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57 Economic evaluation of different types of fishing methods along Indian coast

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ABSTRACT

It is imperative to study the economic performance of different types of fishing units for the guidance of fishermen and fishing industry and also for formulation of appropriate fishery policies. The Central Marine Fisheries Research Institute has conducted various case studies on the economics of different types of fishing units in maritime States of India during the eighties and nineties. The studies on the economics of trawlers operating along the coast of Gujarat, Maharastra, Goa, Kerala, Tamil Nadu and Andhra Pradesh; Gillnets operated by OBM crafts at Poonthura in Kerala; at Kochra Nivti (Maharashtra) and Dhamlej (Gujarat); gillnetters (boat with in-board engine) at Cochin Fisheries Harbour, Satpati and Khardanda and Tuticorin; 'dol' operations along the North West Coast; purse seine in Karnataka and Kerala and several other gear and crafts operated along the Indian coast and deep sea trawling are highlighted.

Introduction

Fisheries development in India was slow during the pre-plan period. Under different Five Year Plans of the Central and State governments, priority areas in fisheries were identified and a good amount of funds were made available for development of infrastructure facilities in marine and inland fisheries sectors. Fishery cooperatives were encouraged and financially assisted. Modernisation of fishing techniques has taken place mainly in the sixties and seventies. The cotton material for gear fabrication was replaced by more durable and light materials such as nylon and synthetic thread. Technically more effective methods of fishing like trawling and purse seining were introduced. Over the years, mechanisation and motorisation of fishing crafts took

place very fast in certain maritime States such as Kerala, Gujarat and Maharashtra.

Of late, there developed a competition among various types of fishing units to harvest scarce resources in in-shore and off-shore waters. Besides, mechanised units which are responsible for most of marine fish landings are competing for same input resources. Labour, fuel, gear material, wood and capital are some such input resources which affect relative economic performance of various fishing units. In such circumstances certain units would run in profit whereas others in loss. In case of continuous uneconomical operations for some period, certain diversifications in these units were also noticed.

With the increasing number of different fast moving mechanised units and reduction in mesh size of gears, certain fishery resources have been over-exploited and the catch per unit effort has been reduced in the recent past. Over input resources together with devastating gears and methods of fishing have caused tremendous pressure on fishery resources, specially within the zone of 50 - 60 metre depth creating management and financial problems in fishing sector. Due to reduction in the quantity of catch per unit effort on one hand and increasing cost of fishing inputs on the other hand, investment in capital intensive fishing units have become risky. It is mainly due to continuous increase in the price of fishes that the fishing units are able to earn moderate profits.

For judicious exploitation of resources and for formulating proper fishery policies it is imperative to study the economics of various types of fishing units operated in Indian EEZ. Considering certain objectives of fishermen welfare and fishing industry, the CMFRI has conducted various case studies on cost and earnings of different types of fishing units during the recent years. Besides studying economics of different types of fishing practices, the studies have highlighted employment status, financial aspects, cause of social conflicts, various needs of fisheries sub-sectors, catching pattern of resources, etc. The findings have been highlighted here along with the recommendations which will be helpful to the fishermen, fishing industry and the planners in many ways.

Materials and methods

In different maritime States of India, cost and earning studies of different craft-gear combinations have been undertaken since 1982. Due to technical reasons case studies alone could have been undertaken in certain selected landing centres. While selecting centre(s), care has been taken so that the type of fishing units in question are properly represented. In a month, ten observation days have been systematically selected and data on catch, price, cost of various inputs, details of craft and gear, finance, employment and capital investment have been collected from the randomly selected units for a period of atleast one fishing season through the proforma specially designed for the purpose. The revenue or the gross income of a unit is the sum total of value received by multiplying the quantities of different species/groups with their respective price. The fixed cost comprises depreciation of craft, engine and gear; interest on initial investment; and insurance. The cost of fuel, labour, repair and maintenance, marketing charges, ice and transportation are accounted for towards the operational cost of fishing. In general, income over operating cost, net profit, returns to capital, man-hour productivity and pay back period were considered as the indicators of economic efficiency of the unit. Seasonal variations in cost, revenue and profits were also found out wherever possible by clubbing a period of 3 months to represent a quarter.

Economics of trawl units

During 1982, the economics of pair trawling in Palk-Bay region of Tamil Nadu was studied . Boats of 9-10m length, fitted with 45-70 HP in-board engine, conducted pair trawling operations mainly during February, March and April. Pomfrets, rainbow sardines and sciaenids formed the majority of the catch. The gross income has been computed to Rs. 2,800 per trip whereas the operational expenditure was Rs. 1,202. The income over operating cost per trip was Rs. 1,598.

The cost and earnings of trawlers and pair trawlers were studied along Nagapattinam coast of Tamil Nadu during 1987-88. The average initial investment worked out at Rs. 1.35 lakhs for a trawl unit and Rs. 3.15 lakhs for a pair trawl unit observing 240 and 104 fishing trips in a year respectively. Both trawlers and pair trawlers were found to be highly efficient with an average catch of 394 kg and 1434 kg per trip respectively. The annual net profit

averaged Rs. 68,639, rate of returns to capital 66% and pay back period 1.5 years for trawlers whereas the value of these parameters was Rs. 1.36 lakhs, 58% and 1.7 years respectively for pair trawlers. With the introduction of pair trawling, the migration of boats in search of shrimps during the lean season has been drastically reduced. It is note worthy that pomfrets contributed more than 50% of the revenue of pair trawlers and prawns about 50% of the revenue of trawlers. The introduction of more and more trawlers in search of shrimps led to decline in catch rates in the in-shore waters.

The studies conducted at Cochin Fisheries Harbour comparing economic performance of trawlers between 1982 and 1986 showed that the trawl operations were mainly aimed at prawn catch due to its export demand. But, per unit prawn catch decreased over the years. The net returns increased from Rs.31,000 in 1982 to Rs. 3.9 lakhs in 1986. The reduction in prawn catch as well as value over the years was compensated by the increase in other fish catch and its price. While comparing efficiency of different types of fishing gears it was found that labour efficiency, fuel efficiency and returns to labour were higher for purse-seines as compared to trawlers.

During 1990 and 1991, cost and earnings studies of trawl operations were conducted at Cochin Fisheries Harbour. Most of the boats were 32 footer fitted with 65-120 HP in-board engine. Crustaceans and threadfin breams were the main catch components. Comparison between different seasons showed that the share of prawn catch was low in third quarter (July-Sept.) whereas the share of threadfin breams was high. Because of ban on monsoon fishing, the number of fishing trips was less (50 days) in this quarter. The annual catch of 81-89 t valued at Rs. 7.0-8.5 lakhs for a trawler in a year. The net profit reduced from Rs. 93,000 in 1990 to Rs. 67,000 in 1991. The rate of return to capital reduced from 39% to 32%. Labour productivity in terms of fish production was 59 kg per man day.

During 1991, economic efficiency of medium (Sona) and small trawlers (Roya, Pablo & Sorrah) was studied at Visakhapatnam and Kakinada. Medium trawlers of 12-15 m length are fitted with 87- 100 HP engine and small trawlers about 10 m are fitted with 60-90 HP engine. With 180-190 fishing days in a year these trawlers could catch 50-70 t of fish. A medium trawler, having acquisition cost of about Rs. 7.7 lakhs in 1991, earned a profit of about Rs. 1.79 lakhs whereas a small trawler with an initial investment of

Rs. 3.9 lakhs earned a profit of Rs. 77,000 during 1991. The pay back period was about 3 years and the rate of return to capital, 34-38%. The average number of fishing days was 180 for a medium trawler and 190 for a small trawler. The labour efficiency was higher for medium trawler as the catch per man day was 49 kg as compared to 45 kg on a small trawler. The medium trawlers were found to be economically more efficient. Further addition to the fishing fleet is not recommended.

The results of input-output study of trawlers at Goa during 1991-92 revealed that a trawler of about 15 m length had an acquisition cost of about Rs.6 lakhs and a small trawler (10-12m) Rs. 4 lakhs. A trawler, on an average, earned about Rs.6.3 lakhs as gross revenue and Rs. 25,000 as net profit during 1991-92. With an average of 160 fishing trips in a year, the pay back period was calculated at 6 years and the rate of return at 20%. The trawling is observed from the month of November to May every year. The small trawlers go for single day fishing trip whereas medium trawlers observe 2-3 day fishing trips. The trawling is carried out upto 70 m depth of water. On an average, catch per unit effort of a trawler was 272 kg valued at Rs.3,930.

Cost and earnings study of trawlers operating at Tuticorin during 1985 showed that the initial investment ranged from Rs. 1 lakh for a 8.5 m(OAL) trawler to Rs. 2.2 lakhs for a 10 m (OAL) trawler. About 70% of the annual revenue was realised from prawn catch. With the total operational cost varying from Rs. 3.3 lakhs to Rs. 5.4 lakhs, net profit ranged from Rs. 59,000 for a small trawler to Rs. 76,000 for a big trawler. The fishing days ranged from 238 to 252 for different size of trawlers. The over-dependence on prawn catch for the sustenance of trawlers was reported to be reduced in this area. The labour productivity, wages, quantum of catch, gross revenue and net profit were comparatively higher for big trawlers since these were fitted with engines of higher HP and could operate beyond the traditional fishing grounds. Introduction of bigger boats with operational capacity in deeper waters would further help to avoid the conflict between the mechanised and traditional units.

During 1987-88, economic feasibility of trawling in Maharashtra was studied. At New Ferry Wharf and Ratnagiri landing centres most of the trawlers were of 12-15 m length fitted with 3-4 cylinder in-board engine. The annual operating cost ranged from Rs. 4 lakhs to Rs. 5 lakhs and the fixed cost from Rs. 1.5 lakhs to Rs. 1.6 lakhs. The annual catch of 55-57 tonnes

valued at Rs. 4.6-5.2 lakhs. The net annual profit ranged from Rs. 19,000 to Rs. 32,000 . The rate of return to capital was 19-22 per cent. At Ratnagiri, a few trawlers were reported to shift over to gillneting and purse-seining due to the uneconomical operations of trawlnet since the catch per trawl unit has been reported decreasing year after year mainly due to the rapid increase in number of trawlers.

Economics of gillnetters (OBM)

At Poonthura (Kerala) during 1985-86, the initial investment in a plank built canoe fitted with OBM, averaged Rs. 41,000. The operational cost of a unit was about Rs. 75,000. Mackerel, carangids, tuna, seerfish and eels were the main catch components. Annual gross revenue was about Rs.1 lakh and the net profit Rs. 12,000. In terms of productivity, gross and net income and employment potential, the canoe, fitted with OBM were found more efficient than non-mechanised gillnet units. The results further showed that non-mechanised catamaran units had better input-output and capital efficiencies as compared to OBM units mainly because of low initial investment. Catamarans with hooks & lines are highly suitable as a family enterprise for the small investors who are capable to go for fishing in their own units. But canoes fitted with OBM is more efficient in terms of higher productivity, employment potential and gross and net income.

In northwest coast of India, a study on economics of gillnetters was conducted during 1986-87 by selecting OBM units at Kochra-Nivti in Maharashtra and Dhamlej in Saurashtra (Gujarat). The initial investment in a gillnet unit ranged from Rs. 77,000 to Rs. 91,000. At Kochra-Nivti, the annual catch of about 15 t of a unit fetched a gross revenue of Rs.1.17 lakhs and at Dhamlej 17 t of catch fetched an amount of Rs.1.5 lakhs. The annual net profit worked out at Rs.799 for 228 fishing days at Kochra-Niviti and Rs.2939 for 212 days at Dhamlej. The rate of return to capital was 13-15%. The pay back period was assessed at about 4 years. Most of the catch was sold to private fish traders who provided loan for operational expenses to the fishermen. Some fishermen were selling their catch to Gujarat Fisheries Central Cooperative Association through fishermen cooperative societies.

Economics of gillnetters (In-board engine)

The initial investment in a gillnet unit during 1982 at Cochin Fisheries Harbour was Rs. 95,000. A unit fetched a gross revenue of Rs. 1.15 lakhs in 1982 and Rs. 2.02 lakhs in 1986. The total cost of fishing increased from Rs. 1.12 lakhs in 1982 to Rs. 1.52 lakhs in 1986. The net income which was about Rs. 3,000 in 1982 raised to Rs. 51,000 in 1986. Wages, fuel expenditure and auction charges were the major cost components. The average number of days fished in a year was 177.

On comparing different types of units operating from Cochin Fisheries Harbour, the initial investment was the lowest for gillnetters among all the mechanised fishing units under study. Operating cost per kg of fish production as well as fuel efficiency for gillnetters was the highest whereas labour efficiency was the lowest as compared to purse seiners and trawlers.

During 1986-87, a study on the economics of mechanised gillnet fishing units was conducted at Satpati and Khardanda centres of Maharashtra. Majority of the boats, ranging from 8 to 14 m were fitted with 2-4 cylinders inboard engine. Pomfret, seerfish, catfish, shark and croakers were the prominent groups in the catch. At Khardanda, about 30 t of catch of a unit valued at Rs. 2.31 lakhs whereas at Satpati, 26 t of catch valued at Rs. 2.68 lakhs. Satpati is an important centre for pomfret landings. A gillnet unit during 1986-87 had an initial investment of 2-3 lakhs. The annual net profit was found to be Rs. 3,400 at Khardanda and Rs. 7,500 at Satpati. The rate of returns to the capital was moderate (13-15%) and the pay back period was 4-5 years at these centres.

On a mechanised gillnetter, the crew comprise 6-9 persons, whereas on a country craft fitted with OBM 3-4 persons form the crew. Due to continuous increase in the number of mechanised boats in the State, there was a report of downward trend in landings per unit of effort. About 90% of the total catch is contributed by mechanised boats in this State.

During 1986-87, economic efficiency of sail boats fitted with in-board engine was studied in Tuticorin region of Tamil Nadu. The initial investment of a sail boat operating gillnet (Kolavalai) was about Rs. 43,000 which resulted in an annual fixed cost of Rs. 17,000. The total cost of fishing was Rs. 64,000 whereas the net profit was Rs. 4,600 during the year. Pay back period of the unit was about 3 years.

On comparison of mechanised and non-mechanised gillnetters, fish production per man day was found to be 12 kg for non- mechanised gillnetters and 17 kg for mechanised gillnetters, valued at Rs. 33 and Rs. 39 respectively. The number of fishing days averaged 277 for non-mechanised units and 293 for mechanised units during 1986-87. In terms of capital and labour efficiency, non-mechanised gillnetters were found to be more efficient, but in terms of number of fishing days and net operating income, mechanised units performed better.

Economics of 'Dol' operation

The study on economics of dol operation was conducted during 1984-85 at three selected centres along northwest coast of India namely, Navedar-Navgaon and Madh in Maharashtra and Navabunder in Gujarat. Craft of 9-14 m length fitted with in-board engine of varying horse powers were used for reaching the fishing grounds and transportation of the catch. The initial investment in a Khamba system of dol operation at Navedar-Navgaon was Rs. 2.7 lakhs. At Madh and Navabunder, the initial investment in a Sus unit worked out at Rs. 1.3 lakhs and Rs. 1.73 lakhs respectively. Bombay duck and *Acetes* formed the main catch. The annual net profit of Khamba system of dol operation was about Rs. 18,000 and that of Sus system Rs. 21, 000. The pay back period was found about 4 years.

The number of fishing days was higher in the villages where crew members were contracted by boat owners as compared to those where they shared catch and operating expenditure with the boat owners. Similar study on dol operation was conducted at Sasoon Dock (Maharashtra) during 1990-91. *Acetes* formed the major catch of dol, contributing about 44% of total catch. The annual gross revenue was about Rs. 1.94 lakhs whereas the total cost of dol operation was about Rs. 1.76 lakhs, resulting in a net profit of about Rs. 18,000 during the year. The rate of return to the capital was calculated at about 23%.

Costs and returns of purse-seiners

During 1989, a study was conducted in Karnataka to assess the socio-economic impact of replacement of *'Rampani'* by mechanised purse-seiners. *'Rampani'* which contributed 60% of the total catch upto early seventies almost disappeared from Karnataka fishery. The per capita annual revenue of

Rampani fishermen worked out at Rs. 3,370 in 1977. The initial investment of a purse-seine unit was calculated at Rs. 7.7 lakhs, revenue Rs. 8.77 lakhs and net returns Rs. 1.3 lakhs during 1989. The rate of return to capital was found to be 32%. The introduction of purse-seines has created more employment opportunities and was helpful in rehabilitation of unemployed rural fishermen who were earlier working in *Rampani* units upto middle of the seventies.

In Kerala, economics of purse seine operation was studied comparing annual performance from 1982 to 1986. The number of annual fishing days ranged from 100 to 140. The annual gross revenue increased from Rs. 6.5 lakhs in 1982 to Rs. 11.9 lakhs in 1986 whereas the net return increased from Rs. 31,000 to Rs. 3.9 lakhs over this period. It is noteworthy that fuel efficiency and labour efficiency were higher for purse seine units when compared with trawl and gill- net units. Purse-seine was considered as a highly destructive gear, because of its operational method. It was apprehended that large-scale purse-seining would result in the depletion of the pelagic fishes like oilsardine and mackerel. Recently, there has been a tendency to use both the trawl and purse-seine by the same crafts depending upon the seasonal variations of the marine fishery.

Economics of ring-seine operation

The study on economic evaluation of ring seine fishery along Kerala Coast was conducted during 1990-91. Canoes fitted with 25 HP OBM were used to operate ring seine units. Sardines, carangids and Indian mackerel dominated in the catch. The average fishing trip per unit was 209 at Punnapra and 178 at Puthiyangadi and per trip gross revenue was Rs. 5,997 and Rs. 3,039 respectively. The economic efficiency parameters indicated that purse seine operating along Kerala Coast was highly profitable during the study period as the pay back period was less than 2 years and rate of returns to capital, about 50%. Many fishermen are under-employed in ring seine units as the existing number of share holders are much more than the required number of crew for its operation. The less efficient ring seine units are not competitive enough to fetch sufficient catch to provide adequate earnings to the crew. Number of ring seine units and the active fishermen depending on them are likely to decrease in the near future. Hence, diversification of fishing techniques in the motorised sector is highly essential for its survival.

Economics of deep sea fishing vessels

Most of the deep-sea fishing vessels are based at Visakhapatnam. It is reported that due to uneconomical operations these Mexican Trawlers are defunct now. The economic parameters of three types of deep-sea fishing vessels namely trawlers, multipurpose fishing vessels and tuna long liners, are based on the relevant data published by CMFRI, MPEDA and FSI (1989-1992). A deep-sea trawler of about 25m OAL, with an investment of about Rs.160 lakhs, could harvest 46 t of catch annually valued at Rs. 76.2 lakhs. The average net profit is calculated at Rs. 17.2 lakhs and rate of return at 26%. The investment in a multipurpose deep-sea fleet is assessed at Rs. 150 lakhs. Annual catch of 76 t would fetch a revenue of Rs. 68.3 lakhs. With the annual fishing cost of Rs 56 lakhs, the net profit would be about Rs. 12 lakhs. About 8 years are required to recover the initial investment with the given rate of fish production. The cost price of a tuna long liner (30m OAL) was found to be Rs. 164lakhs. It could harvest an average annual catch of 900t valued at Rs.101 lakhs. The total annual cost of fishing was about five years and rate of return 27%. For all the three types of above vessels, the rate of return is not very attractive, because of high amount of investment in these units. The fisheries management policies should ensure reduction of fishing pressure on prawns and diversifying fishing efforts to other resources.

Costs and returns of operation of non-mechanised units

The economic study of catamarans operating gillnet along Madras Coast during 1984 revealed that the initial investment of a unit ranged from Rs. 4,000 to Rs. 13,000. The annual number of fishing days varied from 177 to 276. The average catch of a small unit was 0.23 t and for a big unit 0.5 t, with profit ranging from Rs. 1,400 to Rs. 4,000. The rate of return was 70-76%. It was observed that there was manifold increase in the price of catamaran logs. The analysis indicated that earnings of the catamaran unit could be increased by increasing the size of the crafts as well as number of gears.

The initial investment which depends on the size of catamaran and number of gears used, is the most important factor in determining the net return of fishermen. The occasional abundance in catch usually do not help the fishermen as it brings down the price to a very low level. The flexibility in

demand and supply can be considerably controlled by developing adequate storage facilities and fixing minimum support price for different species of fish to avoid monopoly of fish traders. There must be proper implementation of regulation of the area of fishing operation and period of operation for traditional and mechanised units.

If wind is favourable, the sail craft get almost same speed as that of motorised units. As a fuel saving measure, even the motorised units can utilise the sails whenever the wind is favourable. Hence, the motorisation of sail crafts should be carried out only as a supplement to the sails and not to supplant it.

The catch rates of non-mechanised fishing units declined with the advent of mechanisation and motorisation of fishing boats. The rate of return to capital, capital turn over ratio, pay back period and net profit per day of operation were found to be better for a plank-built boat at Tuticorin. But in terms of returns to labour and net income per day, the boats, at Mallipattinam performed better.

Cost and earnings study of traditional fishing units along Trivandrum Coast showed that the gross revenue of the gillnet units averaged Rs. 56,000 and net profit about Rs. 11,000 during 1986-87. The initial investment in a unit was Rs. 8,500. In less than one year, the recovery of capital investment was possible with 263 fishing days.

The catamaran with hooks and lines had an investment of Rs. 3,350. With a gross revenue of Rs. 38,000, the net profit was Rs. 8,600. The pay back period was about half a year.

Since the initial investment is comparatively less, the catamaran units show better input-output and capital efficiencies as compared to OBM units. Because of this reason, still considerable number of traditional units are non-motorised inspite of fast expansion of motorisation in other coastal districts of Kerala.

The economics of sail boats operating trawlnet (Thallumady) and gillnets (Kolavalai) was studied in Tuticorin region of Tamil Nadu during 1986-87. The initial investment of a non-mechanised plank-built boat operating trawl was Rs. 18,000, operational cost Rs. 26,000 and total cost of Rs. 33,000. The

profit of a trawl unit was Rs 3,300 during this period. These units operated on an average of 280 days in a year. The rate of return to the capital was 70%. The capital investment could be covered in less than 3 years at the given production rate.

Sail boats operating gillnet had an investment of Rs. 27,000, annual cost of operation Rs. 48,000 and gross revenue of Rs. 55,000. The annual fishing days averaged 277and the net operating income Rs. 7,000. The pay back period was less than 2 years. The wages for crews and food and bata accounted for 77% of the annual operational cost.

During the last few years most of the traditional gears have gone completely out of operation and the operation of shore-seines declined drastically. The emerging gears in recent years in this area are "disco-nets". Non-mechanised sails boats operating gillnets are found to be economically more efficient than sail boats operating trawlnets and sail boats with in-board engines. But, in terms of number of fishing days, level of income generated and net operating income, the mechanised units were found to be better.

Future research priorities and conclusion

The studies on the cost and earnings of different craft-gear combinations should be conducted on macro-level in different maritime States of India since the case studies alone would not lead to conclude effectively for future planning in marine fisheries sector. Conducting region-wise bio-economic studies over a regular interval of time is the need of the day so that problems of uneconomical operations of certain gears, fluctuations in catches, seasonal variations in catch and price and risk factor in production could be properly reflected. Non- mechanised, motorised and mechanised sector should be given equal priorities while undertaking cost and earning studies. Such studies may also stress on employment potential, marketing problems, financial needs of various types of units and proper management of inputs used for fishing. Besides, economic studies of large fishing vessels should also be conducted since they operate in off-shore regions and catch non-conventional resources. Though small and medium size crafts are found to earn moderate profits, no further addition of the fleets is recommended upto 70-80 m depth zone along Indian Coast.