ECONOMICS OF FISH FARMING IN THANJAVUR DISTRICT OF TAMILNADU

By

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CERTIFICATE

Mr. S. GURUNATHAN has satisfactorily prosecuted the course of research and that the thesis entitled "**ECONOMICS OF FISH FARMING IN THANJAVUR DISTRICT OF TAMIL NADU**" submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the thesis or part thereof has not been previously submitted by his for degree of any university.

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This is to certify that the thesis entitled "**ECONOMICS OF FISH FARMING IN THANJAVUR DISTRICT OF TAMIL NADU** " submitted in partial fulfillment of the requirements for degree of **Master of Science in Agriculture** of the **Acharya N.G.Ranga Agricultural University,** Hyderabad, is a record of the bonafide research work carried out by **S.GURUNATHAN** under my guidance and supervision. The subject of the thesis has been approved by the **Student's Advisory Committee.**

No part of the thesis has been submitted for any other degree or diploma or has been published. The published part has been fully acknowledged. The author of the thesis has duly acknowledged all assistance and help received during the course of investigations.

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Date : 29.02.2008

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ABSTRACT

The present study entitled "Economics of fish farming in Thanjavur district of Tamil Nadu" was undertaken mainly to study costs, returns, and resource use efficiency along with marketing aspects. The study was conducted in Thanjavur and Orathanadu taluks of Thanjavur district of Tamil Nadu. Two clusters of four villages each were selected from each taluk to represent sixteen villages. Sixty farmers were selected randomly from the selected groups of small (up to 2 ha.) and large (more than 2 ha.) categories. The selected small and large farmers were 35 and 25 in numbers respectively. Conventional tabular, functional and break-even analysis were used to arrive at valid conclusions.

The total cost of fish farming per hectare was found to be Rs.6,994.69 on pooled farms. The cost of farming decreased with increase in the size of farm from Rs.69, 044.06 on small farms to Rs.59,254.26 on large farms. The variable costs accounted for 78.12, 72.88 and 74.51 per cent of total costs on small, large and pooled farms respectively. The fixed costs were 21.88, 27.12 and 25.49 per cent on small, large and pooled farms respectively.

The farmers, on an average received a gross income of Rs.97.271.84 per hectare. The gross income was higher (Rs.99, 954.00) on large farms when compared to small farms (Rs.86, 800.00). Similarly the net income was higher (Rs.40, 699.74) on large farms as compared to small farms (Rs.17, 755.94). Large size group registered a high input-output ratio of 1.69 than the small (1.26.)

Functional analysis revealed that fertilizer on small farms, feed and manure on large farms ; and feed, fertilizer and manures on pooled farms were found significantly influencing the yields. The production elasticity of human labour was found non-significant.

Three different marketing channels were identified. Out of which, channel III (Producer-----Wholesaler-----Retailer ----- Consumer) was found to have greater share in routing the fish.

The producer's share in consumer's rupee was found to be 80.00 and 70.00 per cent respectively in channel II and III respectively.

introduction

CHAPTER – I

INTRODUCTION

In recent years the search for inexpensive alternative sources of protein has focussed substantial interest on aquaculture. Aquaculture defined as the culture and husbandry of aquatic organisms has a long history.

In many countries people derive more than 50 per cent of their daily animal protein requirement from fish[1]. In fact protein deficiency is the world's most serious human nutritional problem today and perhaps 30 to 40 per cent of the world population and 70 per cent of Indian population suffers from protein malnutrition.

Aquaculture has definite advantages over capture fisheries. In capture fisheries less effort is used, besides there is no guarantee of catch. The environmental conditions can be controlled in aquaculture and genetic improvement of the species can be made to increase the fish production. Further, fish are efficient converters of feeds and of low quality plant materials and wastes. The cost of production of a tonne of protein from fish is said to be a half that of beef and one third that of pork. Besides these production advantages, aquaculture has advantages with regard to marketing. The market demand for fish from aquaculture can be expanded more easily than for wild fish[2].

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1 Shang Y C. Aquaculture Economics: Basic concepts and method of analysis. Colarado West View Press 1981 p.3

2 Venkataswamy Reddy H R and Satyanarayana Rao H N. Aquaculture: Its nature and scope in wider perspectives. Seafood Export Journal 17(3): 33-34, 1985.

Fishery resources of India are either inland or marine. The principal rivers and their tributaries, canals, ponds, lakes, reservoirs comprise the inland fishers. The marine resources comprise the two wide arms of gulf and bays along the coast. India has a coastal line of about 7500 km. and an Exclusive Economic Zone (EEZ) of 2.02 million sq.km. offering a wide scope for exploitation.

The enactment of Indian Fisheries Act in 1987 is considered as an important milestone in the history of Indian fisheries. This act delegated the power and responsibility of development and conservation of fisheries in the inland territorial waters to the respective states.

After independence, concerted efforts were taken for the development of fisheries sector in the country. Immediate steps were taken for organizing research and development in this sector. Institutions like the Central Institute of Fisheries Nautical Engineering and Training (CIFNET), Central Marine Fisheries Research Institute (CMFRI) and Central Inland Fisheries Research Institute (CIFRI) etc. were established.

India has declared through an act in August 1976, an Exclusive Economic zone (EEZ) of 2.02 million sq.km. to explore, exploit, manage and conserve the living and non-living resources of her seas[3]. This measure was undertaken taking note of the general consensus among nations and the emerging trends of the United Nations Conference on the Law of Seas (UNCLOS).

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3 George P C. Indian Fisheries 1944-'77. Central Marine Fisheries Research Institute. Cochin 1977 p.1

India has a coastal length of 7517 km. and a continental shelf area of about 4,14,868 sq.km up to 200 m depth[4]. Against the estimated total potential of about 4.5 million tonnes, the present yield from Indian EEZ is about 2.3 million tonnes.

India has rich inland fisheries resources of 1,73,287 km of rivers, 20.90 lakh hectares of reservoirs and 22.54 lakh hectares of ponds and tanks. The fish production in India during 1950-'51 to 1997-'98 is presented in table 1.1[5]. The marine fish production has increased from 5.34 lakh tonnes in 1950-51 to 27.10 lakh tonnes, while inland fish production during the same period increased from 2.18 lakh tonnes to 17.70 lakh tonnes. The total fish production had increased from 7.52 lakh tonnes to 44.80 lakh from during the period under report.

Fisheries sector provides a full time employment for 17,41,265 persons, occasional employment for 22,89,010 persons and part time employment for 13,26,983 persons. During 1990-91, fisheries sector contributed Rs.4635 crores at current prices to the GDP at factor cost and Rs.1610 crores at constant prices (base 1980-'81) to the GDP at factor cost[6]. During 1993-'94, 243,960 tonnes of fish worth at Rs.2503.62 crores are exported[7]. Aquaculture in India contributed 23 percentage of total fish production of which 21 per cent was from inland aquaculture and 2 per cent from coastal aquaculture[8].

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4 Report of National Commission on Agriculture Part VIII Fisheries. Government of India, New Delhi 1976 p.183

5. Source : Government of India, Ministry of Agriculture, Annual Report 1990-'91
Fishing chimes 13(11): 1994 p.41. and
The Hindu survey of Indian Agriculture 1999: 121-128.

6 Government of India Fisheries Statistics, Ministry of Agriculture, New Delhi 1991.p.96

7 Central Marine Products Export Development Agency. PRIME XVIII (22): 4 1994

8 Dibakar Naik. Inter State Performance of inland fish production in India. Fishing Chimes 12(11): 11-16. 1993

Table 1.1 : Fish production in India (in lakh tonnes)

Year	Marine	Inland	Total
1950-51	5.34	2.18	7.52
1960-61	8.80	2.80	11.60
1970-71	10.86	6.70	17.56
1980-81	15.55	8.87	24.42
1984-85	16.98	11.03	28.01
1985-86	17.16	11.60	28.76
1986-87	17.13	12.29	29.42
1987-88	16.58	13.01	29.59
1988-89	18.17	13.35	31.52
1989-90	22.75	14.02	36.77
1990-91	23.00	15.36	38.36
1991-92	24.40	17.01	41.41
1992-93	25.00	17.50	42.50
1997-98	27.10	17.70	44.80

The country would need a minimum fish production of 5.5 million tonnes per annum by 2000 AD. It has been planned to achieve an annual target of 7 million tonnes – a threefold increase from 1985 level of production. Of the 7 million tonnes, the share of inland fisheries sector would be 4 million tonnes[9].

Tamil Nadu ranks fourth in marine fish production and produced 2.89 lakh tonnes of fish in1990-'91. The state has a coastal length of around 1000 km. with 422 coastal villages[10]. Aquaculture has already proved its worth in Tamil Nadu. Farmers have adopted a fish based mixed farming system in which ponds are used for fish culture, bunds are used for growing coconut trees and raised for paddy cultivation.

Thanjavur district lies between North Latitudes 9° 5' and 11° 25' and East Longitudes 78° 45' and 79° 25'. Integrated Thanjavur district has a vast potential of fishing resources of long coastal length of 145 km., 2166 hectares of inland water spread area and 638 km of canals and 2135 inland fishermen are engaged in fishing as a subsidiary occupation.

In 1997-'98 the marine fish production stood at 10400 tonnes valued at Rs.4,160 lakhs and the inland fish production was 6540 tonnes valued at Rs.2,289 lakhs. There are 147 Fish Farmers' Development Agencies (FFDAs) in operation in our country. In Tamil Nadu, there are 11 FFDAs. Among them the Thanjavur FFDA was sanctioned in 1976-77 and was commenced from 5.5.1976.

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9 Natarajan A V. Aquaculture planning for the year 2000 AD. Fishing Chimes 5(1): 53-57.1995

10 Anonymos. Fishing Chimes Vol.II No.10 1992. p.9

In view of the vast potential for fish farming in Thanjavur district, it is felt desirable to probe into the economic aspects of fish farming. Thanjavur is one of the promising districts in Tamil Nadu for the development of fisheries particularly with the operation of FFDAs. Thisenterprise is productive in improving the farmers' economy. As such an attempt has been made to study the economics of fish farming in Thanjavur district with the following specific objectives.

OBJECTIVES

1. To estimate the capitall investment on the construction of fish farms
2. To workout costs and returns in fish farming
3. To estimate resource use efficiency. and
4. To examine the price spread in fish marketing.

SCOPE OF THE STUDY

The study provides information on the cost structure, returns, factor productivity and factor use efficiency in fish farming. These details are useful to the fish farmers to plan for higher returns and to the new entrepreneurs who plan for taking up fish farming. Thanjavur district being the granary of Tamil Nadu, traditionally the farmers are engaged in rice cultivation. Now the trend has been changing slowly towards other enterprises which give higher profit. The farmers feel that aquaculture may be a better choice for a profitable occupation. Hence the study may be useful for those who are opting for fish farming. The findings of the study are useful for financial agencies to estimate the credit requirements. Further the study of price spread and role of middlemen will be of greater relevance to the policy makers to remove the bottlenecks in the marketing of fish.

LIMITATIONS OF THE STUDY

The study was conducted over a limited period of time, in a limited area of a specific agro-climatic and socio-economic situation. Hence the results of this study may not be applicable to other parts of the state or country. More over data were collected based on 1998-99 year prices. Since the data was collected by survey method, data collected may have the recall bias in the absence of records. But necessary checks and cross checks were made to get more reliable data.

PLAN OF THESIS

This study is presented in five chapters. The introductory chapter (Chapter I) consists of importance of fish farming, objectives, scope of study and limitations of study.

Chapter II deals with critical review of previous works made on the present study both in India and abroad.

Chapter III consists of sampling designs, method of data collection, methods of analysis and various concepts and definitions used in this study.

Chapter IV deals with the results of the study along with the discussion.

The last chapter shows the summary and conclusions of the study.

review of literature

CHAPTER – II

REVIEW OF LITERATURE

A review of the earlier studies on the economic aspects of production and marketing of fish is presented in this chapter so as to understand the work that had been done on the subject. The review is presented under the following heads.

2.1 Costs and returns

2.2 Resource productivity and resource use efficiency. and

2.3 Marketing of fish.

2.1 COSTS AND RETURNS.

Lakshmanan *et al.*, (1971) worked out the economics of composite fish culture and observed that income ranged between Rs.6,631 and Rs.11,823 from a hectare of water spread area among the selected farmers in an year indicating the merit of fish cultivation.

Blanco (1972) evaluated the production level of demonstration and experimental farms as well as those of the private sector ponds and found that culture of milkfish, shrimps and mollusks was beneficial to the producer.

Bhowmick (1975) estimated the operational expenditure of induced breeding of Indian major carps for producing one crore of spawn at Rs. 9,856, while the gross returns were at Rs.12,000.

Korringa (1976) reported the farming practices of marine fishes and shrimpss in different countries. Among the items of expenditure it was observed that the purchaseof fry was the major item of cost in milkfish farming in Indonesia and feed assumed 50 per cent of the expenses in culturing yellow tail in Japan.

Brown (1977) studied the economics of different culture practices in different parts of the world. The cost components were identified and it was observed that feed constituted the major item of cost in rainbow trout farming in many of the tempemte waters.

Murshed *et al.*, (1977) studied the potentials and constraints in carp culture technology in West Bengal. The index of untapped yield reservoir from fresh water fish culture alone was estimated at 4.4, indicating that the average traditional fish productiivity could be about 440 per cent more if modern carp culture was adopted. An average gross profit of Rs.16,500 per hectare was reported.

The CIFRI (1979) undertook a research project on economics of carp culture from 66 privately owned and 72 Governmental or institutional fishponds. The study revealed that fish production from 3.0 to 6.5 t/ha per year was generally obtained. Yields as high as 7,284 kg per hectare per 8 months and 5,890 kg per hectare per 6 months were reported although the expected yield was 3000 kg per hectare per year only. The results further indicated the possibility of attaining still higher production.

Rabanal and Shang (1979) analyzed the economics of pond culture of finfish and explored the possibility of adoption of monoculture vis-a-vis polyculture and the adoption of extension vis-a-vis intensive culture techniques. Intensive operation was reported to increase the productivity and reduced the cost of production per unit of output. Polyculture was reported to be more profitable than monoculture.

Chua and Teng (1980) studied the economics of cage culture and identified the problems encountered in the management and maintenance of fish farms. Cost-benefit analysis estimated for eight culture techniques revealed that production cost would be reduced by improved method of culture.

Dwivedi and Sinha (1980) worked out the economics of two models of paddy-cum-fish farming schemes. The results of the study indicated that one hectare and model of two hectare seed farms revealed one hectare farm gave a surplus of Rs. 19,000, while a two hectare farm had brought in Rs. 77,700.

The National Council of Applied Economics Research (1981) evaluated the performance of FFDAs. The study complimented the FFDAs for having brought in 6000 hectares of water spread area under carp culture, which were lying unused. The study reported that 400 t of carps are annually produced at a maximum yield of 6 t per hectare with an average of 582 kg per hectare for 1978-79.

Sumitra *et al.*, (1981) studied the culture of pearl spot in an estuarine pond and estimated the cost of production as Rs.3,300 per hectare and the rate of return on investment as 33 per cent.

Galapitage (1982) evaluated the economic feasibility of cage culture tilapia in Sri Lanka and found that cage culture was not a profitable method. The major factor for losses was low output. A breakdown of costs indicated that the capital component was very high and variable costs were very low in non-feeding cages.

Sevilleja (1982) analyzed the economic feasibility of integrated pig-fish farming operations in the Philippines based on fish yields from experimental trials. Using partial budgeting technique, it was estimated that integrated fish production would increase farm income. The additional capital requirements were found to reduce the rates of return on total investment.

Cosh (1983) described briefly the farming of snapper in Japan and explored the possibilities of snapper farming in New Zealand. He concluded that snapper farming was not likely to be economic in New Zealand due to high cost of feed.

Srivastava *et al.*, (1983) conducted a survey of fish and prawn farms across the coastal states of Kerala, West Bengal, Andhra Pradesh, Tamil Nadu and Orissa. They analyzed the data collected from 91 intensive culture, 35 extensive culture and 45 filtration farms. The revenue was based on the production and average price. The price per kg of prawns was highest in the case of intensive culture (Rs.36/kg) followed by extensive culture (Rs.24/kg) and filtration fields (Rs.13/kg). They also found that intensive culture gave a profit of 15.2 per cent over investment.

Vijayaranchan (1984) estimated on all India basis the average input cost at Rs.2,998 per hectare, while the most important inputs in fish culture viz., fish seed and fertilizer amounted to Rs.459 (16.18%), labour consumed a major portion Rs.1,106 (6.89%) and miscellaneous costs accounted for 21.68 per cent.

IIM (1985) conducted a study on the inland fish marketing in India. According to the study an average yield of 681 kg per hectare per year and an average net income of Rs.1,740 per hectare per year was reported. The study covered the various culture practices adopted by the fish farmers.

Rao and Nagabhushanam (1985) reported that the total cost of production of fish breeding farms was Rs.50,461 and Rs.44,722 per hectare on small and large farms respectively. The corresponding net returns were Rs.44,104 and Rs.16,800 per hectare. The productivity of fish fry seed was 14.43 lakhs and 9.83 lakhs and input-output ratios were 1.87 and 1.37 on the corresponding farms respectively.

Sukumaran and Rahman (1985) conducted eight sets of experiments and worked out the economics of fish farming. The average cost of production per kg was found to be between Rs.0.74 and Rs.4.97.

Nandeesha and Rao (1988) described the semi-intensive carp culture technology developed and adopted by fish farmers in Andhra Pradesh. Yields obtained were as high as 9,000 kg per hectare per year. Production costs ranged from Rs.4 to12 per kg and the price realized per kg of the carps ranged from Rs.15 to 60, but averaged not less than Rs.20 in the Howrah market.

Rao (1988) reported that Indian inland fish production rose from 4,77,000 t in 1966 to 1.1 million tonnes in 1984 with an annual growth rate of 7.4 per cent and projected under some assumptions that it may reach 2.6 million tonnes by 2000 AD. Gross income, expenses and net income in ponds of 0.60 ha. in 1984 were reported to be Rs.19,186, Rs.9,865 and Rs.9,321 respectively. Average fixed capital was estimated at Rs.5,000 per hectare and the returns to the capital was 186.4 per cent.

Rao and Chowdary (1988) studied the investment structure of inland fish farming in Andhra Pradesh. They reported that about 90 per cent of the investment was on pond construction in large farms. Manures and feeds constituted 50 per cent of the total operational expenditure. Labour and seed costed about 31.36 per cent.

Sharma *et al.*, (1988) studied Pig-carp farming and its economics. The percentage of returns on variable costs was worked out to 75 to 77.8

Sharma *et al.*, (1989) conducted the benefit cost analysis of fishponds in Himachal Pradesh. The results showed the net income from fish pond of size 0.10 ha was Rs.2,052.50. If this income was viewed from the point of one hectare, it worked out to be Rs.20,525. The benefit cost ratio worked out to 1.30.

Chandra Prakash *et al.*, (1990) studied the economic viability of aquaculture in sewage. The study conducted at Thana reported an annual production of fish and prawn at 3,500 and 600 kg per hectare respectively. It was concluded that an extra remuneration of Rs.15,000 can be generated by replacing supplementary feeds with sewage.

Jayaraman *et al.*, (1991) investigated into the profitability of integrated rice-carp farming system in the Cauvery Delta Zone in Tamil Nadu. The returns over total cost rose from Rs.8,745 per hectare in the conventional plan to Rs.21,562 per hectare in the improved farm plan. Reduction of farm business risk was measured by the co-efficient of variation in net farm income which came down from 45.71 per cent in the conventional plan to just 15.61 per cent in the improved farm plan, indicating high and stabilized net farm income.

Ramana *et al.*, (1991) conducted a study on economics of fish farming in Guntur district of Andhra Pradesh. They estimated the total cost of rearing at Rs.29,574, Rs.31,079 and Rs.30,307 on small, large and pooled farms respectively. The study revealed that the fish production obtained was 4.80 and 5.30 tonnes on small and large farm with an average of 5.05 tonnes. They reported Rs.90,100 and Rs.59,021 as gross returns and net returns respectively and an input-output ratio of 2.89.

Panicker *et al.*, (1992), in his cost-benefit analysis of fish culture in Kerala stated that the financial gain to the community was Rs.1,82,052 for 763 ponds under Chinese-carp mono culture and Rs.1,83,740 for 1,000 ponds under poly culture with this fish and catla.

Lambregts *et al.*, (1993) estimated costs and returns for catfish farms in Texas coast. They reported the internal rate of return for small, medium and large catfish farms at 0.150, 0.183 and 0.219 respectively. Total investment in conventional farms was higher than that of farms with static ponds, but investment per unit of production capacity was 7 to 16 per cent lower. Average total costs were estimated as between $ 0.565 and $ 0.541

per pound. From these results they implied regional comparative advantage of catfish production as well as the incentive for adoption of new technology in conventional ponds.

Ravikesh and Maurya (1996) studied the economics of inland fish production in district Mau, Uttar Pradesh. They reported that total costs per acre of water area were highest for small producers followed by medium producers. They also reported that small producers gave more attention to fish production, where as large producers treated fish farming as a secondary income activity.

Jayanthi *et al.*, (1997) studied the economic efficiency of component linkage in lowland integrated farming system and they analyzed the economics in term of gross and net returns, returns per day and cost-benefit ratio. They reported that crop + pigeon + fish + mushroom integration was economically superior with highest net return of Rs.90,252 per hectare per year with highest per day returns and highest benefit cost ratio of 2.44.

Johnson and Walsh (1998) studied the cost effectiveness of additional production of catchable rainbow trout. They suggested that when the scope of the study was the Colorado State and the reported state costs were used, purchasing fish could result in a loss of $ 0.53 per lb. When the scope of the study was Colorado State and the opportunity costs were estimated, purchasing could result in a loss of as much as $ 0.02 per lb. or a saving of as much as $ 0.51 per lb. When the scope of the study was nation, and the opportunity costs were estimated, purchasing could result in cost saving of $ 1.71 to 2.24 per lb.

2.2 RESOURCE PRODUCTIVITY AND RESOURCE USE EFFICIENCY

Chowdary and Tripathy (1969) studied the resource use productivity of farms in intensive agriculture areas of Andhra Pradesh, Punjab and Orissa. The findings of the study indicated that the working capital followed by human labour and size of holding had significant influence on the gross revenue earned on farm.. They found that with the present level of the know-how, farm planning could be more effective by broadening opportunities for using more working capital in farm operations.

Singh (1975) used Cobb-Douglas production function to work out the elasticities of production of inputs which in turn were used to calculate the marginal value products at their geometric means for average farms. The results of the study revealed the prevalence of constant returns to scale for both small and large farms in selected regions. The marginal productivity of labour was found to be quite high on large farms but very low on small farms

Cheong and Lizarando (1982) studied the input-output relationship of Philippines milkfish aquaculture and brought out the existing gap between experimental yield and potential yield. The determinants of yield were estimated by Cobb-Douglas production function. The input which had significant impact on output were stocking of fry and fingerlings, age of pond, farm size, fertilizer and miscellaneous operating costs.

Tripathi and Ranandhir (1982) described the production aspects of composite fish culture and compared traditional and experimental culture practices. Input-output relationship studies showed that seed was the major component in traditional culture method and feed in experimental culture. In experimental fish farm the productivity was reported to be 10-14 times higher than those of traditional culture practices.

Gupta (1983) analyzed the inefficiency in composite fish culture production system by comparing the actual and optimum input mix. The estimated Cobb-Douglas production function model revealed constant returns to scale. The study showed sub-optimal input mix and recommended that the application of fertilizer and stocking density were required to be enhanced, while the use of labour, manure and feed needed to be curtailed depending on the requirement.

Nissan Ayuppa (1985) in his study on economic analysis of shrimp culture in Nakoran Srithammaraj of Southern Thailand applied Cobb-Douglas production function and found that the R^2 was 0.68 denoting 68 per cent variation in the yield of shrimp was explained by the explanatory variables.

Rao and Nagabhushanam (1985) reported that water spread area on large farms and proportionate cost of breeders on small farms exhibited negatively significant production elasticities. But human labour, manures and feeds showed positively significant production elasticities. Increasing returns to scale operated on small farms while constant return to scale on large farms. The MVP to opportunity cost ratio indicated that the small farmers could earn more profits by increasing their size of farms.

Upadhyay and Naseer (1985) by fitting a Cobb-Douglas production function compared the combination of input factors in the gross value of catches. They found that the labour cost contributed much to the gross value of catch. Variable cost was found to be at the point of saturation in non-mechanized crafts, while increase in this cost was possible in mechanized crafts. On the other hand fixed cost was at the point of saturation in both the cases and hence they concluded that an increase in this cost would result in loss in both the cases.

Datta *et al.*, (1989) in their study at Orissa coast attempted the marginal productivity analysis. The marginal productivity of fishing days was Rs.0.01 for mechanized units at Bahabalpur and Rs.0.02 for the small catamaran at Bandar, which suggested that those units should not increase their fishing days.

Nerrie *et al.*, (1990) used Cobb-Douglas production function for their economic analysis of catfish production in West-Central Alabama. Marginal value products for feed, stocking rate and capital were consistently higher than input costs. Profit-maximizing levels of input use were higher than the levels of inputs used in West-Central Alabama during the study period. Results indicated that more intensive use of production inputs would increase yield and profits.

Ranandhir and Tripathi (1992) estimated a Cobb-Douglas production function model in composite fish culture. The production function showed decreasing returns to scale suggesting scaling down of the inputs particularly fingerlings stocked and labour.

Dey *et al.*, (1996) used Cobb-Douglas production function to evaluate efficiency of resource use in fish seed farms in Chittagong district of Bangladesh. Findings suggested that operational area was less than optimal for small farms, but more than optimal for large farms. Spawn and fry resources were not sufficiently in abundance in large and pooled farms and feed, fertilizer and manure were used at less than optimal levels in all farm groups. It was concluded that large farms allocated resources less judiciously compared to other groups and all the farms could increase their economic returns through greater use of feed, fertilizer and manure.

Engle (1997) developed a mathematical model from survey data of Rwandan farmers to determine optimal resource allocation on subsistence farms in Rwanda. His study had a specific objective of determining the farm plans that maximize returns to representative Rwandan farm family's resources, subject to constraints of the farm family's protein and caloric requirements. Fish production was selected as the principal cash crop, in most cases lending support to the evidence that fish was more important as a cash crop than as a primary source in Rwanda.

Kathiha *et al.*, (1997) developed an optimal resource management plan for reservoir fisheries using production function analysis with gear weight and fishing effort as variables influencing fish production. The study conducted at Pong Dam reservoir in Himachal Pradesh revealed that the existing level of fishing effort was much lower than the optimal level. The gap between the potential and actual harvests indicated the scope for increasing fishing intensity. The unit cost of fish production could be reduced by downward adjustment of the gear weight used and the simultaneous increase in fishing effort.

Haung and Haung (1998) developed a translog cost model to study the price elasticity of factor demand and output elasticity of small abalone farms in Taiwan. An output elasticity of 0.889 revealed decreasing returns to scale in production for both inland and tidal culture farms. Comparing price elasticity, the results showed that feed in tidal culture and seed in inland culture were inelastic. The estimated Allen substitution elasticity showed that labour substituted with seed, feed and management.

Sharma *et al.*, (1999) conducted research on economic efficiency and optimum stocking density in fish polyculture. They found that the average technical efficiency score for the sample of Chinese fish farm as 0.83 and the allocative efficiency 0.87 and the average of economic efficiency as 0.74. They also found that by operating at full efficiency, the farmers would be able to increase the production from 6,881 to 10,338 kg per hectare and profit from 4,250 t 13,501 Yuan per hectare.

2.3 MARKETING OF FISH

Rao (1970) reported that the returns from fishing industry were not certain because of unpredictable nature of fish catch and highly perishable nature of the commodity. It was also observed that the fishermen were not able to get reasonable share in consumer's rupee.

Rao (1973) discussed the various problems in the marketing of fish and suggested that marketing studies should be given due importance.

Ilyas (1977) found that long distance between production and consumption centres and uneven density of human population were the major constraints in fresh fish trade in Indonesia. The interplay of technological, socio-economic and administrative aspects were discussed in relation to fisheries development.

Natarajan and Paul (1981) noted that the problems in fish marketing have not been studied in depth partly due to subsistence character of the sector and partly due to the lack of information on marketing margins and production prices.

Lee (1982) studied the marketing of milk fish fry and fingerlings and market size milkfish and observed that the marketing expenses were less for fry as the marketing channels were short. In marketing fingerlings, the profit of the middlemen accounted for about 51 per cent of the total marketing costs. In marketing of milkfish three major marketing channels were identified. Producers were observed to receive 74 per cent of the retail price where as the remaining 26 per cent was absorbed in the marketing process.

Paul (1983) furnished information on the marketing system for fish produced and suggested the reorganization of fish market. The fish was marketed through retailers top the consumer's. The share of producer in consumer's price ranged from 70.8 per cent to 91.5 per cent.

Banks (1984) analyzed the structure and distribution system for fresh and frozen fish products in Northern Ireland. In 1983 the fresh, frozen and the other fish products accounted for 43, 36 and 21 per cent of the total fish products retailed respectively. Inland

merchants, primary processors and retailers contributed 42, 37 and 20 per cent respectively to the total fresh fish market.

Lizarondo and Valdellon (1984) studied operational and marketing conditions of fishermen. Their study reported that 80 per cent of the fishermen had knowledge of the market centres where fish could be marketed. They also reported that 29 per cent were aware of storage facilities, but only 2 per cent reported to use such services.

Varpiam *et al.*, (1984) studied the experience of fresh fish marketing in Port Moresby. They found that fish vending was largely a part time activity and for most vendors fish formed a notable means of subsistence.

Vijayaranchan (1984) emphasized the importance of proper marketing facilities to obtain reasonable returns. The farmers got 81.5 per cent of the consumer's price. The average all India prices was Rs.7.64 per kg. He reported that 60 per cent of the fish farmers sold their produce in the local market. Prices were fixed based on variety and weight either at pond site or at market.

Lizarondo and Valdellon (1985) analyzed the marketing operations of tuna fishermen in the Philippines. Their analysis showed 15 types of marketing flows. Fishermen sold directly. Disposition was mostly by cash. Fishermen recorded a net margin of P.3.0 per kg of tuna. Traders grossed P 0.91 to P.25 per kg. Retailers and assemblers got net margins of P 2.50 and P 2.20 per kg respectively.

Datta *et al.*, (1989) studied the role of middlemen in marine fish marketing in Orissa coast. The study revealed that 90 per cent of both mechanized and non-mechanized fishing units compelled to sell their catch exclusively to traders to whom they were already indebted. It was also observed that there was wide variation between the landing price and the final consumer price particularly in the case of quality fish.

Devarajan (1989) estimated the price spread in prawn marketing in Tamil Nadu. He reported that longer the channel lesser was the producer's share. He identified 3 types of marketing channels.

1. Fisherman → village merchant → wholesale merchant → processor.
2. Fisherman → wholesaler → processor
3. Fisherman → processor.

Producer's share was 72.29, 62.07 and 64.48 per cent in channels III, II and I respectively. 81.95 per cent of total quantity sold was disposed through channel I and it was 12.69 and 1.76 per cent through channel II and channel III respectively.

Ramana *et al.*, (1990) identified three different channels of fish marketing in Bapatla mandal of Guntur district of Andhra Pradesh. They reported that retailer's margin was the highest among the total marketing costs and margins shared by different market functionaries. The main problems encountered by the producers were uncertainty of fish catch, exploitation by the wholesalers of illiterate producers, unhealthy collusion among market functionaries and absence of proper storage facilities.

Prasad and Nath (1992) in their study on price spread, marketing costs and marketing constraints of fish production in Andhra Pradesh reported that producers obtained 61.29 per cent of the consumer's rupee and the retailers and wholesalers 22.04 per cent jointly. Among the costs incurred by the producer, transport accounted for 4.52 per cent followed by market commission (4.29 per cent) and discount (3.07 per cent). They reported that the channel consisting of producer – commission agent – wholesaler – retailer consumer was reasonably efficient.

Chauhan (1995) in his study of reservoir fisheries in Gobind Sagar reservoir of Himachal Pradesh reported that winter prices were higher than summer season. His study also revealed that the fishermen's share in consumer's rupee was 41.29 per cent and 43.12 per cent during summer and winter season respectively in the marketing channel of fishermen → Co-operative society → Fisheries Department → Fish Federation → Commission Agent → Retailer → Consumer. In this channel, 53 per cent of the total fish catch was marketed. Marketing costs were also higher in this channel due to more number of intermediaries. The marketing efficiency declined from 2.59 in channel I to 1.64 in Channel III for summer marketing. Similar trend was observed for winter season also.

Dibakar Naik (1995) in his study of anatomy of fish market in Balaspore district of Orissia, identified 10 marketing channels. The study further reported that the net share of the fishermen got reduced with the increase of intermediaries in the market channel. It varied from 93.10 per cent (Silafish) to 95.12 per cent (Kankita fish) of the price paid by the consumers in the direct selling without involvement of intermediaries.

Hima Bindu (1995) reported that transport charges accounted for 22.04 per cent of total marketing costs met by retailer. Storage charges and losses accounted for 29.38 and 17.63 per cent respectively.

Shrivastava and Ranandhir (1995) reported that fish producers of Andhra Pradesh met 85 per cent of the fish demand in Bhubaneswar City of Orissa. The producer's share in consumer's rupee was highest for local producer and lowest for non-local producers. The largest component of price spread and net margin was attributed to retailers followed by wholesalers and commission agents. The net income of non-local producers-cum-wholesalers was found to be highest because they handled a larger quantity of fish. Also, the return to one rupee investment was recorded to be more than 100 per cent. There existed scope for earning super normal profit by intermediaries because the market was not perfectly competitive. It was recommended that the Government to formulate a suitable fish price policy to eliminate this imperfection from the market.

Singh (1995) in his economic evaluation of fishponds in Janpur district of Uttar Pradesh reported large producers enjoyed a 68.93 per cent share of consumer's purchase price. The study further revealed that large units followed by the small and medium units gained the highest economic returns.

Sahu and Tripathy (1998) identified four marketing channels in the study of price spread and marketing channels for shrimp in Puri district of Orissa. A channel consisting shrimp farmers – shrimp collector – commission agent – processor cum exporter was identified in which 80 per cent of the total shrimp produced was marketed. It was

observed in this channel that shrimp farmers received highest per cent of the exporter's price (53.85 per cent) followed by processor – cum – exporter (6.41 per cent) shrimp collector (1.28 per cent) and commission agent (0.51 per cent). They also reported that the marketing efficiency of this channel was 5.39, which was the highest among the four different channels identified.

methodology

CHAPTER - III

METHODOLOGY

In this chapter procedural details of selection of sample, method of collection of data and computation procedure regarding production and marketing aspects of fish are detailed. It also deals with various concepts and terms used in the present study. This chapter is presented under the following heads.

3.1 Sampling design

3.2 Collection of data

3.3 Methods of analysis

3.4 Tools of analysis, and

3.5 Concepts and terms used in the study

3.1 SAMPLING DESIGN

3.1.1 Selection of the district

For the study, Thanjavur district of Tamil Nadu was purposively selected as it has a long coastal line of 145 km. before it was trifurcated. Cauvery and Kollidam are the prominent rivers of this district. During 1997-98 total inland fresh water spread area was 2,166 hectares. This district has 25 marine fishing villages and 445 farmers engaged in inland fish farming. This district produced 10,412 tonnes of marine fish valued at 4,160.00 lakh rupees and 6,540 tonnes of inland fish valued at 2,289 lakh rupees during 1997-98. Among 13 Fish Farmers Development Agencies (FFDAs) of Tamil Nadu, Thanjavur

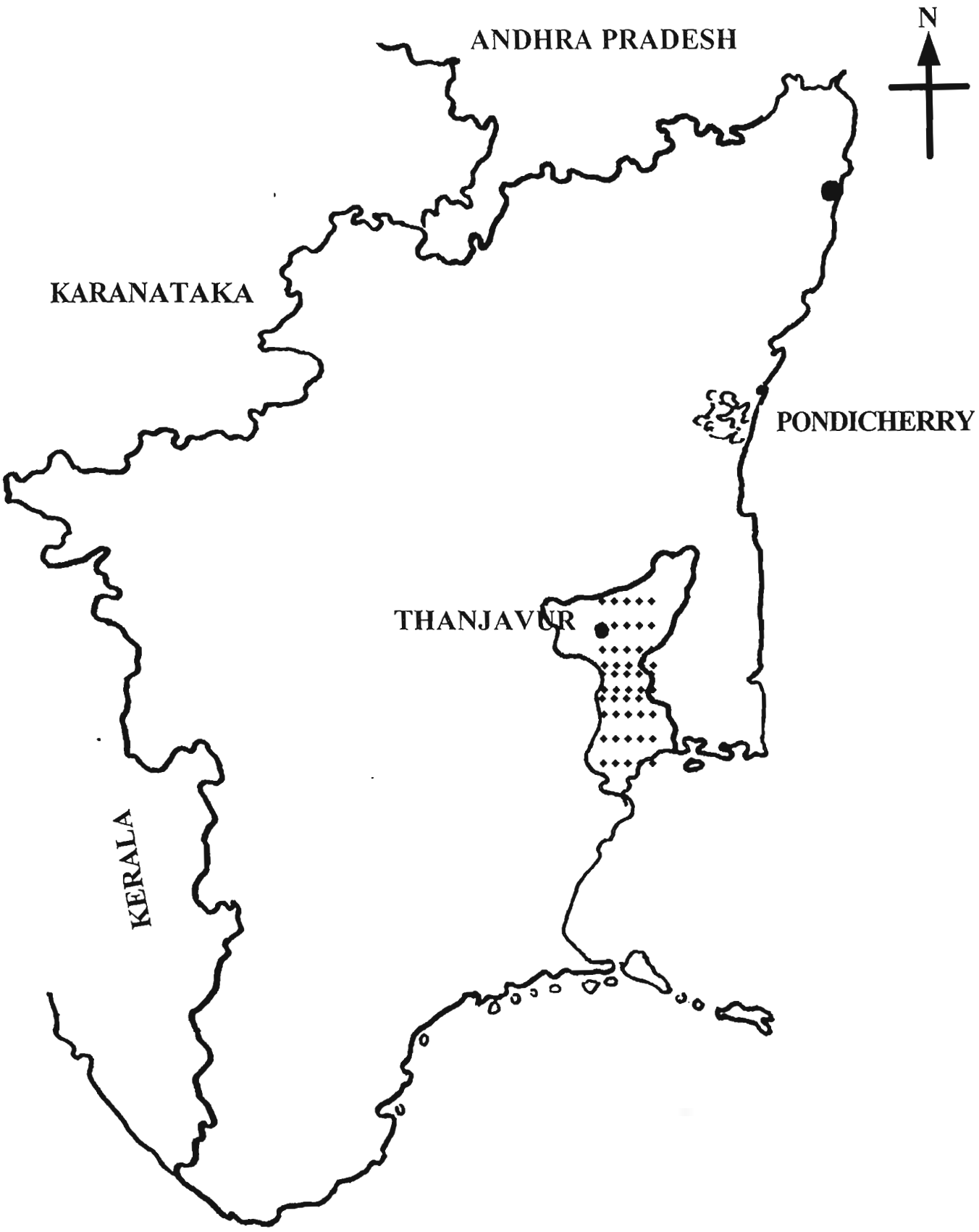

Fig.2.1 Map showing the Location of Thanjavur District

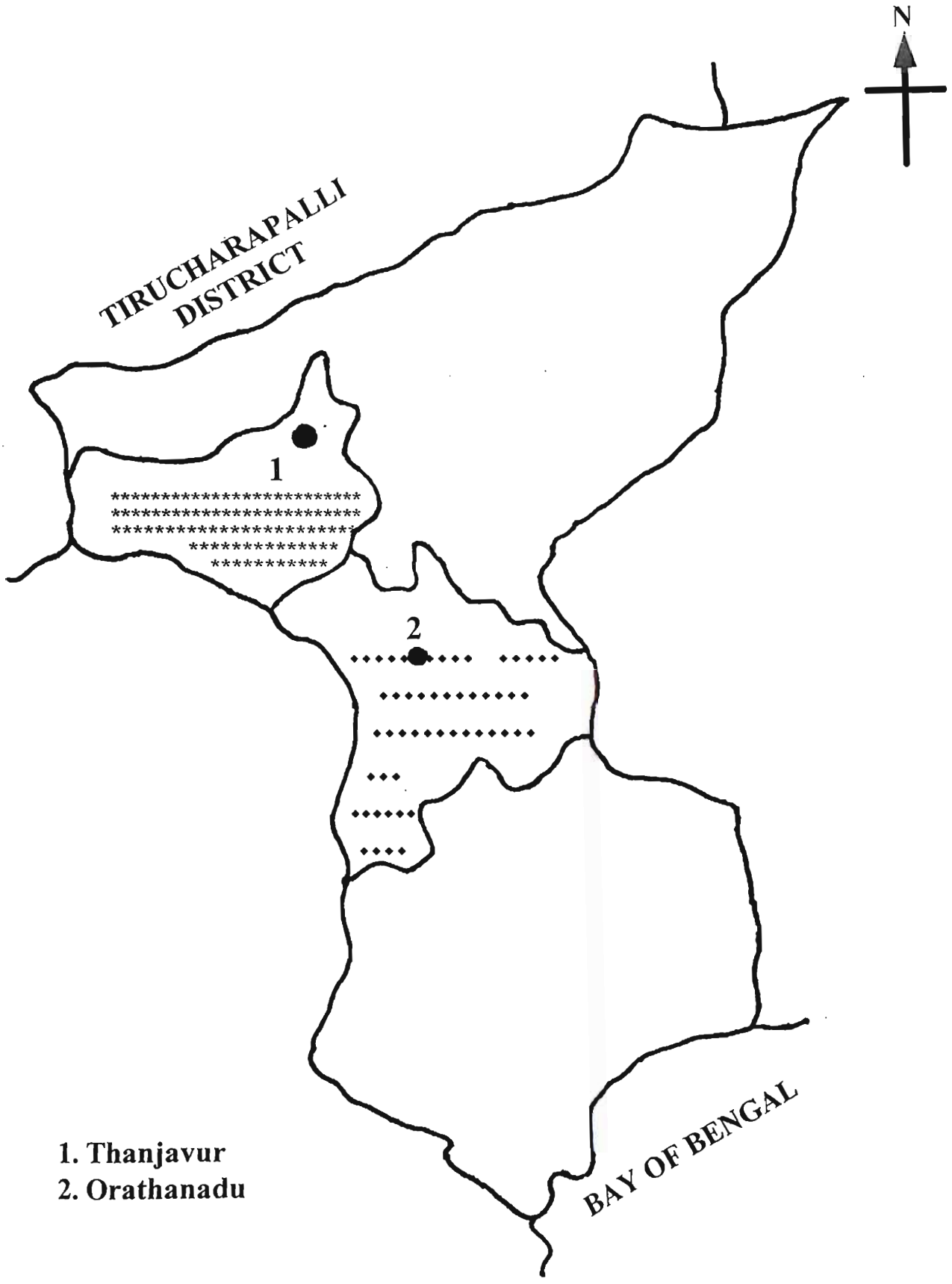

Fig.2.2 Map of Thanjavur District showing the selected taluks

FFDA commenced on 5.5.1976 reported to be most successful as per the statistics of Directorate of Fisheries (1993).

In the Cauvery Delta Zone comprising Thanjavur district, rice is the major crop. Being the granary of the state it contributed over 1/4th of the state's rice production. Rice cultivation since found less profitable fish culture has become attractive to the farmers for increasing farm profits.

Thanjavur district has the following advantageous features for adopting fish culture[11].

i) Loamy, clayey loamy soil and ground water and river flow. and

ii) Large number of ponds and tanks

Keeping all the above points in view, Thanjavur district of Tamil Nadu was selected for present study.

3.1.2 Selection of Taluks

The list of taluks in the district along with number of FFDA farmers and water spread areas was obtained and the top two taluks were selected purposively based on this criterion. The taluks thus selected were Thanjavur and Orathanadu.

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11 Government of Tamil Nadu. Fisheries statistics 1992093. Directorate of Fisheries, Chennai. 1993. P.47

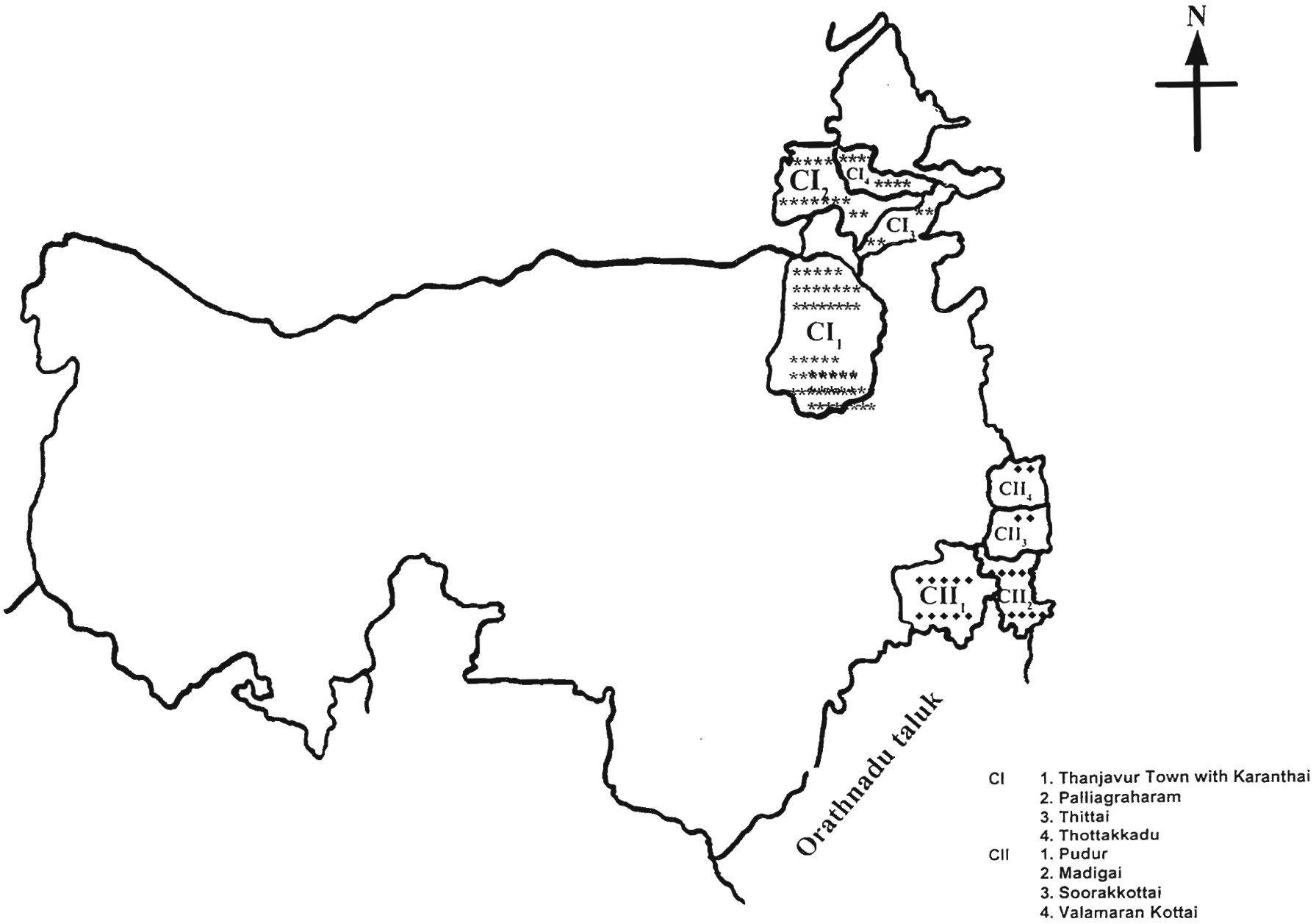


Fig.2.3: Map of Thanjavur taluk showing the selected clusters of villages

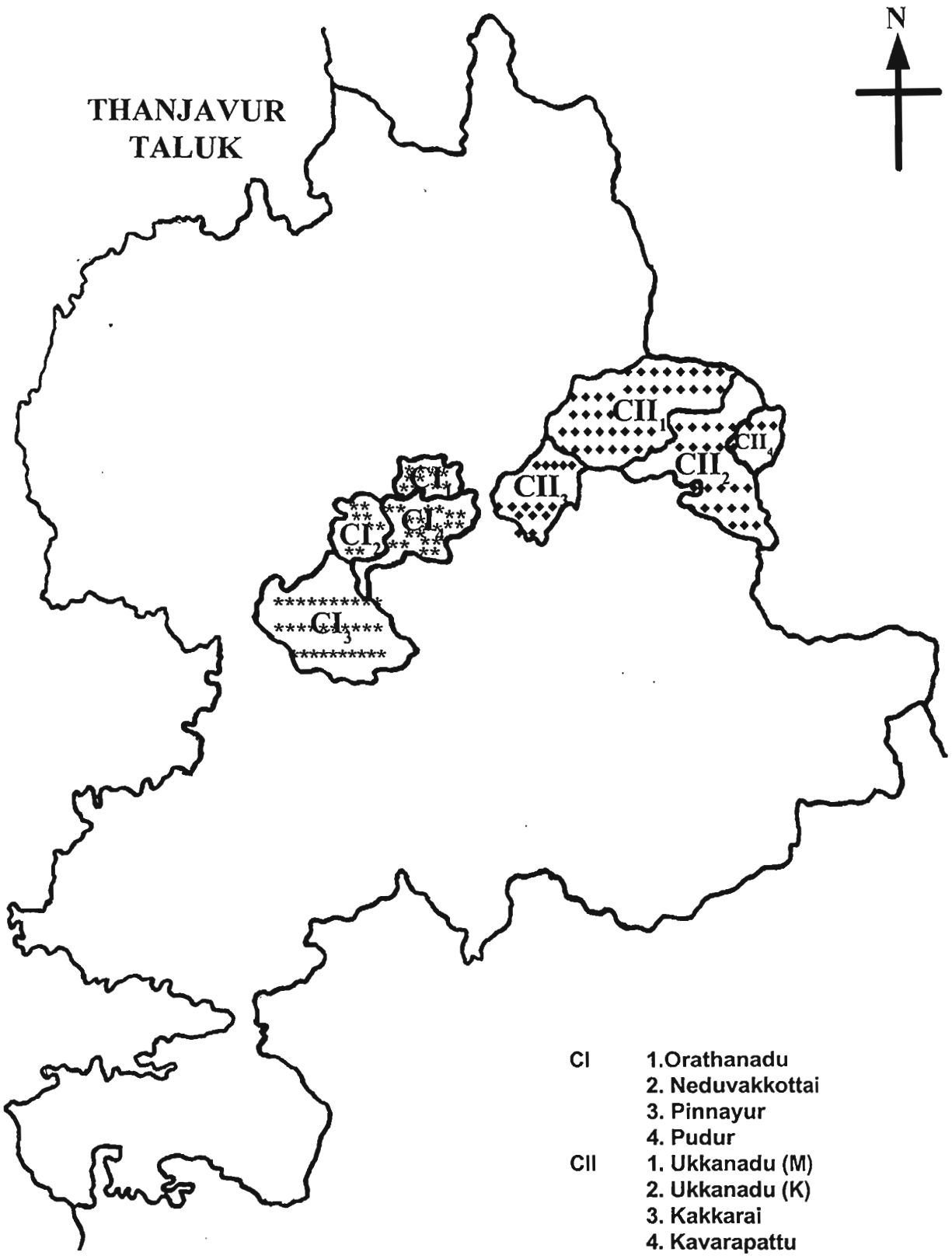


Fig.2.4 Map of Orathanadu taluk showing the selected clusters of villages

3.1.3 Selection of villages

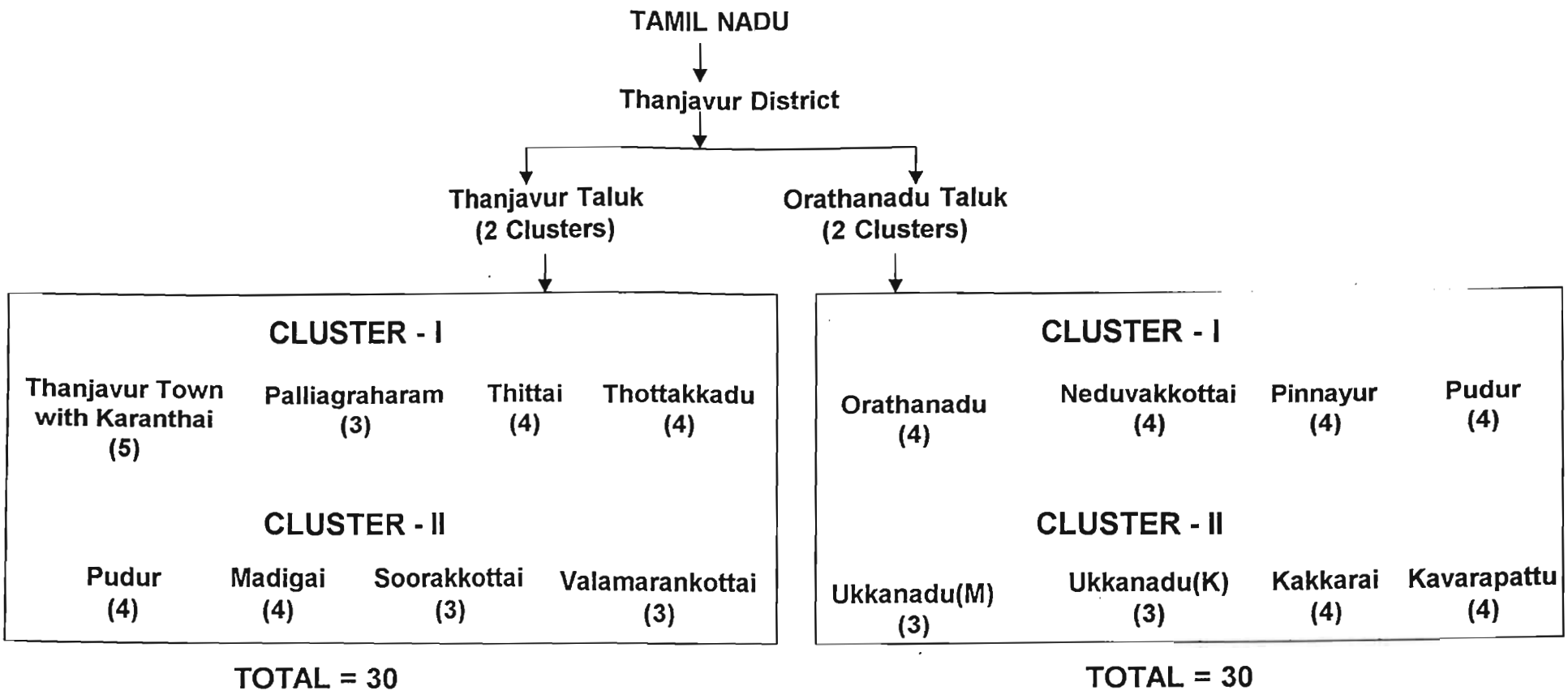
The list of villages from the selected taluks was obtained and clusters of four villages each were prepared using the taluk map. From the clusters so prepared four clusters were selected randomly representing two from each taluk. The four clusters selected represent sixteen villages. The details of the sample units thus selected are listed below.

Taluk	Cluster	Villages
Thanjavur	I	Thanjavur Town (with Karanthai)
		Palliagraharam
		Thittai
		Thottakkadu
	II	Pudur
		Madigai
		Soorakkottai
		Valamarankottai
Orathanadu	I	Orathanadu
		Neduvakkottai
		Pinnayur
		Pudur
	II	Ukkanadu – Melayur
		Ukkanadu – Keelayur
		Kakkarai
		Kavarapattu

3.1.4 Selection of respondents:

All the farmers with their operational holdings under fish farming were listed out. The farmers were categorized into two sizes viz., small and large groups. Those farmers

FIG. 3.5 : SAMPLING PROCEDURE FOLLOWED



TOTAL = 30

TOTAL = 30

TOTAL RESPONDENTS = 60

NOTE : Figures in Parentheses are No.of respondents selected from corresponding villages

having 2 hectares and more of water spread area were considered as large and the farmers with less than 2 hectares as small. 35 farmers from small group and 25 farmers from large group were selected at random in probability proportion to their number in each group thus making the sample size of the study to sixty. To study the marketing aspects, 5 wholesalers and 5 retailers were selected at random.

3.2 COLLECTION OF DATA

Data were collected with suitably designed and pre-tested schedule. Survey method was adopted for collecting primary data needed to achieve the set of objectives of the study. All the sixty farmers were personally contacted to obtain the data regarding farm assets, costs of production, returns etc. Separate schedule was prepared for collecting marketing information on purchase price, labour charges, transportation costs, packing, storage costs etc. The data for the present study pertained to the agricultural year 1998-'99.

3.3 METHODS OF COMPUTATION

3.3.1 Cost of cultivation aspects of fish farming

The detailed procedure followed in calculating the cost of fish cultivation is detailed below.

3.3.1.1 Human Labour

Human labour utilization in different operations of fish cultivation was calculated on the basis of number of hours of work done by both family and hired male labourers. Wages paid in cash or kind or in both were computed in rupees equivalent. Family labour was imputed at prevailing wage rate of casual labour in that area.

3.3.1.2 Seed

Actual price paid for the purchase of fish seed was considered

3.3.1.3 FYM

Cost of FYM was considered based on market prices both for owned and purchased manures.

3.3.1.4 Feed

The actual price of ready made feed along with the incidental charges were taken into consideration.

3.3.1.5 Fertilizers

Cost of fertilizers was computed at actual market price including transport charges.

3.3.1.6 Pond construction cost

This included excavation costs either manual or mechanical and construction cost of inlets and outlets. The total cost of construction of pond was apportioned to one season based on the life span of the pond.

3.3.1.7 Interest on working capital

Interest was calculated at the rate of 12.5 per cent per annum.

3.3.1.8 Land revenue

Actual amount paid towards land revenue was considered

3.3.1.9 Rental value of owned pond

Based on the prevailing rents in the selected villages, the rental value of owned pond was estimated.

3.3.1.10 Depreciation

Depreciation on each capital asset was calculated by straight-line method.

3.3.1.11 Interest on fixed capital

It was calculated at the rate of 10 per cent per annum.

3.3.2 Marketing aspects of fish

3.3.2.1 Marketing channels

Three distinct marketing channels were identified in the marketing of fish in the study area, which are presented below.

Channel I	:	Producer ---- consumer
Channel II	:	Producer ---- retailer ---- consumer
Channel III	:	Producer ---- wholesaler ---- retailer – consumer

3.3.2.2 Marketing costs

Marketing costs include transportation charges, loading and unloading charges, packing and storage costs, labour charges, spoilage loss etc. Marketing costs were worked out per kg of fish while estimating price spread.

3.3.2.3 Marketing margin

This is the difference between the total payments (cost + purchase price) and receipts (sale price) of the middleman.

3.3.2.4 Price spread.

It is the difference between price paid by the consumer and the price received for an equivalent quantity of fish by the producer.

3.3.2.5 Producer's share in consumer's rupee

It is the percentage of price received by the producer to the consumer's price.

$$P_s = \frac{P_p}{P_c} \times 100$$

Where, P_s = Producer's share in consumer's rupee

P_p = Producer's price.

P_c = Consumer's price

3.4 TOOLS OF ANALYSIS

Tabular and functional analyses were used to analyze the data. Tabular analysis was used for costs and returns and farm efficiency measures. Break-even analysis was employed to find out the profitability of fish farming. Functional analysis was used to estimate resource productivity, returns to scale and resource use efficiency.

3.4.1 Tabular analysis

I. Cost concepts

Concepts generally used in farm management studies like Cost A_1, Cost A_2, Cost B and Cost C were employed in this study.

a) Cost A_1.

It includes expenses incurred on hired human labour, seed, feed, manures and fertilizers, depreciation, land revenue, interest on working capital etc.,

b) Cost A_2.

Cost A_2 = Cost A_1 + rent paid for leased in land. In this study all the respondents were owner cultivators of fish farms. Hence Cost A_1 and Cost A_2 are one and the same.

c) Cost B

Cost B = Cost A_1+rental value of owned pond + interest on owned fixed capital (excluding land value) + apportioned cost of pond construction.

d) Cost C

Cost C = Cost B + imputed value of family labour. It gives the total commercial cost of cultivation.

II. Farm efficiency measures

a. Gross income

It is derived by taking the total value of the fish produced during a production cycle valued at market price.

b. Net income

It is obtained by deducting Cost C from gross income

c. Farm business income

This is the return to the fish farmer for himself and family labour and interest on owned capital. It was worked out by deducting Cost A_1 from gross income.

d. Farm family labour income

It is the measure of returns from fish cultivation to the family labour. It was obtained by subtracting Cost B from gross income.

e. Farm investment income

It is the measure of returns from fish production to the fixed capital investment. It was obtained by adding rental value of owned land and interest on fixed capital to net income.

f. Input-output ratio

This is the return per rupee of investment. This was calculated by following formula.

$$\text{Input-output ratio} = \frac{\text{Gross income}}{\text{Cost C}}$$

3.4.2 Break-even analysis

Profitability of fish farm was studied with the help of the management tool like break-even analysis. It locates the level of out put that equates total revenue to the total cost. A firm is said to be at break-even point when its costs are equal to revenue i.e., when the contribution margin is exactly equal to the fixed costs. Thus, break-even analysis is the tool used to calculate the level of output at which the farm neither makes profit nor suffers a loss. The formula used to derive the break-even output was

$$\text{Break – even output} = \frac{\text{Total fixed cost/ha}}{\text{Price/kg – variable cost/kg}}$$

3.4.3 Functional analysis

Cobb-Douglas production function was selected among different types of production functions for the present study because of its relative advantages over others. Elasticities of production of inputs can be obtained directly, which indicate the percentage change in output due to one per cent change in a particular input. The sum of elasticities of production provides the estimate of returns to scale. It has great use in economic analysis indicating marginal product at geometric mean level of inputs.

The Cobb-Douglas production function is specified in the following form with four inputs.

$$Y = ax_1^{b1}x_2^{b2}x_3^{b3}x_4^{b4}e^u$$

Where,

Y = The fish yield in tonnes
X_1 = Human labour in man days
X_2 = Feed in tonnes
X_3 = Fertilizers in kgs
X_4 = Manures in tonnes
a = Intercept
u = Stochastic term
e = Napier base.

It can be presented in double logarithmic form as

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + \ln U$$

3.4.3.1 Marginal value products

Equality of MVP to factor cost is the basic condition that must be satisfied to assess the efficient resource use. In Cobb-Douglas production function, MVP of X_j, the j^{th} input factor is given by the following formula.

$$Yi = a\, x_{1i}^{b1}\, x_{2i}^{b2}\, x_{3i}^{b3}\, x_{4i}^{b4} \ldots\ldots\ldots\ldots\ldots x\, ji^{bj}\, e^{ui}$$

Where,

i = 1 to n farms

j = 1 to k inputs

$$\text{MPP of xj input} = \frac{bj\,\bar{Y}}{\bar{X}_j}$$

Where,

MPP = Marginal physical product of j^{th} input
bi = Partial elasticity co-efficient
$\bar{Y}$ = Output at its geometric mean levels.
$\bar{X}j$ = j^{th} independent variable at its geometric mean level.

The MVP for each factor is obtained by multiplying the MPP of each factor with unit price of the input i.e, MVP = MPP . Py

Where P_Y = Price per unit of output

Marginal value productivities are compared with acquisition costs in order to study the resource use efficiency. A resource is said to be efficiently used when its MVP = MFC.

3.4.3.2 Returns to scale

The sum total of production elasticities of all the inputs (sum of bi s) indicates returns to scale. Returns to scale are said to be increasing, constant or decreasing if $\sum$ bi is greater than unity or equal to unity or less than unity respectively.

't' test was carried out to know whether sum of bi ($\sum$ bi) is significantly deviating from unity or not. The formula is

$$t = \frac{\sum_{1}^{n} bi - 1}{SE\left(\sum_{1}^{n} bi\right)}$$

$$= \frac{\sum_{1}^{n} bi - 1}{S\sqrt{(C_{11} + C_{22} + \ldots + C_{nn}) + 2(C_{12} + C_{13} + \ldots + C_{nn})}}$$

Where,

$$S = \frac{\text{Sum of squares due to error}}{\text{Error degrees of freedom}}$$

C_{11}, C_{22}, ...C_{nn}, C_{12}, C_{13}, ...C_{nn} are the elements of variance – covariance matrix inverse.

3.5 CONCEPTS AND TERMS USED IN THE STUDY

3.5.1 Fish

An edible sea animal used as a non-vegetarian food.

3.5.2 Pond

A small, shallow area with silent standing water in which extensive occupancy by higher aquatic plants is a common characteristic. No exact limits of area and depth have been laid down for a pond.

3.5.3 Farm size

Farm size was denoted in terms of water spread area in this study,.

3.5.4 Fish farming

It means to promote or improve growth and thus produce fish for commercial use by protection and nurture.

3.5.5 Man day

It is the work turned out by a normal healthy male adult in a day of 8 hours.

3.5.6 Fixed costs

In the present study, rental value of owned pond, apportioned cost of pond construction, depreciation on capital assets, land revenue and interest on fixed capital were considered as fixed capital.

3.5.7 Variable costs.

Costs incurred towards human labour, seeds, feeds, manures, fertilizers and interest on working capital were considered as variable costs.

3.5.8 Farm asset structure

It refers to the investment on farm buildings, implements and other machinery, irrigation structures, tubes, nets, motors etc. used in fish production.

3.5.9 Break-even output

It is the output at which there is neither profit nor loss in fish production. At this output level, total revenue obtained is equal to the total costs incurred.

3.5.10 Resource use efficiency

When the marginal value product of a resource is just sufficient to meet the cost of production, the resource is said to be employed efficiently.

3.5.11 Marketing

It is the process of sale of fish spreading between production and distribution activities including functions of middlemen, transporting agency etc.,

3.5.12 Marketing channel.

The chain of intermediaries through which fish moves from producer to consumer constitutes a marketing channel.

3.5.13 Wholesalers

Wholesalers are those merchant middlemen who buy and sell fish in larger quantities.

3.5.14 Retailers

Persons who purchase fish either from producer or from wholesaler for selling to consumers. Retailers are the closest to the consumers in the marketing channels.

results and discussion

CHAPTER-IV

RESULTS AND DISCUSSION

The study elucidates the "economics of production and marketing of fresh water fish in Thanjavur district of Tamil Nadu". The important findings of this study are furnished and discussed under the following heads in accordance with the objectives formulated for the study.

4.1 Socio-economic profile of the selected pisciculturists
4.2 Costs and returns from fresh water fish farms
4.3 Break even analysis
4.4 Resource use productivity of fresh water fish farms
4.5 Price spread in the marketing of fish
4.6 Opinion survey

4.1 SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

The socio-economic profile shows the social and financial status of the fish farmers. Here, educational status, size of holding and pattern of assets of selected pisciculturists are discussed.

4.1.1 Educational status

From the details furnished in Table 4.1 it is observed that more than 95 per cent of the farmers maintaining fish farms as an enterprise were educated, though the level of education varied. Running fish farms needs sound technical knowledge and managerial

Table 4.1: Educational status of the selected fish farmers

S.No.	Educational level	Small		Large		Pooled	
		No.	% to total	No.	% to total	No.	% to total
1.	Illiterate	2	5.71	1	4	3	5.0
2.	Primary	18	51.43	7	28	25	41.7
3.	Secondary	9	25.72	10	40	19	31.7
4.	College	6	17.14	7	28	13	21.6

ability. So the level of education may have impact on the production and productivity of fish farms.

In large farms about 28 per cent of respondents were educated up to college level and it was 17.14 on small farms. On large farms, a majority of 40 per cent respondents was educated up to secondary level whereas on small farms, 51.43 per cent of the respondents had primary education only.

Only 2 farmers (5.71 per cent) were illiterates in small category and the same was 4.00 per cent (1 farmer) in large farmer category. The observations clearly indicate that the education level of the large farmers was higher than that of the small farmers.

4.1.2 Size of holding

Farm size is measured in terms of net water spread area. Farm size has a role in efficiency of production of the fish farms. Table 4.2 presents the area under fish farm for the selected categories of farmers.

The total area under fish farming was 50.33 ha. with an average fish farm size of 1.00 hectare for the sample as a whole. The total water spread area operated by 35 small farmers stood at 30.40 ha. with an average fish farm size of 0.87 ha. whereas the same figures for large farmers were 78.20 and 3.13 ha. respectively.

Table 4.2 : Size of holding on selected fresh water fish farms.

S.No.	Particulars	Farm size		
		Small	Large	Pooled
1.	Total area under fish farm (ha.)	30.40	78.20	50.33
2.	Average area of fish farm (ha.)	0.87	3.13	1.00
3.	Total number of respondents	35	25	60

4.1.3 Asset structure of selected fish farms

The composition of and the value of farm assets possessed by the farmers indicate their economic background and ability to adopt modern methods of production. The particulars of farm assets per hectare are presented in Table 4.3.

The value of assets including land per hectare ranged from Rs.2,03,925.16 on large farms to Rs.1,93,914.79 on small farms with an overall average of Rs.2,01,122.99 on pooled farms, indicating a direct relationship between land holding and asset value.

It is observed that land constituted a major share of about 80 per cent of total asset value in all size groups viz., small, large and pooled farms.

Between the size groups, per hectare value of land was slightly more on large farms than on small farms. Lands of large farmers might possess relatively more amenities thereby commanding relatively more value. The value of non-land assets on small, large and pooled fish farms was Rs.40,477.51, Rs.41,265.95 and Rs.41,045.27 accounting for 20.87, 20.24 and 20.41 per cent of total value of assets respectively.

4.1.4 Economic aspects of fish farming

4.1.4.1 Construction of fishponds.

Any fish culture commences with the construction of fishponds. The particulars of construction of fishponds are furnished in Table 4.4.

Table 4.3 : Asset structure of sample fish farms (Value in rupees)

S.No.	Particulars	Small	Large	Pooled
1.	Value of land	1,53,437.28 (79.13)	1,62,659.17 (79.76)	1,60,077.71 (79.59)
2.	Value of filter points	6,941.67 (3.58)	8,132.99 (3.99)	7,799.51 (3.88)
3.	Value of electric motor	6,083.39 (3.14)	6,521.74 (3.20)	6,399.03 (3.18)
4.	Value of sluice and shutters	5,792.49 (2.99)	6,317.14 (3.10)	6,170.28 (3.07)
5.	Value of sheds	10,139.23 (5.23)	9,040.92 (4.43)	9,348.37 (4.65)
6.	Value of wells	10,872.46 (5.61)	10,431.38 (5.12)	10,554.85 (5.25)
7.	Value of implements	648.27 (0.32)	821.82 (0.40)	773.24 (0.38)
8.	Value of total assets Without land	40,477.51 (20.87)	41,265.99 (20.24)	41,045.27 (20.41)
	With land	1,93,914.79 (100.00)	2,03,925.16 (100.00)	2,01,122.99 (100.00)

Note: Figures in parentheses indicate percentages to the total value of assets including the value of land.

Table 4.4: Cost of construction of fish ponds (in rupees per hectare)

S.No.	Particulars	Small	Large	Pooled
1.	Excavation costs	13,646.93 (91.67)	14,782.61 (92.81)	14,464.70 (92.49)
2.	Inlet-outlet material costs	1,239.86 (8.33)	1,148.32 (7.2)	1,173.94 (7.51)
3.	Total	14,886.79 (100.00)	15,930.93 (100.00)	15,638.64 (100.00)

Note: Figures in parentheses indicate percentages to total cost.

The excavation cost of fish farms was Rs.13,646.93 on small farms, Rs. 14,782.61 on large farm and it was Rs. 14,464.70 on pooled farms. Excavation costs constituted more than 90 per cent of total construction costs in both the size groups. The total cost of construction of fish ponds was of the order of Rs.14,886.79 and Rs.15,930.93 on small and large farms with an average of Rs.15,638.64.

4.1.4.2 Human labour utilization

Success of any farming needs better labour management. Keeping this in view, an attempt was made to examine the labour utilization in fresh water fish farming. From the results it is observed that fish farming was not much labour intensive.

The total man-days utilized in fish culture had an inverse relationship with size of the farm. On small farms the human labour utilized were 65.86 man-days and the same was 60.88 and 62.27 man days on large and pooled farms respectively (Table 4.5). Among all operations of labour use, 21.71 per cent of total human labour was utilized for artificial feeding, 21.25 per cent for water management and 18.09 per cent for watch and ward on the pooled farms. The other important operations were harvesting (14.31 per cent) and pond preparation (11.32 per cent) on the above said farms.

4.1.4.3 Utilization of material inputs in fresh water fish farming.

Organic manures like farmyard manure and poultry manure, inorganic manures like lime, N, P, and K fertilizers were used as supplementary feeds for obtaining high production on ponds thorough phytoplankton production. The commonly used feeds in fishponds were oil cakes of groundnut and coconut, rice bran, fish meal and soya powder.

Table 4.5: Operation-wise human labour utilization in fish farming (in man days per hectare)

S.No.	Particulars	Small	Large	Pooled
1.	Pond preparation	5.90 (8.96)	7.50 (12.32)	7.05 (11.32)
2.	Bund rising	6.38 (9.69)	6.25 (10.27)	6.29 (10.10)
3.	Water management	15.42 (23.41)	12.38 (20.34)	13.23 (21.25)
4.	Stocking	1.00 (1.52)	1.00 (1.64)	1.00 (1.61)
5.	Manuring and fertilization	1.00 (1.52)	1.00 (1.64)	1.00 (1.61)
6.	Artificatical feeding	16.47 (25.00)	12.38 (20.34)	13.52 (21.71)
7.	Watch and ward	12.31 (18.69)	10.87 (17.85)	11.27 (18.09)
8.	Harvesting	7.38 (11.21)	9.50 (15.60)	8.91 (14.31)
	Total	65.86 (100.00)	60.88 (100.00)	62.27 (100.00)

Note: Figures in parentheses indicate percentages to the total.

All ingredients were boiled and made into small balls and the same were fed to the fish. However nowadays these feeds are used in powdered form.

Table 4.6 shows that on an average 5,284; 5,780 and 5,641 fingerlings were stocked in small, large and pooled farms. It was interesting to see that both the categories of farmers were nearly following the recommended dose of 5,000 fingerlings per hectare. However, the farmers were not keen on mortality aspect and this might be a reason for lower yield they obtained compared to the potential yield of 6 tonnes per ha. The use of manure per hectare of pond was 6,639.63 kgs on small farms and 7,448.80 kgs on large farms. The use of fertilizer was 228.40 kgs and 293.16 kgs on small and large farms respectively. However usage of feed showed an inverse relation with farm size. The use of feed was 6,937 kgs on small farms and it decreased to 6,060 kgs on large farms. The anxiety of deriving more yields might be the reason for higher use of feed by small farmers.

4.2 COSTS AND RETURNS IN FRESH WATER FISH FARMING

4.2.1 Cost structure in fish farming

Discussion of total costs under various cost components is necessary in any economic investigation. Hence total costs of fish farming were discussed under variable costs and fixed costs on the widely accepted norms. In general variable costs alone are reckoned to be the cost of cultivation by the farmers and the profit and loss too are worked out accordingly, ignoring the fixed costs. But in any business enterprise fixed costs are also taken into account to arrive at the total costs and the returns.

Table 4.6 : Material inputs used in fish farming (per hectare)

S.No.	Particulars	Unit	Small	Large	Pooled
1.	Seed	Nos.	5284.76	5780.05	5641.41
2.	Manures	Kg.	6639.63	7448.80	7222.29
3.	Fertilizers	Kg.	228.40	293.16	275.03
4.	Lime	Kg.	461.15	492.30	483.58
5.	Feed	Kg.	6937.00	6060.00	6305.50

Under variable costs, labour expenses for different operations of fish farming and expenses on material inputs viz., manures and fertilizers, seed, feed and interest on working capital were included. The fixed costs were land revenue, depreciation, and apportioned cost of pond construction, rental value of pond and interest on fixed capital. Generally the crop period is six months, for which various cost components are analyzed and the results furnished according to size in Table 4.7.

The total cost of fish cultivation was Rs.61,994.69 per ha. on pooled farms. It was maximum on small farms at Rs.69,044.06 and decreased with increase in farm size to Rs.59,254.26 of large farms. Variable costs accounted for a major portion of total cost of cultivation in both of farm size. On small farms they were Rs.53,937.68 which was 78.12 per cent of total costs. It was Rs.43,184.86 and Rs.46,194.86 on large and pooled farms respectively accounting for 72.88 and 74.51 per cent respectively.

Among operational costs, cost of feed got a lion's share of 58.28 per cent of the total costs on small farms and it was 50.07 and 52.62 per cent in case of large and pooled farms. The results was in accordance with Korringa (1976). Expenditure on seed came next with Rs.5,601.85 (8.11 per cent), Rs.6,122.76 (10.33 per cent) and Rs.5,976.94 (9.94 per cent) on small, large and pooled farms respectively. Interestingly, human labour costs accounted only for about 5 per cent on the farms under study indicating less labour intensive nature of the fish farming.

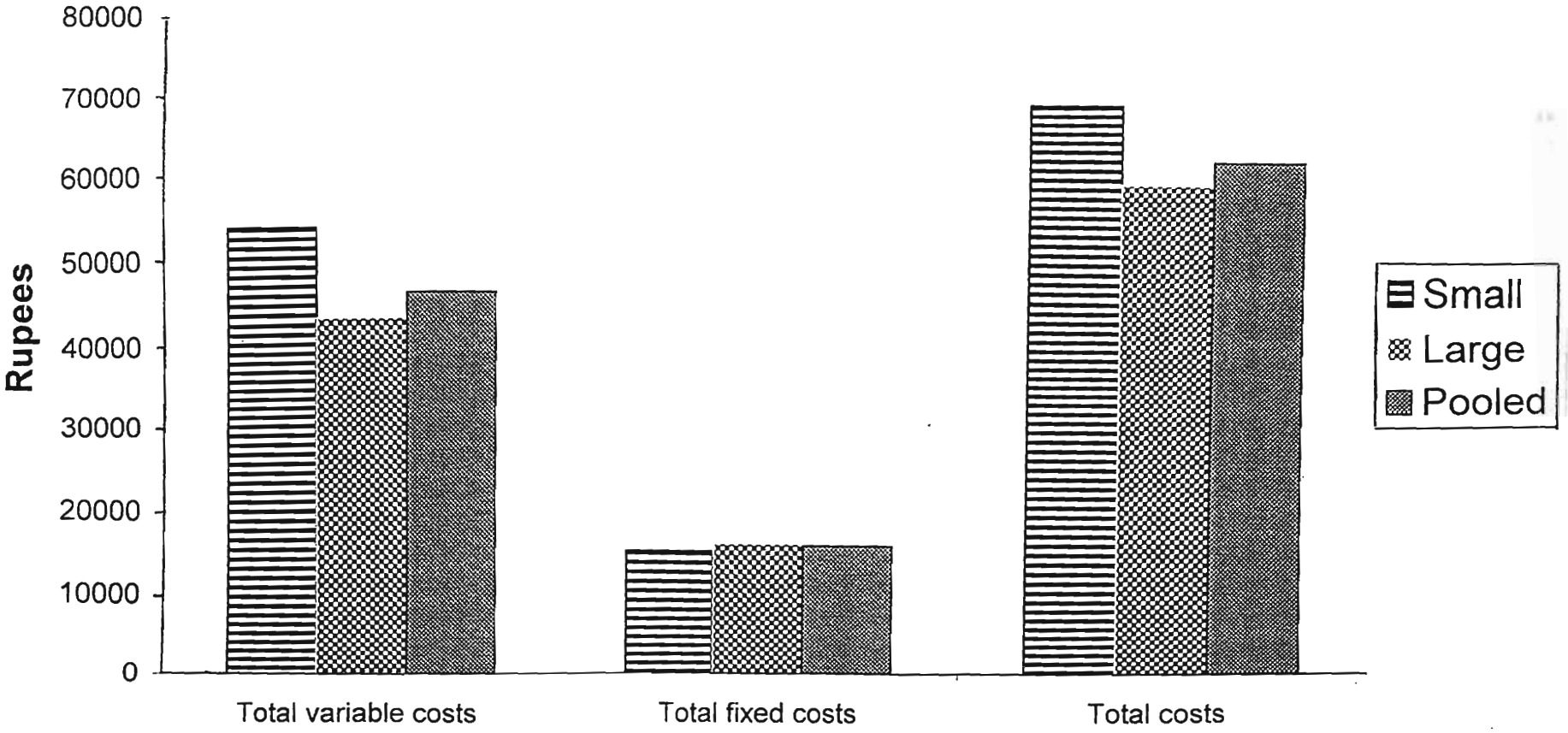
The results also revealed that the per hectare fixed costs amounted to Rs.15,106.38, Rs.16.069.40 and Rs.15,799.83 accounting for 21.88, 27.12 and 25.49 per cent to total costs for small, large and pooled farms respectively. Further it was found that rental value

Table 4.7 : Component wise cost of production on fish farms (in rupees per hectare)

S.No.	Particulars	Small	Large	Pooled
	A. VARIABLE COSTS			
1.	Human labour	3473.90 (5.03)	2979.34 (5.03)	3117.78 (5.03)
2.	Manures and fertilizers	2328.12 (3.37)	2604.03 (4.39)	2526.80 (4.08)
3.	Seed	5601.85 (8.11)	6122.76 (10.33)	5976.94 (9.64)
4.	Feed	40234.66 (58.28)	29667.52 (50.07)	32625.54 (52.62)
5.	Interest on working capital	2299.15 (3.33)	1811.11 (3.06)	1947.80 (3.14)
6.	Total variable cost	53937.68 (78.12)	43184.86 (72.88)	46194.86 (74.51)
	B. FIXED COSTS			
1.	Land revenue	72.50 (0.11)	69.91 (0.12)	70.64 (0.11)
2.	Depreciation	1451.94 (2.10)	1582.16 (2.67)	1545.71 (2.49)
3.	Pond construction cost (apportioned)	615.89 (0.89)	637.24 (1.07)	631.26 (1.02)
4.	Rental value of owned pond	10942.17 (15.85)	11594.03 (19.57)	11411.56 (18.42)
5.	Interest on fixed capital	2023.88 (2.93)	2186.06 (3.69)	2140.66 (3.45)
	Total fixed costs	15106.38 (21.88)	16069.40 (27.12)	15799.83 (25.49)
	C. TOTAL COSTS (A+B)	69044.06 (100.00)	59254.26 (100.00)	61994.69 (100.00)

Note: Figures in parentheses indicate percentages to the total costs.

Fig 4.1: Cost of rearing of fish according to farm size and component wise



of owned pond was high at Rs.11,594.03 (19.57 per cent) on large farms as against Rs.10,942.17 (15.85 per cent) on small farms. It was Rs.11,411.56 (18.42 per cent) for pooled farms. The depreciation and interest on the fixed capital formed 2.49 and 3.45 per cent in total costs respectively on pooled farms. The results were on contrast with Rao and Chowdary (1988).

The analysis of cost structure in fish farming exhibited that total costs decreased with the increase in farm size., which is due to economies of large scale production. An inverse relationship was observed in utilization of feed with size of the farm. Even though the per hectare fingerling population was more (5780) on large farms than small farms (5284), the expenses on feed was more at Rs.40, 234.66 (58.28 per cent) on small farms than the large farms where it was Rs.29, 667.52 (50.07 per cent). This evidently indicated the anxiety of small farmers to spend more on feed (8 per cent more than large farmers) with a hope of obtaining more yield. This resulted in higher feed cost on small farms.

4.2.2 Output and returns on fish farms.

Table 4.8 shows that 3,052, 3,702 and 3,520 kilograms of fish were obtained per hectare on small, large and pooled farms respectively. Due to better input management, large farms obtained higher yield. Also there existed a direct relationship between farm size and income. On pooled farms Rs.96, 271.84 were the gross income per hectare. The gross income was Rs.86, 800 on small farms and Rs.99, 954 on large farms. Similarly the net income also was higher at Rs.40, 699.74 on large farms compared to small farms on which it stood at Rs.17, 755.94.

Table 4.8: Output and returns from fish farms (per hectare)

S.No.	Particulars	Small	Large	Pooled
1.	Yield (Kg.)	3052	3702	3520
2.	Gross income (Rs.)	86,800.00	99,954.00	96,271.84
3.	Total costs (Rs.)	69,044.06	59,254.26	61,994.69
4.	Net income (Rs.)	17,775.94	40,699.74	34,277.15

4.2.3 Unit cost of production on fresh water fish farms.

The unit cost analysis will be useful in decision making at micro level and policy making at macro level. Table 4.9 reveals that the total costs per kilo of fish were Rs.22.62 on small farms and Rs.16.00 on large farms. A kilo of fish yielded a net income of Rs.5.82 and Rs.10.99 on small and large farms respectively.

4.2.4 Cost of fish cultivation according to cost concepts.

Various cost concepts have their own economic significance and it becomes necessary to work out them. Cost A_1, Cost A_2, Cost B and Cost C were adopted in the present study. The concept of cost C is the most comprehensive one. It includes all costs both fixed and variable and hence it provides a basis for comparison between different kinds of operational holdings. The cost worked out on the basis of Cost A_1 is the variable costs incurred in cash or kind by an owner farmer which excludes the imputed value of family labour. Under Cost B, besides Cost A_1, indirect costs such as interest on fixed capital, rental value of owned pond are included. Cost C is computed by adding the imputed value of family labour to Cost B.

The details of the cost concepts are presented in Table 4.10. From the table it was evident that Cost A_1, and Cost A_2 remained one and the same because there was no leasing activity among the selected aqua farmers. All farmers are owner cultivators.

Table 4.9: Unit cost of production on fresh water fish farms (in rupees per Kg.)

S.No.	Particulars	Small	Large	Pooled
1.	**COSTS**			
	a. Variable Costs	17.67	11.67	13.12
	b. Fixed Costs	4.95	4.34	4.49
	c. Total Costs	22.62	16.00	17.61
2.	**RETURNS**			
	a. Gross income	28.44	27.00	27.35
	b. Net income	5.82	10.99	9.74

Fig.4.2: Costs and returns per kilogram of fish (Rs.)

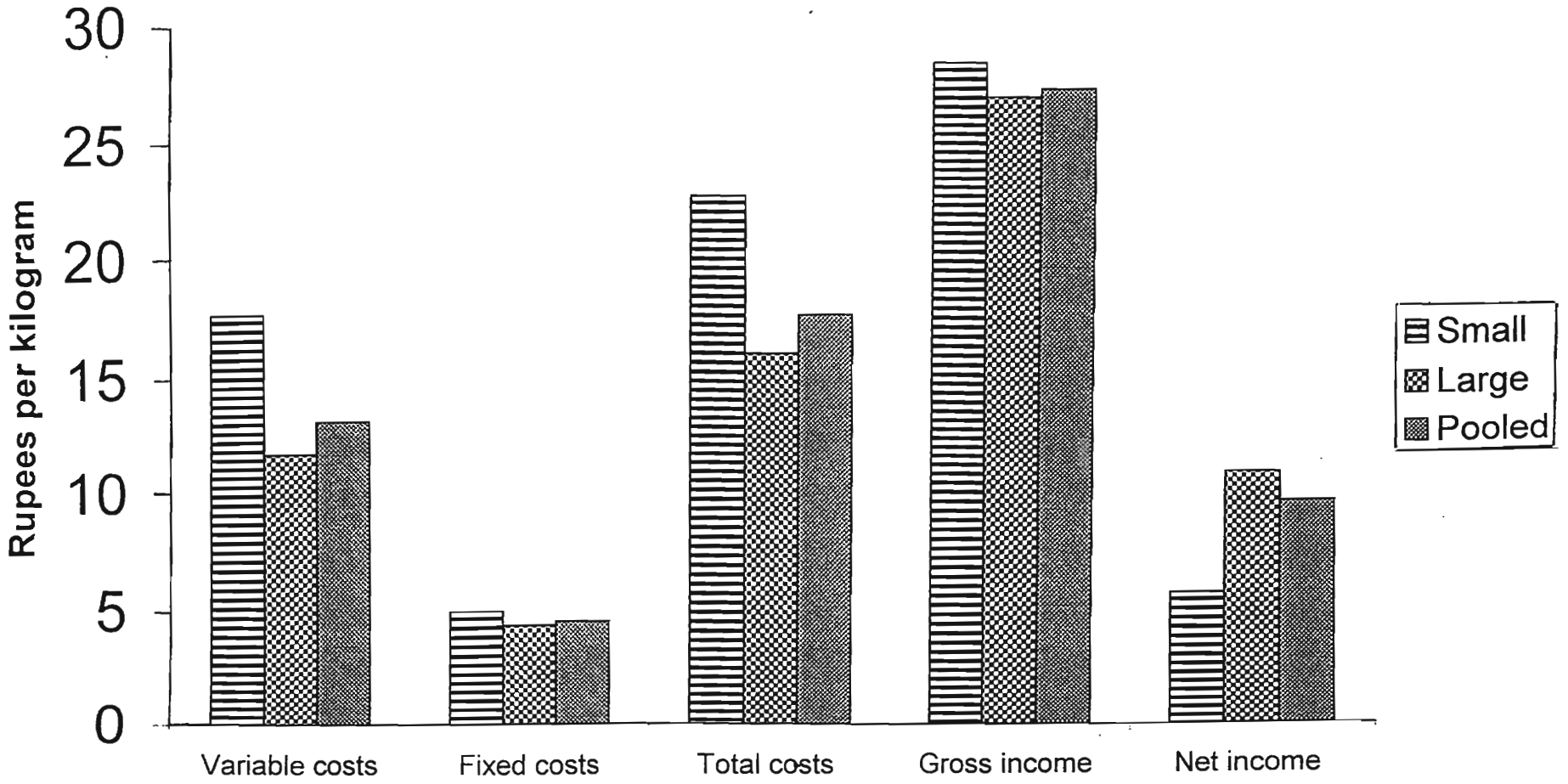


Table 4.10: Cost concepts in fish farming (in rupees per hectare)

S.No.	Particulars	Small	Large	Pooled
1.	Cost A_1/A_2	54,846.62	44,289.59	47,244.78
2.	Cost B	68,428.56	58,706.92	61,428.26
3.	Cost C	69,044.06	59,254.26	61,994.69

The table shows that commercial cost of cultivation (Cost C) was higher at Rs. 69,044.06 on small farms than on large farms (Rs.59, 254.26) It was Rs.61, 994.69 on pooled farms.

4.2.5 Farm business analysis

Costs and returns are two important components of any business enterprise. Costs represent the monetary value of the material inputs and services used in the production process whereas returns represent the value of the output obtained. The relative magnitude of costs and returns from the enterprise indicates the success of the farm business.

A measuring stick is necessary to provide standards for appraising the use of various resources. To achieve this objective, various farm efficiency measures viz., gross income, net income, farm business income and farm investment income were computed. In addition, input-out put ratio was also worked out. The details are presented in Table 4.11.

4.2.5.1 Gross income

The table revealed that large farmers obtained higher gross income per hectare (Rs.99,954) than small farms (Rs.86,800) establishing a direct relationship with farm size. Higher productivity on large farms was the reason for this trend.

Table 4.11: Measures of farm income in fish farming (rupees per hectare)

S.No.	Particulars	Small	Large	Pooled
1.	Gross income	86,800.00	99,954.00	96,271.84
2.	Net income	17,755.94	40,669.74	34,277.15
3.	Farm business income	31,953.38	55,664.41	49,027.07
4.	Family labour income	18,371.44	41,247.08	34,843.58
5.	Farm investment income	30,721.99	54,421.46	47,787.35
6.	Input-output ratio	1.26	1.69	1.55

Fig.4.3: Measures of farm income in fish farming (Rs. Per hectare)

4.2.5.2 Net income

It is clear from the table that the net income per hectare was Rs.17, 755.94 on small farms as against Rs.40, 699.74 on large farms. The same was Rs.34, 277.15 on pooled farms. The higher per hectare cost of cultivation and lower yields contributed to the lower net income on small farms.

4.2.5.3 Farm business income

It is observed that the large farms realized farm business income of Rs.55, 664.41 followed by small farms with Rs.31, 953.38. The same was Rs.49, 027.07 on pooled farms. The possible reason for this trend was higher gross income and lower variable costs on large farms against the small farms.

4.2.5.4 Family labour income

It is evident from the results of the Table 4.11 that the family labour income was Rs.18,371.44, Rs.41,247.08 and Rs.34,843.58 on small, large and pooled farms respectively indicating a direct relationship with the farm size.

4.2.5.5 Farm investment income

It was of the order of Rs.30,721.99, Rs.54,421.46 and Rs.47,787.35 on small, large and pooled farms respectively. This measure also indicated direct relationship with farm size.

4.2.5.6 Input-output ratio

This measure indicates the returns for every rupee of investment. It was computed by dividing gross returns with Cost C. It was found from the analysis that input-output ratio had positive relationship with the size of fish farm. The input-output ratio ranged between 1.26 on small farms to 1.69 on large farms indicating profitability of fresh water fish farming. The ratio obtained in the study area showed contrasting value when compared with the results of Ramana et al., (1991).

4.3 BREAK-EVEN ANALYSIS

It is an important tool to study the profitability of any enterprise. In fact this technique is used to locate the point of break even output which is the minimum output that has to be produced in order to continue the production without loss.

From Table 4.12 it is evident that a minimum of 1,437.33, 1,048.23 and 1,110.32 kgs of fish should be produced per hectare on small, large and pooled farms respectively to run the production without loss. The percentage of break even output to average yield on small, large and pooled farms was 47.10, 28.32 and 31.54 respectively. It was further noticed that small, large and pooled farms obtained yields which were nearly 53.90, 71.68 and 68.46 per cent more than the corresponding break even output levels confirming that they were in profit zone.

Table 4.12 : Break-even analysis.

S.No.	Farm size	Average yield (kg)	Total revenue (Rs.)	Fixed costs (Rs.)	Variable cost (Rs.)	Total costs (Rs.)	Variable costs per kg(Rs.)	Price per kg (Rs.)	Break even out put (kg.)	% of BEO to average yield
1.	Small	3052	86800.00	15106.38	53937.68	69044.06	17.67	28.18	1437.33	47.10
2.	Large	3702	99954.00	16069.40	43184.86	59254.26	11.67	27.00	1048.23	28.32
3.	Pooled	3520	96271.84	15799.83	46194.86	61994.69	13.12	27.35	1120.32	31.54

FIG. 4.4 : BREAK EVEN-OUT OF FISH FARMING PER HECTARE SMALL FARMS

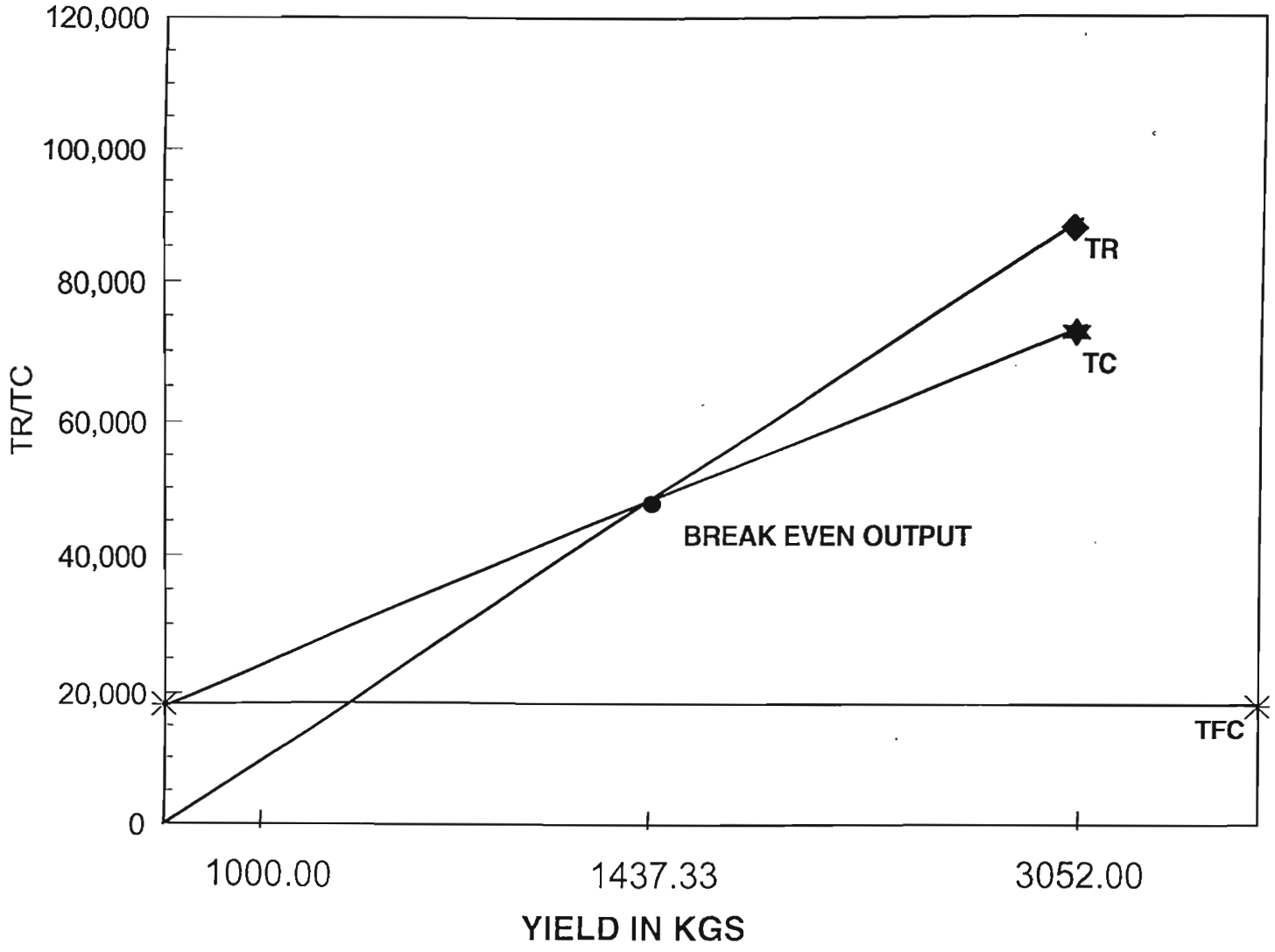


FIG. 4.5 : BREAK EVEN-OUT OF FISH FARMING PER HECTARE LARGE FARMS

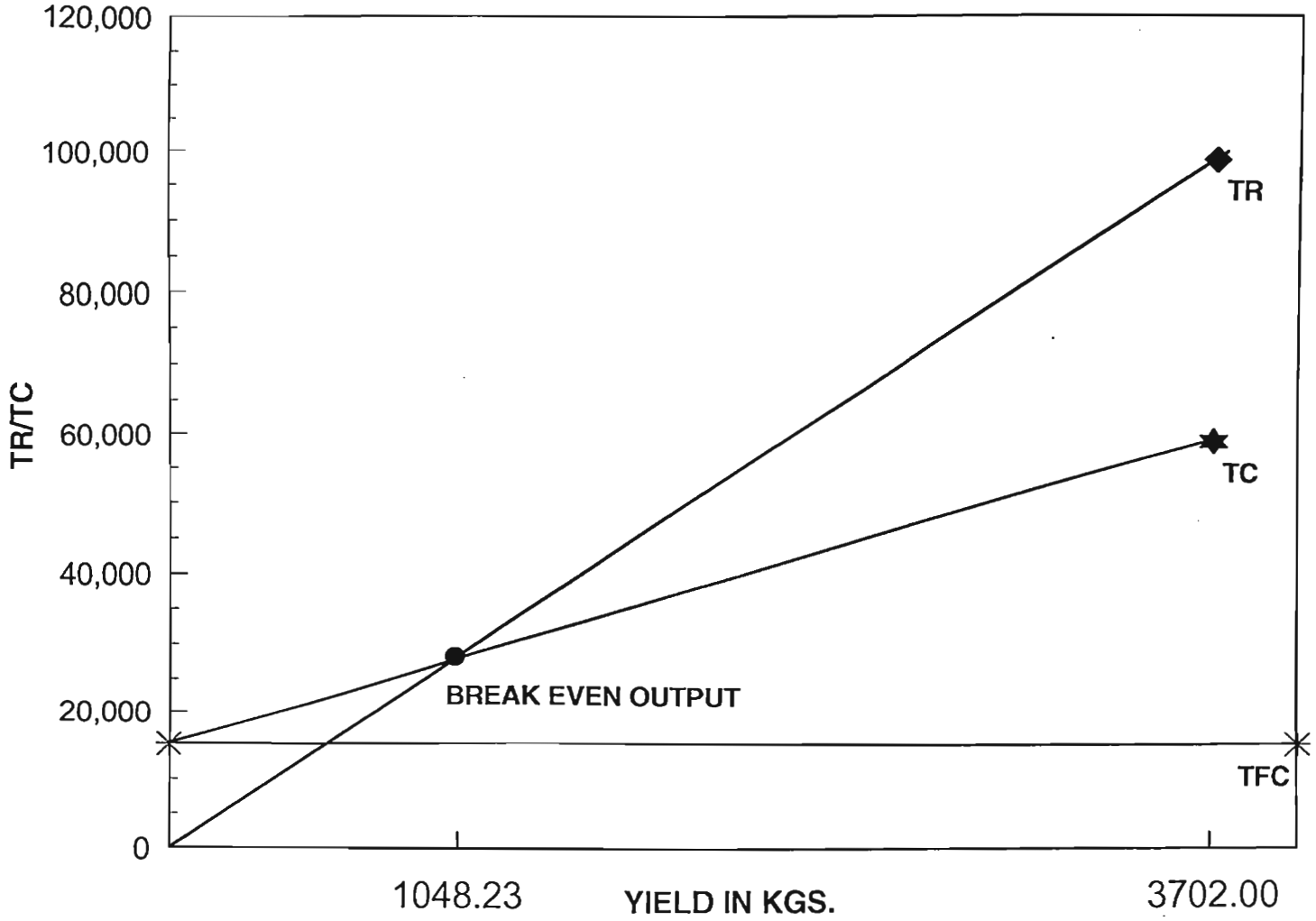
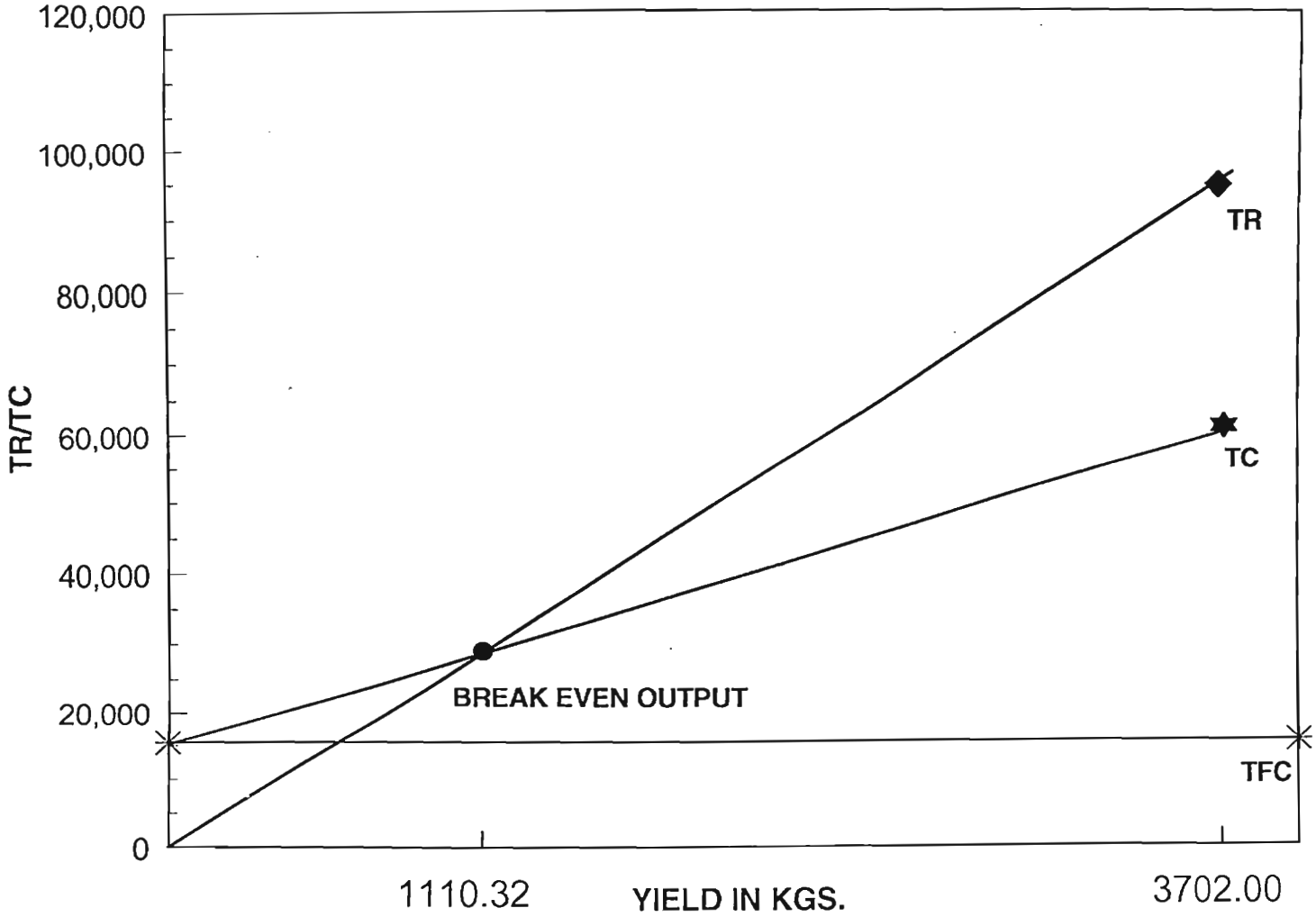


FIG. 4.6 : BREAK EVEN-OUT OF FISH FARMING PER HECTARE POOLED FARMS



From the above analysis it was evident that the break-even output of the two size groups of fish farms in the study area was quite lower than the actual average yields obtained. Thus it was clear that the fresh water fish farming was profitable in the study area. There is greater scope to increase the area under fish since all the selected farmers were operating in the profit zone.

4.4 RESOURCE PRODUCTIVITY AND RETURNS TO SCALE.

The ultimate objective of the farmers in any business is to maximize the returns from their farming activities with the limited resources they have. Hence adjustment in the allocation of those limited resources is inevitable to operate the farm business at economic optimum level. It is important to study how the resources are used on the fish farms in Thanjavur district of Tamil Nadu. With this view in mind, resource use efficiency is estimated on the selected sizes of fish farms. The regression coefficients of different inputs included in the production function were estimated separately for each size group of fish farms and the results are presented in Table 4.13.

4.4.1 Small farms

The coefficient of multiple determination (R^2) was 0.91 and it was significant at 5 per cent level. This indicated good fit to the data and 91 per cent of variation in the yield was explained by selected variables.

The analysis of small farms exhibited that out of four explanatory variables included in the model, only fertilizer was significant at five per cent level. The production

Table 4.13: Production elasticities , marginal value products of resources and marginal value product to opportunity cost ratios in fish farming.

S.No.	Particulars	Small	Large	Pooled
1.	Number of farmers (n)	35	25	60
2.	Intercept (a)	- 3.14405	- 0.35730	- 1.59443
3.	Human labour (X_1)	- 0.0681 (0.1052)	0.0590 (0.0687)	0.0489 (0.0567)
4.	Feed (X_2)	0.0292 (0.0692)	0.6669** (0.1742)	0.3259** (0.0704)
5.	Fertilizer (X_3)	0.7944** (0.2728)	- 0.1202 (0.1772)	0.5290** (0.1563)
6.	Manure (X_4)	0.1050 (0.2713)	0.4316* (0.2358)	0.5917** (0.1688)
7.	Returns to scale Σb_i	0.8605 ((- 0.024))	1.0373** ((4.302))	1.4955** ((4.882))
8.	Coefficient of multiple determination (R^2)	0.91**	0.89**	0.96**
9.	MVPs (Rs) Human labour X_1 Feed X_2 Fertilizer X_3 Manure X_4	 - - 4.38 -	 - 6663 - 4.019	 - 6982 4.192 12.158
10.	MFCs (Rs) Human labour X_1 Feed X_2 Fertilizer X_3 Manure X_4	 - - 3.58 -	 - 4895 - 200	 - 4895 3.58 200
11.	MVP/MFC Ratio Human labour X_1 Feed X_2 Fertilizer X_3 Manure X_4	 - - 1.223 -	 - 1.361 - 0.02010	 - 1.4263 1.1709 0.06079

Figures in ( ) are standard errors
Figures in (( )) are 't' values

** Significant at 1% level
* Significant at 5% level

elasticity of human labour was negative and non-significant. The co-efficient of manures and feed were positive but found non-significant.

The regression coefficients are the elasticity coefficients of the Cobb-Douglas production function, as they show the percentage change in output due to one per cent change in input. Keeping other factors constant, at their geometric mean level, one per cent increase in fertilizer would result 0.79 per cent increase in the yield.

The sum of elasticities was 0.8605. The results of 't' test proved that Σ bi was not found deviating significantly from unity, indicating the prevalence of constant returns to scale in accordance with Singh (1975)

4.4.2 Large farms

The coefficient of multiple determination (R^2) for large farms was 0.89, which indicated that the variables included in the function explained 89 per cent variation in the fish yield of large farms.

The elasticities of feed (X_2) and manures (X_4) were positive and significant at 1 per cent and 5 per cent respectively. Keeping other inputs constant, at their geometric mean level, o0ne per cent increases in the feed and manures would result in 0.67 and 0.43 per cent increased in fish yields respectively. The elasticities of human labour and fertilizers were non-significant.

The sum of elasticities was 1.0373. The t-test showed that the Σ bi was significantly deviated from unity showing increasing returns to scale.

4.4.3 Pooled farms

The coefficient of multiple determination (R^2) was 0.96 in the pooled farms, which indicated that the variables included in the function explained 96 per cent of variation in the fish yield.

Among the selected variables the elasticities of feed (X_2) fertilizer (X_3) and manure (X_4) were positively significant at 1 per cent level. Keeping all other variables constant, one per cent increase in feed, fertilizer and manure would result in an increase of fish output by 0.33, 0.53 and 0.59 per cent respectively. The elasticity of human labour was positive but non-significant.

The sum of the elasticities was 1.4955, significantly deviated from unity indicating the existence of increasing returns to scale.

4.4.4 Allocative Efficiency

To examine the economic efficiency of resource use, the Marginal Value Product (MVP) of each input was compared with its acquisition cost i.e., Marginal Factor Cost (MFC). Marginal factor costs are the unit costs of inputs. Marginal factor costs of feed (tonnes), manures (tonnes), fertilizers (kgs) and human labour (man-days) were their

respective prices. MVP/MFC ratios indicate the potentiality of factors for their further use. Its higher value (greater than unity) shows greater potentiality for further use. Its value of less than one indicates lesser profitability of its use. The negative ratio indicates over use of the resources and suggests reduction in the present level of resource use. The resource is said to be allocated efficiently if the MVP=MFC. The ratio of MVP to their acquisition cost was computed only for the significant factors for each size of fish farm and is presented in Table 4.13.

It is seen from the table that ratio of marginal value product (MVP) to opportunity cost (MFC) of fertilizer on small farms was more than unity indicating the scope of increasing the yield of fish by further its use. In respect of large farms also the ratio of MVP to MFC was more than unity suggesting the potentiality of feed to increase the fish yield with its further use. In respect of pooled farms the ratio of MVP to MFC for feed and fertilizer was found to be more than unity revealing the possibility of furthering their use for increased fish yield.

4.5 PRICE SPREAD IN THE MARKETING OF FISH

The marketing of fish is characterised by inelastic nature of supply in short period, elastic demand for the commodity, high perishability and traditional practices adopted in marketing. The relationship between the producer's price and consumer's price is manifested by what is known as price spread, which explains the difference between the price received by the producer and the price paid by the consumer. This aspect helps bringing out the wasteful costs and superfluous middlemen so that efforts can be made to eliminate them. Keeping these points in view, an attempt has been made to study and

analyze the marketing costs and price spread in fish marketing in Thanjavur district of Tamil Nadu.

4.5.1 Marketing channels

These are the channels or the distribution paths through which the products are transferred from the point of production till they reach the ultimate consumers.

Marketing channels of fish

Three distinct marketing channels were identified in the marketing of fish in the study area viz.,

Channel I	: Producer	---- Consumer
Channel II	: Producer	---- Retailer ---- Consumer
Channel III	: Producer	---- Wholesaler ---- Retailer ---- Consumer

Channel I

Producer ---- Consumer

In this channel, the producers dispose their produce to the consumers at their pond site itself. Consumers from local and adjuscent villages come to the pond site and purchase the fish there itself. However, the extent of sales in this channel was negligible.

Channel II

Producer ---- Retailer ---- Consumer

In this channel, the producers directly sold their produce to the retailers eliminating the wholesalers. Various marketing costs like, transport and spoilage are met by retailers themselves in this channel. The extent of sales in this channel was nearly 40 per cent

Channel III

Producer ---- Wholesaler---- Retailer ---- Consumer

In this channel fish were sold in the local markets through local wholesalers and retailers. Local wholesalers belonging to nearby towns visited the villages and purchased fish from the fish farmers at their pond site immediately after the harvest and transported them to the local town markets by lorries or vans. Then the retailers bought the fish and sold them to the local consumer after adding their margins.

4.5.2 Marketing costs incurred in fish marketing.

4.5.2.1 Channel I

In channel I, as the producers directly disposed their produce to the consumers, no marketing costs were added to the price of the fish.

4.5.2.2 Channel II

It is clear from Table 4.14 that the retailers, the lone market intermediary in this channel on an average incurred Rs.2.25 on marketing of one kg of fish. Among the costs incurred, transportation charges took a major share (Re.0.90) with 40 per cent of total marketing costs followed by spoilage losses (Re.0.50) market fee (Re.0.25), loading and unloading, labour and storage (Re.0.20 each) whose respective percentages in total marketing costs stood at 22.22, 11.11, 8.89, 8.89 and 8.89.

4.5.2.3 Channel III

A perusal of Table 4.14 revealed that a total cost of Rs.5.90 was incurred on marketing of one kg of fish in this channel. Out of the total marketing costs, wholesaler spent Rs.3.65(61.86 per cent) and the retailer incurred Rs.2.25. Among various costs incurred by the wholesaler, transportation took lion's share with Rs.1.45 (24.57 per cent of fish marketing costs) followed by commission charges (Re.0.50), packing (Re.0.40), loading and unloading (Re.0.32), spoilage loss (Re.0.30) and labour cost (Re.0.25).

Out of total cost incurred by the retailer (Rs.2.25), transportation occupied major share with 15.25 per cent followed by spoilage loss (8.47 per cent) and market fee (4.24 per cent).

From the above discussion it can be observed that marketing of fish through channel III was costlier compared to channel II owing to the presence of two intermediaries (wholesaler and retailer) instead of one in channel II (only retailer). In both the channels transportation charges took lion's share of about 40 per cent out of total marketing costs.

Table 4.14 : Marketing costs for one kilogram of fish (amount in rupees)

S.No.	Name of the functionary	Channels	
		II	III
1.	WHOLESALER		
	Loading and unloading		0.32 (5.42)
	Transportation		1.45 (24.57)
	Packing		0.40 (6.80)
	Labour		0.25 (4.24)
	Storage		0.43 (7.29)
	Spoilage loss		0.30 (5.08)
	Commission charges		0.50 (8.47)
	Sub total		3.68 (61.86)
2.	RETAILER		
	Loading and unloading	0.20 (8.89)	0.20 (3.39)
	Transportation	0.90 (40.00)	0.90 (15.25)
	Labour	0.20 (8.89)	0.20 (3.39)
	Storage	0.20 (8.89)	0.20 (3.39)
	Spoilage loss	0.50 (22.22)	0.50 (8.47)
	Market fee	0.25 (11.11)	0.25 (4.24)
	Sub total	2.25 (100.00)	2.25 (38.14)
3.	Total marketing costs	2.25 (100.00)	5.90 (100.00)

Note: Figures in parentheses indicate percentages to total marketing costs

4.5.3 Price spread in fish marketing

The price spread for the three marketing channels was worked out and presented in Table 4.15. From the results of the price spread analysis, it is evident that the producer's share in the consumer's rupee varied from channel to channel and was highest (100.00 per cent) in channel I. It was 80.00 per cent in channel II and 70.00 per cent in channel III. .

Price spread or gross marketing margin was highest (Rs.12.00) in channel III which was the lengthiest among the three followed by channel II at Rs.7.00. The producer had not incurred any marketing costs, as he did not involve directly in marketing of produce in all the three channels.

The wholesaler in channel III incurred Rs.3.65 towards the marketing costs per kg. He obtained a margin of Rs.3.35 thereby getting 8.43 per cent of consumer's rupee. The total marketing costs in channel III were Rs.5.90.

The retailers incurred Rs.2.25 each towards marketing costs in channel III and channel II. But he took higher margin of Rs.4.75 in channel II when compared to channel III (Rs.2.75). The share of retailer's margin in consumer's rupee was 6.83 and 13.57 per cent in channel III and channel II respectively.

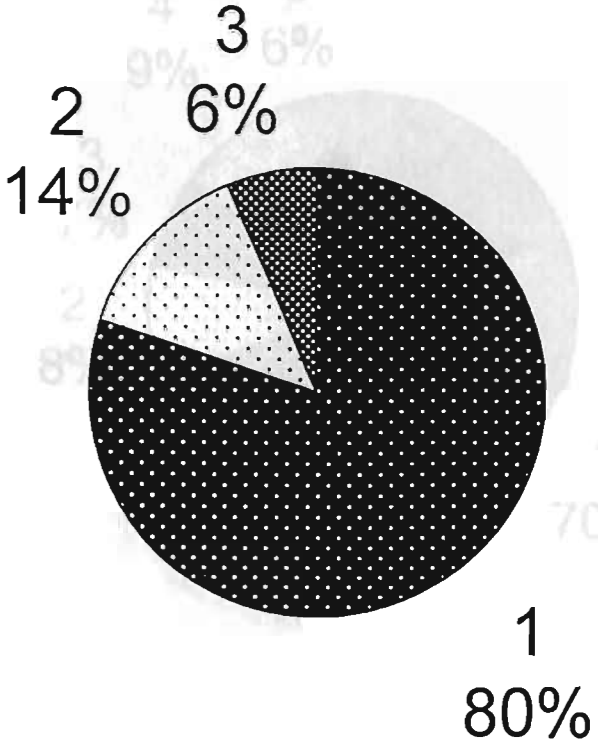
The consumer paid a higher cost of Rs.40.00 per kg of fish in channel III followed by channel II (Rs.35.00) and channel I (Rs.28.00).

Table 4.15: Marketing margins and price spread for one kilogram of fish (amount in rupees)

S.No.	Particulars	Channels		
		I	II	III
1.	Price received by the fish farmer	28.00 (100.00)	28.00 (80.00)	28.00 (70.00)
2.	Wholesaler's margin	-	-	3.35 (8.43)
3.	Retailer's margin	-	4.75 (13.57)	2.75 (6.83)
4.	Cost of marketing	-	2.25 (6.43)	5.90 (14.74)
5.	Gross marketing margin	-	7.00 (20.00)	12.00 (30.00)
6.	Consumer's price	28.00 (100.00)	35.00 (100.00)	40.00 (100.00)

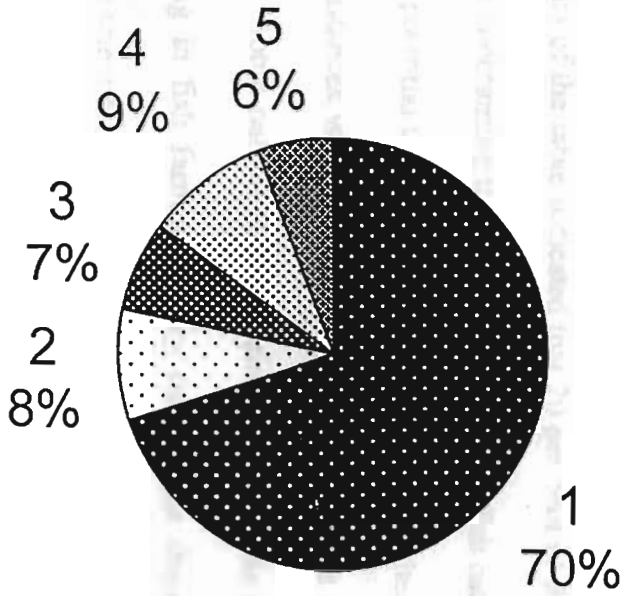
Note: Figures in parentheses indicate percentages to consumer's price.

Fig.4.7(a): Price spread in fish marketing - Channel II



1 Price received by the farmer
2 Retailer's margin
3 Retailer's marketing cost

Fig.4.7(b): Price spread in fish marketing - Channel III



1 Price received by the farmer
2 Wholesaler's margin
3 Retailer's margin
4 Wholesaler's marketing cost
5 Retailer's marketing cost

From the above discussion it can be concluded that the price spread was lower in channel II when compared to channel III. In channel II, 20.00 per cent of the consumer's rupee was shared by marketing costs and marketing margins, where it was 30.00 per cent in channel III. Though the price spread was slightly higher in channel III it was this channel through which greater percentage of sales were made.

4.6 OPINION SURVEY

Though fish farming is profitable enterprise, it is not free from limitations as expressed by the respondents. Therefore an opinion survey was conducted in the study area to identify the production and marketing problems of fresh water fish farming. The opinion of the fish farmers on production and marketing problems are summarized in Table 4.16.

The particulars of the table indicated that 20 per cent of the respondents expressed about the difficulties in obtaining the quality seeds though fish hatcheries in the study area were having enough potential to provide quality seed to the limited number of fish farmers in this district but instances were recorded wherein the farmers had to face problems in getting quality seed. About half of the respondents reported the need for better scientific and technical training in fish farming. They desired the department to bestow more attention in imparting scientific training to the fish farmers in the study area.

The problems in obtaining the institutional credit were felt by 60 per cent of the respondents. The farmers wanted required amount of timely credit. The high costs of inputs were the problem expressed by 100 per cent of the farmers. Further the farmers'

Table 4.16: Opinion survey

S.No.	Particulars	Percentage to the total respondents
PRODUCTION PROBLEMS		
1.	Availability of quality seeds	20.00
2.	Need for training	55.00
3.	Problems in obtaining institutional credit	60.00
4.	Costs of inputs	100.00
MARKETING PROBLEMS		
1.	Transportation costs	80.00
2.	Wide price fluctuation	95.00
3.	Lack of market information	75.00
4.	Spoilage losses	40.00
5.	Lack of storage facilities	35.00

problems were compounded as they have to get feeds from Salem which is far way from the study area.

Transport problems like 80 per cent of the respondents reported poor conditions of roads, which connect the consuming areas. 95 per cent respondents opined that instability and wide fluctuation in the price of fish affected their profit. The other problems faced by the farmers were lack of market information, spoilage loss and lack of storage facilities as expressed by 75, 40 and 35 per cent of respondents.

summary and conclusion

CHAPTER – V

SUMMARY AND CONCLUSIONS

The present study entitled "Economics of fish farming in Thanjavur district of Tamil Nadu" is intended to examine the cost structure, resource use efficiency and price spread in fish production with the following objectives.

1. To estimate the capital investment on the construction of fish farms.
2. To workout costs and returns from fish farming.
3. To estimate resource efficiency. and
4. To examine the price spread in fish marketing.

The study was under taken in Thanjavur district of Tamil Nadu as it has a long coastal line of over 145 km. before it was trifurcated. The district has a vast potential of inland water resource besides the operation of the FFDA. Two taluks viz., Thanjavur and Orathanadu were selected as they accounted for more number of fresh water fish farmers. Two clusters of four villages each were selected from each taluk to make sample villages to sixteen. All the farmers with their operational holdings under fish farming were listed out. The farmers were categorized into two size groups viz., small and large. Those farmers having 2 ha. and less water spread area were considered as small and those farmers with above 2 ha. were taken as large farmers. 35 farmers from small group and 25 farmers from large group were selected at random in probability proportion to their number in each group, thus making the sample size of the study to sixty.

Survey method was used to collect the data for the agricultural year 1998-'99. The data were analyzed to fulfil the objectives by using tabular, functional and break-even analysis. The major findings of the study are as follows.

Educational levels of the large farmers were higher as compared to that of small farmers. Sixty eight per cent of large farmers were educated up to at least secondary level, while the same was 43 per cent on small farms.

Total area under fish farming was 78.2 ha. for large farms and it was 30.40 ha. under small farms with an average of 3.13 ha. and 0.87 ha. respectively.

The value of farm assets including land per ha. ranged from Rs.2,03,925.16 on large farms to Rs.1,93,914.79 on small farms with an average of Rs.2,01,122.99 on pooled farms. The share of land value in the total value of farm assets was more or less same on both size groups.

An inverse relationship between labour use and farm size was observed in fish farming. Human labour utilization was more (65.86 man days) on small farms than the large farms (60.88 man days).

Total cost of construction of fishpond was worked out at Rs.15, 638.64 on pooled farms. The cost of construction was relatively less (Rs.14, 886.79) on small farms and more (Rs.15, 930.93) on large farms indicating direct relationship with farm size.

The use of material inputs viz., seed, manures and fertilizers indicated a direct relationship with farm size, where as the use of feed exhibited inverse relationship with the size of farm.

The per hectare total cost of fish cultivation was found to be Rs.61,994.69 on pooled farms. The cost of production decreased with increase in the size of the farm from Rs.69,044.06 on small farms to Rs.59,254.26 on large farms. The variable costs accounted for 78.12, 72.88 and 74.51 per cent of total costs on small, large and pooled farms respectively. Among the variable costs, the share of feed costs was higher than the other inputs accounting for 58.28, 50.07 and 52.62 per cent on small, large and pooled farms respectively. The analysis revealed that the fixed costs were highest (Rs.16,069.40) on large farms and lowest (Rs.15,106.38) on small farms.

It was found that the fish output obtained was of the order of 3,052 and 3,702 kilograms on small and large farms respectively with an average of 3,520 kilograms on pooled farms. The gross income per hectare was higher (at Rs.99,954.00) on large farms when compared to small farms (at Rs.86,800.00). The net income on large farms (Rs.40,699.74) was higher by about 2 ½ times than that of small farms (Rs.17,755.94).

The cost of production per kilogram of fish was Rs.22.62 on small farms as against Rs.16.00 on large farms showing an inverse relationship between cost per unit and farm size. One kilogram of fish yielded a net income of Rs.5.82 on small farms and Rs.10.99 on large farms.

The results of cost concepts indicated that Cost A_1/A_2, Cost B and Cost C were higher on small farms than large farms. This trend may be due to the differences in magnitude of expenditure on feed, interest on working capital, human labour etc.

The farm business analysis showed that all the measures of income were directly related with farm size. The input-output ratio revealed that it was higher (1.60) on large farms than on small farms (1.26). The same was 1.55 on pooled farms.

From the functional analysis it was found that fertilizer on small farms, feed and manure on large farms; and feed, fertilizers and manures on pooled farms were found to be significantly influencing the yields. The output elasticities of human labour were non-significant in both the size groups. The co-efficient of multiple determination was significant at 1 per cent level in both the size groups. The R^2 values were 0.91, 0.89 and 0.96 on small, large and pooled farms respectively.

The ratio of MVP to MFC of fertilizer on small farms was more than unity indicating the scope of increasing the yield of fish. In respect of large farms also the ratio of MVP to MFC was more than unity also suggesting the potentiality of feed to increase the fish yield with its further use. In respect of pooled farms the ratio of MVP to MFC for feed and fertilizer was found to be more than unity revealing the possibility of furthering their use for increased fish yield.

The break-even output on small, large and pooled farms worked out to 1437.33, 1048.23 and 1110.32 kilograms respectively. The percentage of break even output to average yield was less on large farms with 28.32 per cent compared to small farms in which it was 47.10 per cent.

With regard to marketing of fish, three channels were identified. The marketing costs incurred by the wholesalers were Rs.3.65 per kg of fish on channel III. The marketing costs incurred by the retailers were Rs.2.25 in both channels. The total marketing costs incurred by various intermediaries were Rs.2.25 and Rs.5.90 per kilogram of fish in channel II and III. Though the price spread was slightly higher in channel III, it was this channel through which greater percentage of sales were made. Producer's share in consumer's rupee was 80.00 per cent in channel II and it was 70.00 per cent in channel III.

Half of the respondents reported the need for scientific and technical training. Sixty per cent of the respondents expressed problems in obtaining institutional credit. All respondents felt that the cost of inputs were too high and 95 per cent of them reported the problems of instability of the prices.

5.1 CONCLUSIONS

The following are the major conclusions of the present study.

1. Fish farming is a capital intensive enterprise and requires an investment of Rs.61,994.69 per hectare.

2. The total human labour utilization was higher on small farms compared to large farms. There was an inverse relationship between labour use and farm size. Fish farming is less labour intensive.
3. Seed, fertilizer and manure indicated a positive relationship with farm size whereas feed exhibited an inverse relationship.
4. The cost of fish farming had inverse relationship with farm size. There existed an inverse relationship between farm size and variable costs where as the relationship between fixed cost and farm size was direct.
5. The yield, gross return and net returns exhibited direct relationship with the size of the farm.
6. An inverse relationship between cost concepts and farm size was found in the study.
7. Analysis of input-output ratio revealed that the fresh water fish farming is a profitable venture.
8. The farm business analysis showed that all the measures of income were directly related with farm size.
9. Fertilizer had positive influence on yields on small farms, while on large farms feed and manure exhibited positive influence on fish yield. Human labour was non-significant in both size groups.
10. The break-even output was much lower than the average output. The percentage of break-even output to average yield was less on large farms with 28.32 per cent compared to small farms in which it was 47.10 per cent.
11. Producer's share in consumer's rupee was 80.00 per cent in channel II and 70.00 per cent in channel III.
12. About 50 per cent of the respondents reported need for scientific and technical training.

5.2 POLICY IMPLICATIONS:

1. Though the producers were found to obtain greater share in the consumer's rupee promotion of producer's cooperatives help the farmers to protect themselves against the price instability. and
2. Greater efforts are needed by the Fish Farmers' Development Agency in the dissemination of production technology to fish farmers, as the farmers feel that they did not have adequate access to this aspect. This information certainly makes fish farming much more attractive to the farmers.

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