5 ECONOMICS OF MECHANISED AND NON-MECHANISED MARINE FISHING - SOME IMPLICATIONS FOR EFFICIENCY

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Abstract

The study was carried out in Kollam District of Kerala covering 60 respondents each in mechanised and non-mechanised categories. The average level of employment in fishing per household was 316 man-days in motorised category fishing was the major source of income, contributing 85.33 and 76.02% respectively, with an average annual income of Rs.32, 180 and Rs12, 612 in case of motorised and non-motorised category. The inequality in income distribution of both the categories was found less and the Gini concentration ratios worked out to 0.20 and 0.21, respectively, for motorised and non-motorised categories.

There was not much significant difference in number of fishing trips, which was estimated at 279 and 264 per annum for motorised and non-motorised category. The total return obtained from a fishing trip was Rs.1, 398.72 for motorised fishing, while it was Rs. 431.58 for artisanal craft fishing. The total cost incurred per trip was Rs.1170.82 and Rs.391.708, respectively, in the case of mechanised and non-mechanised fishing. On an average net return realised per trip were Rs.227.70 and Rs.39.80, respectively, in the case of mechanised and non-mechanised fishing. The estimates of rate of return show the capital efficiency of mechanisation in fishing and it worked out to 199.21 and 102.05 percent for mechanised and non-mechanised categories. The slope coefficients of regression analysis with regard to distance to fishing ground showed that with an increase in the distance of one km from their respective mean levels of 14.54 km, and 5.87 km, the gross income would increase by Rs.66.12 and Rs.43.07 respectively, for motorised and non-motorised categories. The economic and capital efficiencies of mechanised fishing suggest transformation of traditional crafts for improving fishing efficiency. It is also imperative that identification of specific fishing area using remote sensing and dissemination of such information to fishermen are necessary to reduce the risk.

Introduction

Marine fish resources have been augmented till 1970 through artisanal method of fishing and nearly 60 per cent of Indian fish production is from the sea. But in the recent past, development and expansion of trawlers and purse seine boats compete with artisanal method of fishing for inshore resources, which resulted in motorization of crafts for effective fishing reaching distant waters. Particularly in Kerala (Leela and Hridayanathan, 1988) of the total 5.68 lakh tonnes of marine fish

production, 43 per cent was contributed by the artisanal sector and that of motorised sector was 39 per cent. The share of artisanal production fell by about 30 per cent between 1970 and 1990. As complete transformation of artisanal to mechanised form is not feasible due to high cost and studies (Sachidanandam, 1972; John Kurien, 1978; Narayanan, 1981; Mathiarjunan, 1989; Rajasenan and Sankaranarayanan, 1990) show that the rate of return is found higher for mechanised fishing crafts, but in terms of employment generation (Narayanan 1981), equity in income distribution (John Kurien, 1978) catch of specific fishes particularly prawn catch (Naryanan, 1981) the motorised boats are found inefficient.

Kerala is one of India's leading maritime States, with a coastline of 590 kms. and a network of inland water bodies. It has a fishable area which is as large as its land surface (13,000 sq.km). The State's coastline accounts for 10 per cent of the country's coastline; but Kerala is the home to over a quarter of the country's half a million active marine fisher people. There are about 10 active fisher people for every single sq.km of coastal waters in Kerala; this figure is over three times the all India average. Although the density of fisher population is high, the average fishing potential of the inshore sea here is 30 tonnes per sq.km (the all India average is 13 tonnes per sq.km). The State today accounts for about 24 per cent of the national marine fish production and 40 per cent of India's seafood exports. According to the State Fisheries Department, about Rs.12 million worth of foreign exchange is earned every day.

According to 1991 Census, 7.75 lakh fisher people are involved in the marine sector in the state. In 1990, there were nearly 5000 mechanised boats, owned largely by non-worker owners and they were operated by about 30,000 fisher people, which accounted for about one third of the volume of output. The major share of the earnings of the mechanised sector came from the prawn harvest, which was wholly exported. The remaining two-thirds of the marine fish harvest, which was consumed locally, was harvested by 50,000 motorised and non-motorised crafts manned by over 120,000 fisher people, largely owner-workers from the traditional fishing communities. In 1990, the overall fish production in the State's marine sector was around 5.7 lakh tonnes. By 1997, it increased to 7.31 lakh tonnes (Krishnakumar, 1999).

In Kerala the artisanal fishery was well developed till 1970's and the maximum yield of that decade was recorded at 4,48,269 tonnes in 1973. The main thrust of fisheries development until 1980 was on augmentation of fish production particularly shrimps for increasing foreign exchange earnings. There was an

uncontrolled expansion of trawlers and purse seine boats, which caused much damage to artisanal fishermen and the inshore resources. The unequal access to the common resources of the sea has been threatening the very survival of smaller crafts operated by majority of the fishermen. They responded to this challenge strongly in the early 1980 s by resorting to motorization of their crafts for competing more effectively and to reach distant waters in search of new fishery resources. By 1990, about 10,000 artisanal crafts were motorised and this process is continuing even today. At present there are nearly 20,800 motorised country crafts operating all over Kerala. In this context, it becomes relevant to understand the advantages of motorization in relation to economic and social aspects of marine fishing and income and living standards of small artisanal fishermen. The paper is organised into five sections, viz., introduction, source of data, analytical methods, empirical results and concluding remarks.

Source of Data

Kollam District of Kerala was chosen for investigation. The district has a coastal line of 37.3 km and accounts for 11.61 per cent of the total fisherfolk population of the State. Kollam District has 27 fishing villages. From this, four fishing villages, namely Thangassery and Eravipuram from the southern part of Kollam District and Neendakara and Cheriazheekal from the northern part were selected based on the predominance of both motorised and artisanal crafts particularly motorised marine plywood boats and non-motorised wooden canoes. Mechanised fish landing centres and fishing villages, where catamarans were predominant, were excluded from the study. The owners of the crafts (*vallams*) were the respondents of the study.

The sample size of 60 each in both motorised and non-motorised categories were selected. The distribution of respondents in the selected villages was done by following proportionate random sampling method. According to the proportion of population, a total of 43 respondents were distributed in Neendakara including 23 under motorised and 20 under non-motorised craft categories and 17 in Cheriazheekal village including 7 under motorised and 10 under non-motorised craft categories. Thus, a total of 60 respondents were distributed with 30 each in motorised and non-motorised categories for the northern region. In the same way, 60 respondents were distributed in the southern region, including 23 under motorised and 21 under non-motorised for the fishing village Thangassery and 7 and 9 respectively under motorised and non-motorised categories for Eravipuram village. The selection of the respondents under each category was done by following random sampling procedure in each village from the category-wise population of craft owners.

Analytical Methods

Gini coefficient

Inequality measurement was again checked by using Gini concentration ratio. Gini ratio is defined as the proportion of area under diagonal line and Lorenz curve. Its value ranges from 0 and 1.

The Gini ratio of 0 means that every individual receive exactly the same income Ratio of 1 would mean that there is inequality in income distribution among the households. Gini coefficient was worked out by using the following equation.

$$G = 1 + \frac{1}{n} - \frac{2}{n^2 Z} \sum_{i=1}^{n} (n+1-i) Y_i$$

Where

n - the number of individuals (respondents)

Y_i - income received by the ith individual and

Z - Y_i/n

Factors determining income from fishing - A linear relation

A linear regression model of the form

$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + e$ was fitted to identify the influence of different variables on fish catch.

Where   Y -   value of fish catch in rupees

X_1 -   experience of the fishermen in fishing in years

X_2 -   distance to the fishing ground expressed in kilometres

X_3 -   operating expenses of the craft which included cost of fuel consisting of cost of fuel oil, lubricating oil and fuel for lighting, cost of bait, food for the crew, crew share and sales commission in the case of motorised category and crew share, food for the crew and sales commission for the non-motorised category

X_4 -   fishing time in hours including hours of journey and actual time spend for fishing

X_5- weighted price which was worked out by dividing the value of catch by the quantity of catch and if P_1,Q_1,P_2,Q_2 and P_3,Q_3 are the prices and quantities of three varieties of fishes obtained by a single catch by a fishermen respondent, then,

$$\text{Weighted price} = \frac{P_1Q_1 + P_2Q_2 + P_3Q_3}{Q_1 + Q_2 + Q_3}$$

a - regression constant

bi - regression coefficient and

e - random error term

The variables selected were same for both the categories of motorised and non-motorised fishermen, since both the categories of fishermen belonged to the same fishing villages, they were subjected to similar fishing situations. Experience of the fishermen was included as a variable, with the assumption that the fishermen might have developed certain skills or fishing techniques over years, or they were able to identify certain fishing spots or movement of fishes in the sea which helped them to increase their gross income. For the motorised category, in addition to this, the efficiency in using engines was expected to improve over years. The distance to the fishing ground was included as a variable with the assumption that the availability of different species of fishes occurred at specific fishing areas and depths, and so the gross income earned was influenced by this. Operating expenses were included as a variable in order to assess the changes in gross income with unit change in operating expenses. Fishing time was included as a variable in order to assess the changes in gross income with changes in hours of fishing. Weighted price was included as a variable to assess whether the gross income was influenced by the highly priced varieties.

Empirical Results

Source and levels of income

Fishing was the major source of income for both motorised and non-motorised categories contributing 85.33 and 76.02 per cent respectively to the total income (Table 1). Fishing related activities constituted 8.22 per cent of the total income for the motorised category, whereas it was 10.66 per cent of the total income

for the non-motorised category. Non-fishing activities contributed only 6.45 per cent to the total income for the motorised category, whereas it was 13.32 per cent for the non-motorised category.

The fishing related activities included marketing of fish, participating in auctioning of fish as commission agents, repairing of fishing gears and engine, net making, as agents of fuel oil, working in boat-yard and drying of fish. For the non-motorised category, the main fishing related activity was the marketing of fish by women in the family. For the motorised category, the main fishing related activity was as commission agents in fish auctioning.

The non-fishing activities included working in cashew processing units, tailoring, running petty shops, working as nurses, drivers and a few with part time job in fishermen co-operative societies. In addition, a very few fishermen families received income from abroad.

TABLE 1. *Source-wise income of the sample households (Average in Rs. per annum)*

Source of income	Motorised category	Non motorised category	Overall
Fishing	32180 (85.33)	12612 (76.02)	22396 (82.48)
Fishing related activities	3100 (8.22)	1769 (10.66)	2434 (8.96)
Non-fishing activities	2434 (6.45)	2210 (13.32)	2322 (8.56)
Total	37714 (100.00)	16591 (100.00)	27152 (100.00)
Per capita income	9596.44	3978.66	6787.55

(Figures in parentheses indicate percentages to total)

The annual income obtained through fishing averaged to Rs.32,180 for the motorised category family and Rs.12,612 for the non-motorised category. The annual earnings from fishing related activities and non-fishing activities respectively were Rs.3,100 and Rs.2,434 and the annual income through all sources averaged to Rs.37,714 per household of the motorised category. For the non-motorised category,

the contribution of fishing related and non-fishing activities were Rs.1,769 and Rs.2,210 respectively and the average annual income from all sources was Rs.16,591. The per capita income worked out to Rs.9596.44 for the motorised category and Rs.3978.66 for the non-motorised category. The Gini concentration ratio worked out to 0.20 and 0.214, respectively, for motorised and non-motorised categories indicating that the inequality in income distribution among the households engaged in both types of fishing was found less.

TABLE 2. *Number of fishing trips undertaken by the sample respondents (Average per craft per year)*

	Motorised	Non-motorised
Northern villages	283	267
Southern villages	276	261
Overall	279	264

Economics of fishing

Fishing trips: The number of fishing trips by a craft ranged from 200 to 320 for the motorised craft category with a mean of 279 fishing trips per year (Table 2). In the northern villages, the number of trips made was higher than that made in southern villages with a mean value of 283 fishing trips and in the southern region it was 276 trips per craft per year.

For the non-motorised category, fishing trips in a year ranged from 220 to 300. The average trip per craft was 267 for northern region and 261 for southern region. The mean fishing trips for the whole sample was lower than that of the motorised category with 264 trips. Reasons for the reduction in the fishing trips was climatic conditions like favourable winds and heavy downpour for the non-motorised category, and restraints like engine repairs, damage to the craft and gears, non-availability of fuel and lubrication oil etc. for the motorised category.

Capital investment in fishing: In fishing much capital expenditure is involved in purchasing crafts, gears, engines, etc. For the motorised category of sample respondents, the capital investment per fishing craft ranged from Rs.25,000 to 75,000 (Table 3). It ranged from Rs.40,000 to Rs.53,000 for the outboard motor and Rs.25,000 to one lakh for the fishing gears. The average capital investment for craft, engine and gears in this category were Rs.40,000, Rs.50,000 and Rs.43,000 respectively. For the non-

45

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motorised category, the purchase price of a craft ranged from Rs.6000 to Rs.30,000 and that of gears Rs.12,000 to Rs.40,000. The average capital investment in craft and gears in the category were Rs.20,000 and Rs.26,250 respectively.

The item-wise capital investment in fishing, including both equity and borrowed capital are presented in Table 3. For crafts out of the total capital investment of Rs.16 per trip, 55.00 per cent was equity and 45.00 per cent was borrowed for the motorised category of fishermen. In the capital investment for engine, 16.67 per cent was equity and 83.33 per cent was borrowed. This was because many of the governmental as well as non-governmental organisations gave loans for purchase of engine, in the study region. Of the total capital investment in gears, 75.00 per cent was equity and 25.00 per cent was borrowed capital. Of the total capital investment in fishing, 48.19 per cent was borrowed capital and 51.81 per cent was equity. For the non-motorised category of fishermen, 83.25 per cent was equity and 16.75 per cent was borrowed out of the total capital investment in craft. For gears it was 40.00 and 60.00 per cent respectively contributed by equity and borrowed capital. Out of the total capital investment of Rs.39.00 per craft, 64.10 per cent was borrowed and only 35.90 per cent was equity.

TABLE 3. *Item-wise capital investment in fishing (in Rs. per fishing trip)*

Category	Motorised category			Non-motorised category		
	Equity	Borrowed	Total	Equity	Borrowed	Total
Craft	8.80 (55.00) [7.69]	7.20 (45.00) [6.30]	16.00 (100.00) [13.99]	3.33 (83.25) [8.54]	0.67 (16.75) [1.72]	4.00 (100.00) [10.26]
Engine	6.67 (16.67) [5.83]	33.33 (83.33) [29.13]	40.00 (100.00) [34.90]	-	-	-
Gears	43.80 (75.00) [38.29]	14.60 (25.00) [12.76]	58.40 (100.00) [58.40]	14.00 (40.00) [35.89]	21.00 (60.00) [53.85]	35.00 (100.00) [89.74]
Total	59.27 [51.81]	55.13 [48.19]	114.40 [100.00]	17.33 [44.43]	21.67 [55.57]	39.00 [100.00]

( ) Indicates percentage to each category total.
[ ] Indicates percentage to the total capital investment.