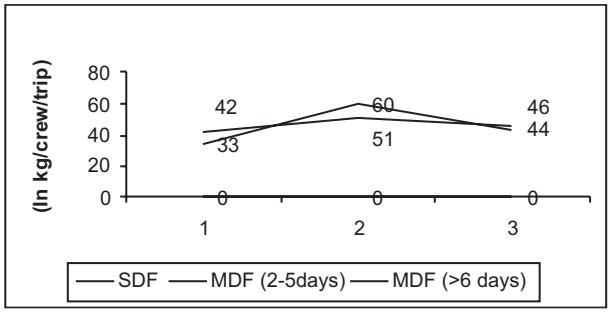

Fig. 15. Labour Productivity of motorized gill net fishing in India (2001-05)

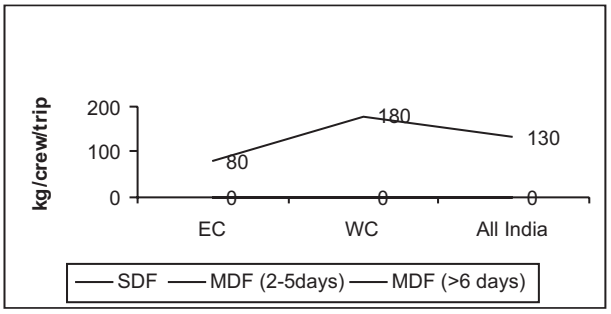

Fig. 16. Labour Productivity of motorized bag net and ring seine fishing (2001-05)

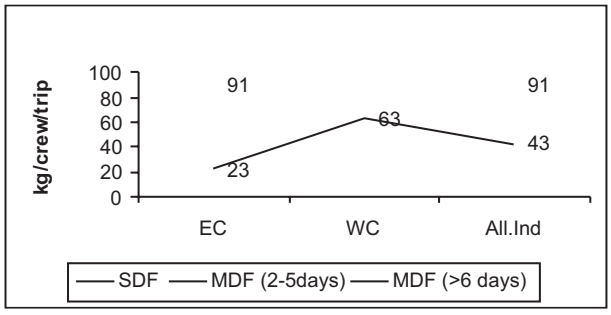

Fig. 17. Labour Productivity of motorized hooks and line fishing (2001-05)

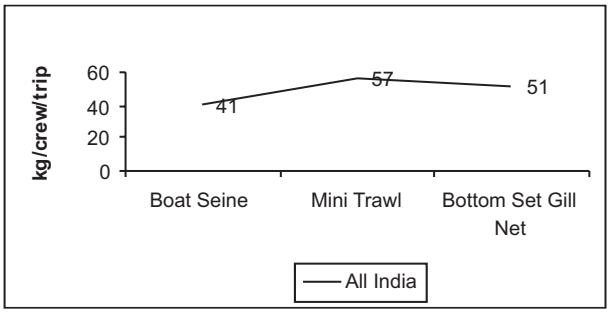

Fig. 18. Labour Productivity of different motorised gears in India (2001-05)

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	

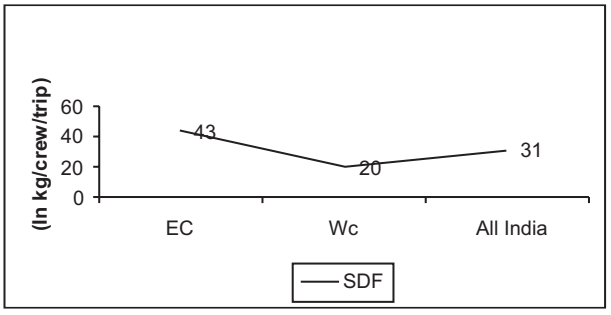

Fig. 19. Labour Productivity of gill net non-mechanised single day fishing 2001-05

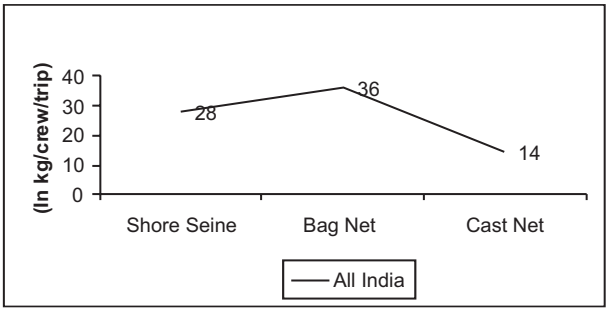

Fig. 20. Labour Productivity of non-mechanised gears in India 2001-05

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.