ECONOMICS OF ORNAMENTAL FISHERIES IN KERALA

Thesis submitted to the
Cochin University of Science and Technology
in partial fulfilment of the requirements
for the degree of

Doctor of philosophy

By

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January 2008

CERTIFICATE

This is to certify that the thesis entitled "**Economics of Ornamental Fisheries in Kerala**" is an authentic record of research work carried out by Smt. Shyma.J under my guidance and supervision, in partial fulfilment of the requirements for degree of Doctor of Philosophy in School of Industrial Fisheries, Cochin University of Science and Technology, Kochi-16, under the faculty of Marine Sciences. No part of the thesis has been submitted for any degree or diploma.

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DECLARATION

I, Shyma.J, do hereby declare that this thesis entitled, "**Economics of Ornamental Fisheries in Kerala"** is based on the original research work carried out by me under the guidance and supervision of Dr. K. T. Thomson, Reader, School of Industrial Fisheries, Cochin University of Science and Technology, Kochi-16 and no part of this work has previously formed the basis of the award of any degree, associateship and fellowship or any other similar title or recognition.

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January 2008

Acknowledgement

I express my sincere gratitude to Dr.K.T.Thomson, Reader, School of Industrial Fisheries for his guidance, constant encouragement and advice as my research supervisor.

I thank Prof. Dr. Saleena Mathew, Director, School of Industrial Fisheries, for providing necessary facilities for my research work. My sincere thanks are also due to Professors, Dr. M. Shahul Hameed, Dr. C. Hridayanathan, Dr, Ramakrishnan Korakandy, former Directors of School of Industrial Fisheries, for their help and valuable suggestions. Dr. Ramachandran was always willing to impart critical comments regarding the course of the work. I thank all the faculty of School of Industrial Fisheries for their valuable advices.

I thank State Government and Director of Dairy Development Department for kindly granting me leave for completing the study on time. I remember with thanks the help and support given by Smt. Lucykutty.M, Dairy extension officer, and my colleagues Smt. Rejitha, C.R. and Ushakumari.C.N. of Dairy extension service unit, Pattimattom.

Help given to me by officials of various fisheries organisations, especially, T.D. Velayudhan, Retd. JD, State Fisheries., Dr. Sobhan Kumar, DGM, Matsyafed., Shri. D. Sanjeevaghosh, Retd. JD, State Fisheries and M.O. Divakaran, Retd. Inland Executive, Matsyafed., Mr. Anildev, Technical officer MPEDA, deserves special mention.

I am also very thankful to Sri. H. Krishna Iyer, Principal Scientist (Retd), CIFT, who rendered help in statistical analysis of data.

I will always remember with thanks, the ornamental fish farmers and traders of Kerala, who co-operated with me. I cannot but remember with thanks the kind help rendered by Sri Saju. M.C, Director, VANILCO, Mr. Elias Josephai, Cochin blossoms, Mr. Antony, Marathukunnu, Mr. Ittichan, Varapuzha, Mr. James Vembenikal, Kottayam, Mr. Anu, Cherpunkal, Mr. Mohandas, Edamuttom, for giving me wholehearted support to study their units in detail.

The constant support, prayers and encouragement given to me by my parents and family deserve special mention. I have no words to express my thanks to my parents. I also remember my son and husband for the many sacrifices they had to make during the period of my study.

The help extended by Dr. Sally. N. Thomas, Sr. Scientist, CIFT, Dr. Mini Sekharan, Lecturer, School of Industrial Fisheries, Smitha Nair, and other fellow research scholars and students of School of Industrial Fisheries deserves special mention.

Help given by librarians, of various fisheries organisations and CUSAT for collecting secondary data, especially, Sri. Jose.T.U of Marine Sciences Library is specially acknowledged.

I thank Mary madam of Teddy day care, who took care of my son during the busy schedules of my thesis work. Also, I thank, Sunil, the graphic designer, from Creative on demand, Thripunithura for editing the photos and Geegimol.N.V, International Academy for helping in correction of thesis.

Dedicated to

My parents

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CHAPTER 1

Introduction

Agricultural stagnation and declining rural employment in Asian countries has resulted in a search for alternate forms of economic activities for sustaining rural livelihoods (Lee, 2005). While many countries have relied on developing rural industries and food for work programs, a number of other countries opted to diversify agriculture and boost the potential for aquaculture to sustain livelihoods. Ornamental fisheries development in these countries has been an offshoot of this recent attempt. With the phenomenal increase in the demand for ornamental fishes worldwide, more countries have realised the economic potential of this industry and intervened directly to promote its development (Lee, 2005)[1].

During the initial phases, ornamental fish culture systems have been integrated with both agriculture and livestock, or with any related activity, in an attempt to offer a balanced portfolio of rural livelihoods. Developing the industrial base by promoting small and medium enterprises or by forming industrial clusters gained prominence later (Fernando and Phang, 1994). As a result, there has been considerable growth and diversification in ornamental fish industry worldwide.

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[1] World history of ornamental fish keeping was given by Leslie (1960) and Sagar (1978). The Indian history of ornamental fishery was explained by Vrinda (2000).

Aquarium fish keeping had been one of the major hobbies confined mainly to the aristocratic and richer sections of the society in the developed world (Alava and Gomes, 1989). In developing countries, on the other hand, this was mainly confined to the landlords and high classes of the society. During the last four decades the number of aquarium hobbyists is growing slow, but steady in the industrialised countries, and faster in particularly emerging economies (Tomey, 1997).

Lee, (2005) reported that according to World Trade Organisation (WTO), international trade in ornamental fishes was valued at about $450 crore with an annual growth rate of eight percent. Of this, Asian countries accounted for a significant 60-70 percent share. The largest markets for tropical fish are United States of America, European Economic Countries and Japan (Dey, 1996). 50 percent suppliers are in Asian countries with main destinations as described above. 90 percent of the freshwater ornamentals traded are captive bred. In addition, there are hundreds of species, which are available only as wild-caught specimens. Major centres for wild-caught freshwater fishes are the Amazon River basin, the Congo River basin and the major rivers of Southeast Asia. Indonesia, Philippines and Srilanka are the major suppliers of marine ornamental fishes. 80 percent of the freshwater ornamental fish in the market comes from Southeast Asia with Singapore and Hong Kong as principal suppliers[2]. Malaysia with

[2] Singapore is known as the ornamental fish culture centre of the world. It is the world's largest producer and exporter. As described earlier, Singapore started ornamental fish culture as a livelihood option where concrete tanks, net cages and

9.3 percent share stands next, followed by Florida with ornamental fish aquaculture, worth US$ 60 million and Thailand in global export of ornamental fish (Singh, 2005). Other developing countries, although contributed negligible proportion to international trade, their contribution is expected to increase considerably in future.

Ornamental fish industry in India is in a primary stage. India ranks one among the top few countries having ornamental fish reserves. Eighty percent of the ornamental fishes exported from India are wild caught and are from North-Eastern states. However, live aquarium fish exports from India during 2006-07 was 5.55 crores only[3](MPEDA, 2007). Ornamental fish production in India takes place mainly in small and medium farms and homesteads in the suburbs of Chennai, Calcutta and Mumbai, where large numbers of breeders find self-employment[4]. They breed only selected species with primitive technology (Tomey, 1986a; Dey, 1996; Mohanta and Subramanian, 2001a; Ghosh *et al.*, 2003b).

With its rich and diverse water bodies and ideal climatic conditions, Kerala enjoys the unique advantage for ornamental fisheries development. However, the process of development has never been that smooth due to the complex socio-political constitution of resource

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earthen ponds were the common culture facilities, which they recently converted to agro technology parks.

[3] Regarding ornamental fish export, neighbouring country Srilanka has achieved a growth of 60 percent within 5 years (Ramachandran, 2002a).

[4] The statistics of ornamental fish breeding in West Bengal shows that in the state alone, about seven to ten thousand people are engaged as part-time breeders of ornamental fish (Debasis *et al.*, 2004).

uses in Kerala. As well known today, the social scenario in the state of Kerala is distinct from other states for specific reasons. Economic stagnation in the primary producing sectors with remarkable progress on social front has been problematic of Kerala[5] (Parameswaran, 1999; Saradamoni, 1999; Tharamangalam, 1999). High opportunity costs of labour, and labour migration have been related issues that challenge the design and implementation of sustainable development. Similarly, the mass inflow of essential commodities into Kerala has labelled it as a consumer state. The present study revealed that more than 83 percent of market demand for ornamental fishes in Kerala has been met from neighbouring states like Tamilnadu[6]. Hence, development of ornamental fisheries in Kerala as a viable enterprise has to be sought under these complex sets of relationships.

1.1 Ornamental fisheries development in Kerala

Ornamental fish keeping as a hobby started in Kerala with the arrival of foreigners. Dutch played a major role in making Cochin, a major centre for trade and hobby. The hobby was passed on to Anglo Indian

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[5] Authors stated that, Kerala achieved social development in the area of education, literacy and health, but failed to attain development in areas like agriculture and industry. This is usually referred to as "Kerala model development". In the urban areas, depletion of paddy fields not only reduced paddy production, but also eliminated the work force associated with it. Coconut was the second major crop and Kerala has come down from its premier position to a rank lower than the neighbouring states of Tamilnadu and Andhra Pradesh. Rubber, which was allowed to substitute many crops, is in crisis. Hence Kerala depends upon neighbouring states for practically everything, from rice, provisions, vegetables, jaggery, flowers and even to, plantain leaves.

[6] Kerala produced only about 17 percent of its ornamental fish demand (See chapter 6, section 2 for details). Not only ornamental fish, the accessories needed for the industry was also supplied by neighbouring states. Tamilnadu Government offers a number of incentives to promote ornamental fish industry, in their State (Anon, 2003)

community, who were influenced by the western culture. Majority of the buyers (90 percent) were middle aged and the demand was more for small and medium fishes, while large ones had to be ordered in advance. Social status of the upper class was reflected in the variety they used and the practice still continues. During early 1950s, ornamental fish culture was traditionally undertaken by marginalised rural people, living in coastal and remote areas, usually in homestead ponds either as full time or part time occupation. The activities were however, limited to a few species like livebearers and goldfishes and concentrated in few selected pockets.

The first aquarium at Cochin was established in 1956, at Kunnumpuram in Fort Cochin. Along with this, its counterpart at Thiruvananthapuram, "*Meenammavan*" was established and still the shop retains its position even though the ownership had been transferred. There were only less than five shops in the State at that time, compared to the 194 trading units during the study period. During those period fishes were brought from Tamilnadu by railways in tin containers. Now, plastic covers of various dimensions packed in paper cartons have replaced it. Moor market of Madras was famous for ornamental fish trade then. The aquarium accessories sold, were only aerators, stones and tubes. Local producers supplied about less than two percent of the cultured ornamental fishes to the market. During 1970s also, fishes were sent to neighbouring states like Karnataka in oxygenated tin containers, and some local producers are still following that practice. Earlier, aquariums or glass tanks were called as glass troughs or locally called as "*Meen Petti*".

Ornamental fish culture was started by late seventies on experimental basis in central Kerala. The experiments proved successful and triggered the wholesale trade of ornamental fishes in Kerala. Thus, husbandry of ornamental fish is not a new phenomenon. Ancient practices based on the modifications of natural bodies of water have just evolved into more systematic, scientific methods and techniques.

As described earlier, the major characteristics of ornamental fisheries in Kerala are that it had begun as a means to provide subsistence in rural areas, mostly by adopting/ modifying culture practices of food fish species. These ornamental fish farms were integrated either with agriculture, viz., coconut, rubber or any other vegetation. Wide and scattered pattern of ornamental fishery systems were noticed during the survey and these were not organised systems of culture. There exists no standardised technology of practices, for ornamental fishery, to follow. Biological knowledge about the fishery has been transferred from generation to generation and most of the times have been kept as family secret. Most of the firms had their own source of money to perform business activities or borrowed it from friends or relatives.

During the last two decades, economic activities based on ornamental fisheries have shown good signs of revival and growth due to the active intervention and supporting services by the State Government.

The Department of Fisheries has recently identified ornamental fishery as an untapped area with immense potential for generating rural income, employment and foreign exchange. Various schemes to promote activities were designed and implemented by the State Government, Kerala State Co-operative Federation for Fisheries Development Ltd (Matsyafed) and Marine Products Export Development Authority (MPEDA)[7]. There has been a phenomenal growth in the volume of trade in ornamental fishes. Possibilities of economic gains increased and affluent section of the society also entered into ornamental fisheries sector. They concentrated on marketing sector, due to the huge profits/easy money this trade generated, rather than concentrating on the production sector.

Ornamental fish markets mushroomed almost everywhere in the state, with complicated channels of distribution. Ornamental fish flow from neighbouring states, increased alarmingly and Kerala being a consumer state accepted every thing they dumped into its market wholeheartedly. Unfortunately, there was no proportionate increase in the supply, and domestic production stagnated.

Even though promotional activities have been formulated, this, being an evolving industry faces many difficulties and bottlenecks from various quarters related to trade, production, extension, finance, technology etc. Hence an attempt was made to unearth these bottlenecks in respective chapters and remedies and

[7] Promotional activities initiated by State Government and other institutions were described by various authors and the details are provided in chapter 2.

recommendations were suggested for developing ornamental fisheries in Kerala.

As mentioned in second chapter, most of the studies relating to ornamental fishery sector were about the resources, and export market. Literatures regarding other aspects of this fishery are lacking.

1.2 Scope and objectives

Comprehensive studies integrating production, consumption and marketing of ornamental fishes were never conducted in the past in Kerala and this study is an attempt to highlight the dynamics in a systematic manner by making a primary empirical study. The advantages of such an approach are many. First, the study entails detailed empirical data under a given time frame on various inter linked economic activities in ornamental fisheries sector. Second, the study tries to improve upon the previous discipline-bound studies by adopting an integrated approach. As Kerala has diverse ecological and climatic conditions, case studies on various ornamental fish production systems help identifying suitable culture practice for selected environmental conditions. One of the major conclusions of this study as explained in the concluding chapter is that although Kerala is blessed with favourable geographic and climatic conditions needed for developing ornamental fishery, diverse local conditions and requirements contain adopting modern methods of enterprise development.

Consumer studies conducted would help to identify the demand of ornamental fishes and the factors leading to it. Market studies would help in understanding the forces behind domestic market, which is very promising, but neglected. Viability studies throw light on the economic performance of both the production systems and the trading units of ornamental fishes. Despite the economic significance of ornamental fisheries industry, its development has been constrained due to various bio-technical, cultural, socio-economic, organisational and above all, institutional and policy failures. The outcome of the study would identify constraints facing the industry and institutional arrangements for development.

Objectives

The major objectives of the study are,

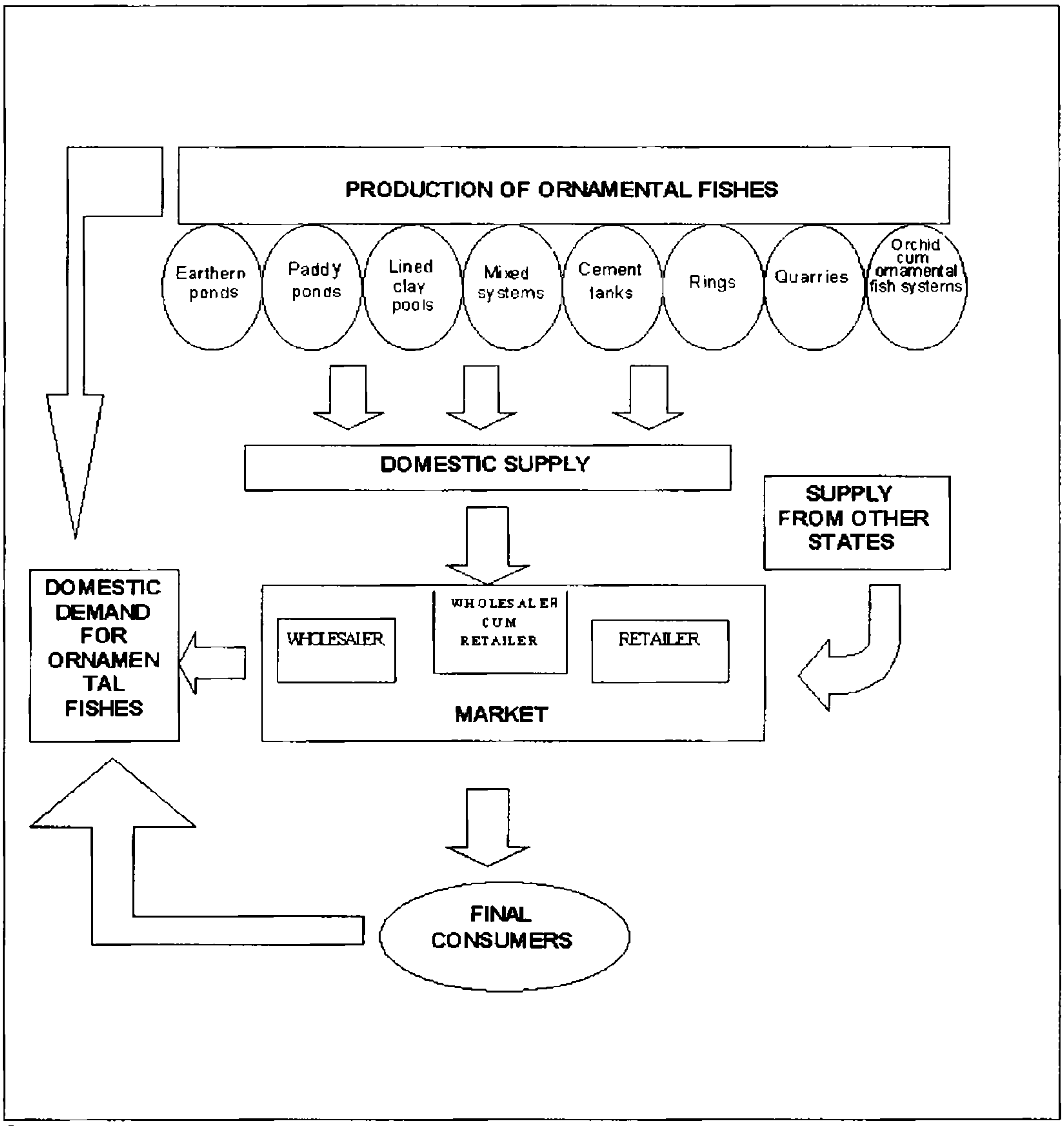
1. To describe the present status of ornamental fisheries in Kerala
2. To estimate the demand for ornamental fishes in Kerala
3. To describe the organising practices of major ornamental fish production systems in Kerala and to analyse their economic viability
4. To analyse the structure, organising practices and economic viability of ornamental fish marketing in Kerala
5. To identify major constraints that influences the production and exchange of ornamental fisheries and suggest improvements.

1.3 Analytical framework and methodology

An evolutionary approach was adopted to trace the economic issues of ornamental fisheries in Kerala. As part of various empirical micro level enquiries, the principles of oral history were adopted and detailed narration on the evolution, present structure and future potential of ornamental fisheries were elicited from respondents. These information enabled logical formulation of interlinked economic activities that provided scope for a better understanding of ornamental fisheries in Kerala.

A detailed picture of the demand and supply of ornamental fishes in Kerala is provided in Figure 1.1. Ornamental fish markets received supplies from domestic producers and external sources. Since the domestic production was unorganised and scanty, ornamental fish traders in Kerala depended heavily on external supply. The market dynamics therefore became complex and demanded active involvement of various intermediaries to facilitate market transactions between sellers and final consumers.

Fig 1.1 Analytical framework for understanding economics of ornamental fisheries



Source: Primary survey

The study begins with a detailed enquiry into the factors influencing the demand for ornamental fishes in Kerala. The demand for the most popular ornamental fish was also estimated. As a second step, a detailed examination of the bio-technical and social organisation practices of different ornamental fishery systems was done. Further enquires were made on the economic viability of ornamental fish culture systems like earthern ponds, paddy ponds, mixed systems, lined clay pools, cement tanks, rings, quarries and integrated culture systems using cost and return analysis. Finally, a detailed analysis of various modes of marketing and their economic viability was also conducted. The study would also unearth constraints that influence the production and exchange of ornamental fisheries. These analyses together determined the social adaptability of ornamental fisheries in Kerala.

1.3.1 Demand for ornamental fishes: Consumer's behaviour

Consumers value various attributes of ornamental fishes in a variety of ways. The various factors influencing purchase of ornamental fishes were identified using Garrets ranking technique (Garret and Woodworth, 1966).

Garrets formula

$$\text{Percent position} = \frac{100\,(R_{ij}\_0.5)}{N_j}$$

Where,

R_{ij} represents the rank given to i_{th} variable by j_{th} respondent

N_j represents number of variables ranked by j_{th} respondent

Respondents were asked to assign rank for factors (like price, substitute's price, income of respondent, size (small, medium and large), shape, colour of fishes, fin attributes, movement, compatibility, variety, feeding habit and health), which influenced purchase of ornamental fishes. The strongest preference was ranked as 1 and decreasing preferences were ranked accordingly. Results obtained by using this formula, were compared with Garrets ranking table and scores were attributed. The total scores of each item were added and ranks were given according to total value.

The demand for ornamental fish was estimated using multiple linear regression[8]. The following regression model was specified and estimated.

$$\boxed{Y_D=\alpha+\beta_1X_1+\beta_2 X_2+ \beta_3 X_3+\ldots\ldots\ldots\ldots\ldots\ldots+ \beta_n X_n}$$

Where

Y_D represents the quantity of ornamental fish demanded

"α" is a constant and represents the combined influence of all the other determinants of demand

β_1 to β_n represents the coefficients, which indicates the change in quantity demanded of one-unit changes in the associated variables, X_1 to X_n.

[8] Only demand functions for selected varieties are estimated and no demand forecasting was carried out.

Consumer survey was conducted to collect data and multi-collinearity was checked using SPSS. Detailed methodology is given in chapter 3.

1.3.2 Economics of ornamental fish culture

Economic viability is the most crucial incentive for ornamental fisheries development. To examine profitability of various domestic ornamental fish culture systems, a simple cost return analysis as per Shang (1990) was employed by adopting a three-step procedure, which included estimation of production costs, estimation of revenues and calculation of profits. Efficiency indices like pay back period, the ratio of net profit to total cost, the ratio of variable cost to total initial investment and rate of return on investment and total costs were also estimated. Since the focus was more to detail various production systems, no attempt has been made at this stage to compare them.

1.3.2.1 Initial investment

Expenditures incurred for producing ornamental fishes in various culture systems were of three types; viz., costs for land and building, costs for system/unit preparation, and costs for equipment.

1.3.2.2 Costs of operation

Production costs included both the fixed costs (FC) and variable costs (VC).

1.3.2.2.1 Fixed costs

Fixed costs include, depreciation, interest on initial investment, opportunity costs on own capital other costs like land lease, rent, security charges and insurance.

Depreciation

Depreciation was imputed using Straight-line method and estimated by dividing the original cost of assets by the expected years of economic life (Shang, 1990:p27).

$$\boxed{\text{Annual depreciation} = \left(\frac{\text{Cost} - \text{Salvage value}}{\text{Expected years of useful life}}\right)} \qquad \text{Eqn. 1}$$

Table 1.1 gives the economic life of various items used for calculating depreciation

Table 1.1 Estimated economic life of various items

Items	Estimated economic life (Yrs)
Building	30, 15, 20
Cement tank	10, 17, 26
Ordinary well	10
Furniture	3, 6, 8
Aquarium tank	6, 10, 17
Aquarium stand	15, 18, 25
Aerator	1.5, 2, 3
Oxygen cylinder	15, 25, 20
Pump	7, 11, 15
Generator	8
Rings	6
Hose	2, 4, 6

Interest on initial investment

As risks were involved in undertaking ornamental fish culture, provisions for granting loans were tough and farmers applied loans showing other purpose, which attracted heavy interest rates. The rate of interest on farmer's own capital was imputed as nine percent and for borrowed capital, the interest rate varied according to norms set by the respective institution. Study noted that interest rates for agriculture loans taken from banks varied from 16-20 percent per annum.

Opportunity costs and other fixed costs

As most of the farmers were undertaking culture operations in own/ inherited land, opportunity costs[9] were imputed on the basis of rent/ lease of similar ponds in the area. Some people cultivated on lands of their friends, family members, relatives or known people, which assured the safety of their stock. The value or the rental price of land varied mainly with its quality and its alternative uses. Normally no written contract/ legal document specifying the responsibilities of each party existed. Lease usually was given for one year, and in some cases extended up to five years. Other than these, tax, rent, security charges and insurance were also included under this head.

[9] Opportunity costs can be defined as the net income sacrificed from the best alternative use. The opportunity cost of resources considered in the economic analysis may be either fixed or variable and they include opportunity costs for own land, own capital and family labour (Shang, 1990).

1.3.2.2.2 Variable costs

Variable costs are system specific and care was taken to elicit all the major costs meticulously. These included costs to procure inputs for producing ornamental fishes and to keep them under controlled conditions till handed over either to final consumers or to traders. Variable costs included cost of seed, cost of feed, cost of fertilizer/ medicine/ reagents, cost of fuel/ electricity, marketing costs for packing and transportation, cost of labour and incidental costs.

Cost of seed

Seed cost included the cost for brooders and fingerlings (growers). In many cases, seed costs accounted for high percentage (40-60 percent) of total operating cost, as fingerlings were purchased for rearing purpose. In systems where farmers used quality brooders reared in own farms, seed costs were nearly fifteen percent.

Cost of labour

Labour cost has been one of the major expenditures in ornamental fish culture. Three kinds of workers were employed on ornamental fish farms. Family labour was the major form, followed by workers hired on permanent or temporary basis. Wages were paid depending on whether they were attached labourers, contractual labourers or casual labourers. Family labour was valued at the wage rate paid to hired labour.

Cost of feed

Cost of feed depended on the system used. Compared to food fish culture, feed costs in ornamental fish culture were low and varied from six to twenty five percent. The farmers lowered the cost of feed by preparing it in own farms using locally available materials and supplemented with artificial pellets bought from market. Cost of home prepared feed varied from Rs.10 to Rs.17, while artificial pellets were bought for Rs.30 per kilogram.

Cost of fertilizers/ medicines/ reagents

In ornamental fish farms, fertilizer costs depended on the area or type of the system and amounted to seven percent. Cost for medicines and reagents might reach up to three percent on normal conditions and could even go high according to the diseases and intensity of usage. Study noted that common salt was most widely used to prevent diseases.

Cost of fuel/ electricity

Costs were incurred on fuel and electricity for pond cleaning, water exchange and final harvesting. More electricity was needed in systems where water was exchanged very frequently, as in lined clay pools. As fuel/ electricity was needed for pumping water from well, pond or river into the system, it was added as costs.

Marketing costs

Marketing costs included packing and transportation costs. Packing materials included plastic covers, cardboard boxes, tins, ropes and rubber bands. Supplying to markets located nearer to production centres reduced transportation costs.

Incidental costs

Incidental cost is associated with risks, unnatural death of organisms and other miscellaneous expenses. Man-made hazards like poaching and pollution of farms by miscreants posed severe threats to the systems. Risks also arose due to attack of birds, amphibians, reptiles and some invertebrates. Water pollution and disease outbreak could destroy the entire crop during a year.

1.3.2.3 Revenue

Total revenue (TR) of a farm is the total value of the sale proceeds of ornamental fishes obtained during the study period in current prices. This is the value obtained by adding cash and credit sales, value of own consumption and in-kind payments.

1.3.2.4 Profit

Net profit (P) is the difference between the total revenue received by the farmer and the total costs of production.

$$\boxed{\textbf{Net Profit = Total Revenue - Total Cost}} \qquad \text{Eqn. 2}$$

Pay back period was calculated using the formula

$$\textbf{Pay back period} = \frac{\textbf{Initial investment}}{\textbf{(Net profit + depreciation costs)}} \qquad \text{Eqn. 3}$$

1.3.3 Economic viability of ornamental fish trader

To estimate economic viability of ornamental fish traders, economic principles mentioned in section 1.3.2 were followed. Initial investment, fixed and variable costs were identified and profit and revenues were estimated. Efficiency indices like pay back period, rate of return on investment, fixed costs, variable costs and total costs were also estimated.

1.3.3.1 Initial investment

Initial investments for land acquisitions and buildings; infrastructures like well, cement tanks, aquarium tanks; equipments like aquarium stand, motor, tools, generator, vehicles, aerators, hose, oxygen cylinder and miscellaneous items like scoop nets, feed trays, tubes, filters etc. were calculated. Cost of land was considered as initial investment, if it was purchased for doing the business.

1.3.3.2 Fixed costs

Fixed costs included depreciation on infrastructure and equipments, interest on initial investment, opportunity costs and other costs, which included tax, rent, insurance and security charges. Depreciation was calculated using straight-line method[10].

Interest on initial investment used for fixed or operating capital was estimated at prevailing average bank rate. The rate of interest on capital was taken as nine percent for own capital and 12-16 percent for capital borrowed from banks or other institutions. Rent, being payment made by trader to another party for using a unit for operation was fixed according to the location of the shop. In the case of own units, imputed value of rent on par with rent of similar firms in the area was charged. If the operator owned land/ shop, then opportunity cost was treated as fixed cost. Opportunity costs for land and capital were included as costs in cost-return calculation. Tax on property was considered as fixed cost.

1.3.3.3 Variable costs

Variable costs for ornamental fish trader included costs of fishes, plants, accessories, feed, medicines, salt, electricity, fuel, labour, telephone, advertisement, packing material, and transportation. These costs changed with the volume of output for a particular enterprise. Apart from local sources, traders procured fish from neighbouring states also. Cost of fish was the major variable cost item in almost all the shops. Plants were bought locally or from the wholesale market at Thrissur. Cost of accessories was another major variable cost.

[10] See equation 1 for the formula used.

Marketing costs Included expenditure for packaging materials, transport and storage. Transportation charges were costs incurred to bring fish from neighbouring states to sale outlets and included railway parcel charges, auto charge, porter fees, and incidental charges. Packing charges included cost of packing material and related items like plastic bags, cartons, rubber band, plastic covers and rope. Opportunity costs were imputed for family labour. Other costs include costs of fuel/ electricity, feed, telephone etc.

1.3.3.4 Economic analysis

In order to evaluate the economic performance of different trading units the net profit, pay back period and rate of return with respect to investment, fixed cost, variable cost and total cost were estimated using standard methods[11].

1.4 Study Locations

Case studies were selected from various districts of Kerala for detailed examination of production systems. Table 1.2 shows sampling stations and are marked in figure 1.2.

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[11] See equation 2 and 3 for the formula used

Table 1.2 Sampling stations and locations

District	Type of system	Case study locations
Ernakulam	Earthern ponds	Varapuzha
Kottayam	Paddy ponds	Cherpunkal
Kottayam	Mixed systems	Athirampuzha
Ernakulam	Cement tanks	Koothattukulam
Ernakulam	Rings	Kuzhippilly
Kannur	Lined clay pools	Thalikkavu
Thrissur	Quarries	Wadakkancherry
Thrissur	Orchid cum ornamental fish system	Edamuttom

1.5 Database

The study employed both primary and secondary data. Secondary data was collected from various sources, to review the literature on biological, social and economic aspects of ornamental fisheries. Matsyafed made available a list of participants in international aquarium exhibitions, held during the year 1998 and 1999. Although partial, this list enabled to establish proper relations with traders and identify domestic producers. Directory of ornamental fisheries and trade units in Kerala provided by Department of Fisheries (2001) was updated during the primary frame survey to identify the actual number of traders existing in Kerala. Hence the population of traders selected for the study increased from 171 to 194. Moreover, the PANFISH book published by the Department of Fisheries (2002) contained information of ornamental fish farmers in different districts of Kerala.

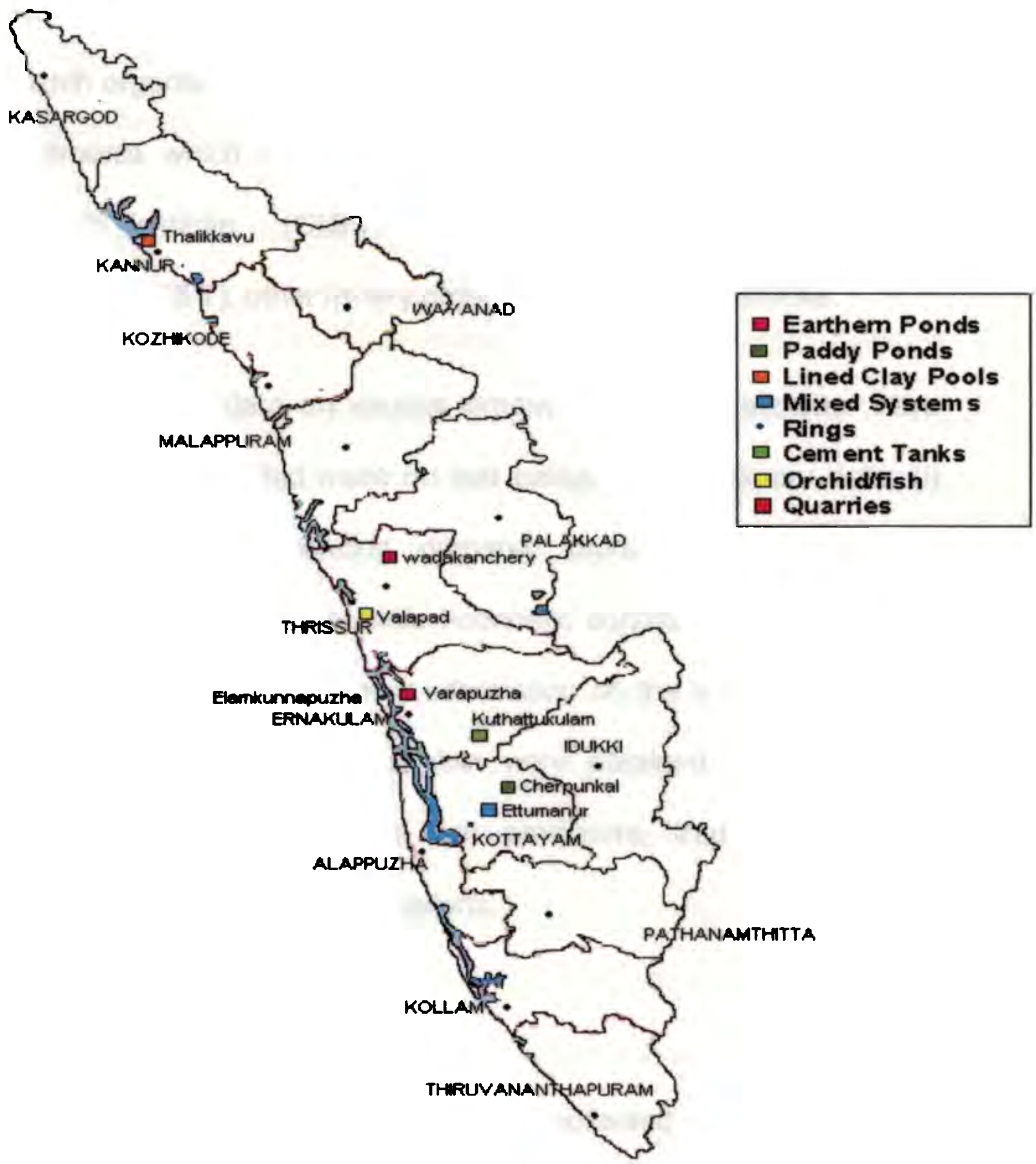

Fig 1.2 **Map showing location of case studies**

Other than this, there are several secondary data sources, which provided information related to the problem, like various publications of research organisations,non-governmental organisations, administrative departments which include MPEDA, The Central Marine Fisheries Research Institute (CMFRI), The Central Institute of Fisheries Technology (CIFT), other fishery organisations and Universities.

Since secondary data on various ornamental fishery systems were scanty, the study relied more on two categories of primary data, (i) data on factors influencing demand, production, marketing of ornamental fishes and the socio economic conditions of consumers, farmers and traders (ii) Primary information on the evolution, growth, technical know-how and constraints were obtained by interviewing fishery personnel, ornamental fish producers, traders, scientists, experts, consumers and organisations.

1.6 Selection of samples

Primary data required for the study was collected during May 2000-April 2001 by designing market and production surveys. While market surveys targeted both consumers and traders, production surveys captured representations of major ornamental fish culture systems. Since the production and other related economic activities depended on the behaviour of consumers, a consumer survey was first carried out to understand the demand for ornamental fishes. Market surveys were subsequently organised to capture the complex behaviour of traders in various markets. These were followed by detailed surveys of local producers to elicit how these diverse groups responded to markets. Data obtained from surveys were analysed using excel and SPSS packages.

1.6.1 Organising market surveys: consumer demand

The study adopted a stratified random sampling for selecting locations and samples. First, Ernakulam district was selected because of the availability of all types of ornamental fishes (freshwater, brackish water, and marine fishes) and a diverse population interested in this hobby. Second, the district was divided into corporation, municipal and panchayath areas and the number of shops were selected. Average number of persons visiting a retail shop was identified and 85 customers were selected. (See table 1.3). The respondents were interviewed using pre-tested designed questionnaire[12] for capturing details on their socio-economic status (income, age, experience, education, gender and occupation) and factors influencing demand.

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[12] See Annexure 3 for the questionnaire for consumer survey

Table 1.3 Selection of samples for consumer surveys

Area	Corporation	Municipality	Panchayath
Average number of consumers visiting a shop per day	100	50	15
Samples selected	60	18	7

1.6.2 Organising marketing surveys

For the purpose of marketing study, Kerala was divided into three zones; south zone with Thiruvananthapuram, Kollam and Pathanamthitta districts; central zone comprising Alappuzha, Kottayam, Idukki, Ernakulam, Thrissur and Palakkad districts and north zone comprising Malappuram, Kozhikode, Wayanad, Kannur and Kasaragode districts. Since there are many ornamental fish traders in all these zones, multistage random sampling was adopted to select traders. Based on the information gathered from baseline survey, mode of operations and volume of trade handled three groups of traders viz; wholesaler (wholesale trade only), wholesaler cum retailer (both wholesale and retail trade) and retailer (direct sales to customer) were selected. Consolidators[13] were included in wholesaler cum retailer group, as they possessed almost all the characteristics of this category. A total of thirty trading units (one wholesaler, eight wholesaler cum retailer and 21 retailers) that make 15 percent of the total were selected for detailed study (Table 1.4).

[13] See chapter 6, section 1 for details.

Table 1.4 Selection of samples of traders for marketing surveys

Zones	Wholesaler	Wholesaler cum retailer	Retailer	Total
South	0 (0)	11 (4)	73 (9)	84 (13)
Central	1 (1)	7 (2)	64 (8)	72 (11)
North	0 (0)	4 (2)	34 (4)	38 (6)
Total	1 (1)	22 (8)	171 (21)	194 (30) **(15%)**

(Figures in brackets represent number of samples selected for study)

Data was collected through personal observations and by interviewing different categories of traders using pre-tested designed questionnaires[14], during monthly visits to various units and the data was cross-checked with producers and agents to ensure reliability.

1.6.3 Organising ornamental fish producer surveys

As indicated earlier, total number of ornamental fish farmers was derived during frame survey using the preliminary information provided by Matsyafed. Since only few people were engaged in the culture of ornamental fishes in Kerala, Case study method[15] was adopted for generating detailed information on various aspects of production (Denscombe, 1999; Aeker *et al.*, 1997). Visits to production units were made on monthly basis. The study incorporated the most important

[14] See Annexure 4 for the questionnaire for ornamental fish traders.
[15] The advantage of case study method is that, it focuses on just one instance of the thing that is to be investigated. Moreover, case studies provide detailed information on relationships and processes that are relevant for future planning.

patterns, monitored the general tendency and variability. Other than the investment and operational details, data on various organising practices like, work organisation, relation with traders, ownership patterns, education status, occupational diversity, environmental impacts, social conflicts, externalities, introduction of exotics, poaching and effects of birds on ornamental fish aquaculture systems were collected through specifically designed questionnaires[16]. Schedules were tested and modified for non-responsive questions.

1.7 Limitations

The study suffers from a few limitations. One of the limitations felt during the course of study was the tendency of certain traders to exaggerate input costs and under-rate figures of revenue. Lack of proper records of farm activities affected the precision of facts and figures. It is however believed that such deviations would not affect conclusions of this study. Moreover, as the focus is more on formation of demand functions for selected major varieties of ornamental fishes, no attempt has been made at this stage to forecast the empirical magnitudes of demand for different varieties of ornamental fishes consumed in Kerala market. This study could be used as a base material for further research. The cost and earnings of different trading units portrayed an average relationship in the industry. Each individual firm might have its individual economic activity, and profitability might lie above or below the industry level.

[16] See Annexure 5 for questionnaire for ornamental fish farmers.

1.8 Scheme of the thesis

The thesis is divided into eight chapters. The introductory chapter highlights the history, present status and issues of ornamental fisheries, scope and objectives, the framework used to guide analysis, database, methodology, and the limitations of the study. Second chapter gives a comprehensive review of literature regarding ornamental fisheries. Consumer's behaviour towards ornamental fish keeping and a detailed analysis of the demand for ornamental fishes in Kerala are provided in chapter three. The influence of socio economic status of consumers on the demand for ornamental fish is also detailed in this chapter. In chapter four, detailed description of the nature and diversity of various ornamental fishery systems in Kerala is given. Production organisation and economic viability of these selected systems are explained in chapter five. Sixth chapter explores the organisational structure, composition and market arrivals of ornamental fishes in the State. Seasonal variations in the availability of ornamental fishes and a detailed cost and earning analysis of ornamental fish trading activities are also explained in chapter seven. The emerging issues in production and marketing of ornamental fishes in Kerala are incorporated in respective chapters. In chapter eight, a brief summary of major findings of the study and concluding remarks and recommendations are provided.

CHAPTER 2

Review of literature

The economic importance of ornamental fisheries has been recognised by many developing countries for employment generation and livelihoods. The approach has been to adopt ecologically suitable culture systems by evolving micro, small and medium enterprises. In order to develop ornamental fisheries as an economically viable business activity, it is essential that we analyse major biological, socio economic and political issues and identify various constraints. Detailed examination of these factors has been undertaken by both natural and social scientists in their individual scientific inquiries. Surprisingly, majority of these studies are confined mainly to biological aspects of ornamental fisheries and trade.

Studies on ornamental fisheries around the world fall under two broad categories. The first set of studies deals with biological processes which include enquiries on (a) ornamental fish resources (b) controlled experiments and (c) studies on introduction of exotic ornamental fishes. The second category represents the influence of markets, and socio economic factors on production, consumption and distribution of ornamental fishes. Specifically these are classified into (a) consumer behaviour and market studies (b) studies on ornamental fish production (c) economic viability studies which includes economic studies and studies examining constraints and development potential of various ornamental fishery systems. The objective of this chapter is to critically examine these studies and summarise the basic contributions and limitations of these approaches. This attempt would help to draw meaningful conclusions and place the study on right perspective. The chapter is divided into three sections. Section 1 presents biological studies. Socio-economic studies are reviewed in section 2. A conclusion is given in section 3.

2.1 Biological Studies

Early studies on ornamental fisheries targeted mainly on identifying and listing various freshwater and marine fishes as ornamental fishes. In addition to these, biologists were also interested in detailing biological properties of ornamental fishes for scientific rearing and housekeeping. These studies are detailed below, beginning with identification studies.

2.1.1 Ornamental fish resources

Since indigenous fish possessed ornamental value, early studies were concerned about biological characteristics of freshwater fishes. One of the classic works to describe species wise distribution of Indian indigenous aquarium fishes was undertaken by Chhapgar (1982). In the same year Jonklaas (1982) made an attempt to assess the potential of aquarium fishes with special reference to Srilanka and India. In the early nineties, a number of attempts were made by individual researchers to report on ornamental fishes and fisheries of

Rio Negro (Chao, 1992) and Barcelos, Amazonas, Brazil, under the project, Piaba (Chao, 1996).

Dey (1996) gave a compilation of Indian, indigenous ornamental ichthyofauna, including the freshwater, brackish water and marine ones in his book, "Ornamental fishes". Brief description on mass production of ornamental fishes, markets, diseases, and procedure for setting up export-oriented ornamental fish units were also given. Arunachalam and Manimekalan (1998) studied ornamental fishes in streams and rivers of Nilgiri Biosphere Reserve. Daniels and Ouseph (1998) studied on the diversified species of indigenous, tropical aquarium fishes in the Western Ghats. Gopalakrishnan and Ponniah (1998) reported about 164 potential indigenous ornamental freshwater fishes, endemic to peninsular India with special reference to Western Ghats. Distribution of these fishes and the ornamentation of various species based on flashy colour and appearance were also given. Arunachalam *et al.,* (1998) conducted a survey of freshwater fishes and habitat features in three east flowing rivers/streams (Cauvery basin) and four west flowing rivers in Wayanad district of Kerala. Philippose (1999) reported on commercially important marine ornamental fish resources from southern areas of India, their collection, basic requirements for breeding, and trade. Sundararaj (1999) highlighted the ornamental fish resources in India, species selection, status of farming and suggested strategies for development through expansion and intensification of farm operations and proper training.

A number of recent attempts to describe the availability of important varieties of freshwater indigenous ornamental fishes offering scope for future exploitation were made by biologists. Ajith Kumar *et al.*, (1999) documented the fish fauna, abundance and distribution of indigenous fishes, which could be considered as ornamental varieties in Chalakudy river of Kerala. Bijukumar (1999a) prepared a list of indigenous freshwater ornamental fishes and their distribution in Kerala and discussed the potentials and possibilities for aquarium keeping. Kurup (1999) indicated various measures to be taken to popularise Indigenous ornamental fishes of Kerala. Sebastian and Feustel (1999) studied the availability of ornamental fishes in reservoirs and feeder streams of Kerala and detailed reasons for their depletion. They proposed environmental awareness programme and legal framework for sustainable exploitation of ornamental fish potentials. Hamel and Mercier (2001) reported that the native, brackish water aquarium fishes of Kerala were very popular abroad, and highlighted the scope for marketing of aquarium plants. Beevi and Ramachandran (2002a& b) gave guidelines for the identification of ornamental fishes and in another study they described the potential of indigenous ornamental fishes of Moovattupuzha river in Kerala. Mercy *et al.*, (2002a) studied the taxonomy, distribution, nature of acclimatisation, compatibility and behaviour in captivity of potential indigenous ornamental fish fauna of Western Ghats. Radhakrishnan and Kurup (2002a& b) described the distribution and domestication methods of various inland indigenous ornamental fishes of Kerala to estimate their marketable potential. In another study, the authors reported on the habitat preference and biodiversity assessment of potential freshwater ornamental fishes of Kerala.

Studies aimed at documenting the various fresh water fish resources in Kerala as a potential commodity for marketing them as ornamental fishes in global markets with special emphasis on their sustainability and proper management was conducted by Ramachandran (2002a& b). Sekharan *et al.,* (2002) studied various species of indigenous freshwater fishes and plants that possessed ornamental values in Chalakkudy river and highlighted major problems and issues in marketing. Kurup and Radhakrishnan (2006) studied the indigenous omamental fish resources of Western Ghats and suggested management measures for conservation.

2.1.2 Controlled experiments

Controlled experiments like food and feeding experiments, breeding techniques, genetic improvement studies and effect of medicines on ornamental fishes were conducted mainly on carps, gold fish and guppy. This section provides a brief summary of such studies.

Food and feeding

Dwivedi *et al.,* (1982) gave the methodology for intensive culture of various live food organisms necessary for production of aquarium fishes, and described aquarium fish diseases and their prevention. Fernando *et al.,* (1991) experimented with the diets and feeding regimes of *poecilid* fishes in Singapore. Abi-Ayad and Kestemont (1994) experimented on the diet requirements of goldfish by feeding its larvae with live, mixed or dry diet. Sheriff and Mathew (1996) carried out experiments on the enhancement of colour in gold fish by giving different diets.

Sivarajan (1999) explained various nutrients required for proper growth in omamental fishes and listed different types of live aquarium feeds. Degani (2002) studied on feed requirements of ornamental fish, blue gourami (*Trichogaster trichopteris*) by experimenting on digestible energy of proteins in feed. Mercy *et al.,* (2002d) studied the food and feeding habits of *Puntius melanamphyx* (Day)- an endemic ornamental fish of Western Ghats- based on gut content analysis. Ahilan and Kumaran (2003) studied the effect of live food organisms on the growth and gonadal maturation of gold fish (*Carassius auratus*) and found that live feed such as artemia has double the effect on fish fed with earthworm. James and Sampath (2004) studied the effect of animal and plant protein diets on growth and reproductive performance in ornamental fish, *Xiphophorus helleri*, and found that 45 percent animal protein gave maximum body length and growth rate.

Breeding

Alava and Gomes (1989) studied the breeding of the anemone fish, a marine ornamental fish. Commercial breeding techniques of gold fish was given by Subramanian (1993) and that of discus was given by Anthony *et al.,* (1996). Mohanta and Subramanian (2001b) examined the general biology, breeding and water quality parameters, of various varieties of gold fish. The author calculated that 90 percent of ornamental fish feed was imported which escalated feed costs for farmers. Mercy *et al.,* (2002b) conducted breeding experiments on *Danio malabaricus* (Jerdon), an endemic, indigenous freshwater ornamental fish of Western Ghats in captive conditions. Phukon and Biswas (2002) studied the maturity and spawning of an ornamental fish, *Erethistes pussilus.* Ramachandran *et al.,* (2002) explained the breeding details of popular exotic ornamental fishes. Breeding technique of Malaysian golden arrowana, *Scleropages formosus* in concrete tanks was given by Suleiman (2003).

Samsal *et al.,* (2004) reported on the statistics of ornamental fish breeding in West Bengal and studied the antibiotic sensitivity of bacterial flora associated with ornamental fish. Tiwari (2004) studied the reproductive biology of the most popular exotic freshwater, larvicidal, aquarium fish, *Poecilia reticulata,* and stressed the biological, ornamental, and commercial value of guppy. Mercy (2006) discussed the steps for captive breeding technology for indigenous ornamental fishes of the Western Ghats of India.

Genetic improvements

Breeding studies conducted on ornamental fishes had provided valuable insights for genetic manipulations and enhanced the economic value of various ornamental fishes. For instance Cherfas *et al.,* (1990) studied the induced diploid gynogenesis and triploidy *in* ornamental (Koi) carp by experimenting on the timing of temperature shock on eggs. Wohlfarth and Rothbard (1991) made preliminary investigations on colour inheritance in Japanese ornamental carp, as colour forms a major aspect of ornamental fish purchase and hence commercial value. Kumar (1997) studied sex reversal in fishes, to illustrate, how male progenies could be made with effective use of hormones and mentioned about its treatment in guppy. He further pointed out the possible extinction of one partner, ecological imbalance and lack of natural competition.

Smartt (2001) detailed all major aspects relating to gold fish breeding and genetics. An account of the evolution and domestication of gold fish, genetic and biological principles and development of new varieties were presented. The significance of gold fish shows and international standards required were also mentioned.

Lutz (2003) reported that the genetic studies for enhancement of colour and finnage in male Siamese fighting fish increased its value in ornamental fish market. He commented that genetic improvement studies have tremendous economic implications for producers.

Nagesh *et al.,* (2004) studied the karyomorphology of three freshwater ornamental perches of West Bengal, *Anabas testudineus, Colisia faciatus* and *Nandus nandus* in an attempt *to* prevent erosion of genetic diversity.

Effect of medicines

Dey and Chandra (1994) studied ornamental fish diseases and the effect of medicines and local herbs for treatment. He explained that most of the chemicals/drugs used for treatment of fish diseases were very costly and small and marginal farmers could not afford to buy them. Alternate application of lime and turmeric, garlic and salt, onion bulb and salt were suggested as remedial measures against various diseases. Hota and Dey (1997) studied in-vitro effect of turmeric on fish pathogenic bacteria and reported that crude extract of turmeric was effective against pond bacteria like *Staphylococcus aureus* and *Aeromonas sp.* Umadevi and Reddy (1999) studied the effectiveness of betel-nut (*Areca catechu*) for the treatment of few common diseases of aquarium fishes and explained the disadvantages of chemotherapeutants. They found that tail rot, fin rot, body ulcers and gill infection were curable using *Areca catechu* and suggested resorting to locally available herbal medicines to cure diseases. Vartak *et al.*, (2002) studied the effect of natural clove oil as an anesthetic on the fry of exotic ornamental fishes like silver dollar (M*etynnis schreitmuelleri* ahl), swordtail (*Xiphophorous helleri,* Heckel) and pearl gourami and found that it was cost effective compared to MS 222 and other anaesthetics. Lipton (2006) explained the various diseases of ornamental fishes and their control.

Growth related studies

Mercy *et al.,* (2002c) studied the length-weight relationship of *Puntius denisonii*, an endemic endangered ornamental fish of Western Ghats and found that it has isometric growth. James and Sampath (2003) studied the optimum stocking densities, survival, growth and reproductive potential of red sword tail by rearing it at different stocking densities of water, under aerated and non aerated condition and found that 10 fish/50 L (10d) could be considered as optimum density. Mondal and Barat (2004) studied the effect of varying stocking density of swordtail (*Xiphophorous helleri*, Heckel) on the water quality and growth rate.

2.1.3 Introduction of exotic ornamental fishes

A number of exotic freshwater fishes were introduced into Indian waters over the last two decades and some of these gained ornamental status due to wide acceptance by consumers. However, very few studies were conducted to find out the effect of these exotic ornamental fishes, on the fauna.

Baskar *et al.,* (1989) listed 261 species of egg laying and 27 species of exotic freshwater aquarium fishes introduced into Indian waters and their role in the aquarium fish trade in India. Natarajan (1989) explained the risk–benefit analysis of the ecological and aquacultural roles of exotic fishes in India. Many scientists had warned policy makers about the potential dangers of uncontrolled introduction of exotics into Indian waters. For instance, Jhingran (1989) gave the status of exotic fishes in India, and about the introduction of almost 300 exotic fish species and warns about the possibility of threat. Acharya *et al.,* (1997) gave a review of the exotic fishes in India, purpose of introduction, threats caused by their introduction and associated risks. Kurup (1998) claimed that the clandestine introduction of exotics has threatened indigenous fish diversity in Kerala. He further suggested that location specific habitat management plans, conservation through participation of local communities, mass awareness programs and liaison with NGOs, fishery officials and local panchayath are essential for conservation of fish diversity.

Bijukumar (1999b) warned about the threats of piranha, and African catfish to our fauna if escaped from captivity. Ansal *et al.,* (2000) reported the biological impact of exotic fishes on native fish fauna and gave a description on how these exotics established dominance over native varieties.

The review of biological studies highlighted that a number of complex issues related to the breeding, survival, growth, feeding and genetic manipulations were the subject matter of scientific inquiries. As the focus of these studies was more on biological and technical specificities, they could only make casual references to the economic and social organisation of ornamental fisheries. This lack of emphasis on social and economic factors has produced only a partial understanding of ornamental fisheries as an economic activity. The next section reviews the social and economic aspects of fisheries development.

2.2 Socio economic studies

Socio economic studies on ornamental fisheries are broadly classified into two. The first group of studies concentrated on consumer's behaviour towards various ornamental fishery systems, studies related to marketing and production aspects. The second set of studies attempts to study the, economic viability of various systems, development aspects and constraints related to the fishery.

2.2.1 Consumer behaviour and market studies

As an environmental good, economic values are attributed to omamental fishes and aquarium systems by consumers. Therefore, development of ornamental fisheries as an economically viable commercial activity depends on the behaviour of consumers and markets. In this section an attempt is made to summarise how various social scientists have analysed these issues in different parts of the world. Since studies dealing with ornamental fisheries were scanty, few studies on consumer's behaviour in related markets were also reviewed.

2.2.1.1 Consumer studies

Consumers attribute values to individual ornamental fish varieties based on colour, size, length, compatibility, movement, and survival through a complex process of value judgment. A number of social scientists have pointed out these parameters in their studies. The advantages of conducting aquarium fish fair, seminars and lectures, getting information about this hobby from various socio economic groups and the influence of market bargains on ornamental fish trade were pointed out by Brelig (2000). Theisen (2000) explained that knowledgeable staff, friendly service and wide selection of healthy fishes were essential to attract hobbyists into ornamental pet shops. Examining the problems faced by ornamental fish retailers, Marinik (2001) argued that the retailers must pass on knowledge, value and service to consumers to maintain their interests and improve market shares in pet keeping. Rice (2001) expressed concerns over the decline in aquarium clubs in America, which were once popular. Author commented that, older generations had failed to catch the passion of entertainment-soaked younger generation. Aquarium clubs competed with cable TV, music TV and internet. In the case of Sweden, Anon (2004) pointed out that lots of youngsters were attracted to aquarium fish hobby, although other leisure activities like internet and computer games were also competing for their time, as it was evident from the less number of younger customers in the aquarium fish market.

To summarise this group of studies, it was noted that a variety of social characteristics such as timely delivery of prompt services, knowledge transfer, diverse varieties of ornamental fishes, aquarium shows and competing products, are crucial factors mentioned by various authors.

2.2.1.2 Market studies

Most of the studies on ornamental fish trade concentrated on export marketing

The publication of *International Trade in Tropical Aquarium Fish* by International Trade Centre (ITC, 1979), which examined in detail, the export market for ornamental fishes in developed countries, was an eye opener to different developing countries all over the world, including India. State sponsored promotional activities of ornamental fisheries development was started in India in 1982, with a seminar organised by MPEDA in association with Central Institute of Fisheries Education (CIFE) Bombay and Bombay Aquarium Society on "Prospects of aquarium fish export from India". The seminar dealt with the maintenance and breeding of exotic and indigenous aquarium fishes, commercial viability and export. Based on the recommendations of the 1982 seminar, one-month survey was conducted by MPEDA in co-ordination with Centre for the Promotion of Imports from Developing Countries, CBI-The Netherlands.

Bawne (1982) studied the status of aquarium fish export trade in Bombay and indicated the potential of natural resources and manpower availability to boost exports. He recorded the price per piece of different sizes of marine and freshwater ornamental fishes suitable for aquarium. Belsare (1982) emphasized the need to scale-up ornamental fish culture systems and explained the basic needs, infrastructures and farm designs needed for large scale aquarium fish culture. Elamparithy (1982b) reported on the requisites for large scale breeding of aquarium fishes for exports. Sheela (1982) reported the commercial aspects and export prospects of aquarium plants and suggested that government should extend all facilities for the cultivation and export of aquarium plants.

Many cross-country studies have pointed out the export potential of ornamental fishes (Mukherjee, 1982; Elamparithy, 1982a). Swarup (1984) identified the problems and prospects of export of live cut flowers and plants and gave details of major players in trade and narrated the strategy for export promotion. He found that non-availability of high quality varieties with standard specifications could cause problems for export of above said ornamentals. Tomey (1986a) conducted survey and reported about marine ornamental resources in Lakshadweep areas and freshwater fishes in Bombay and Madras. The export potential to The Netherlands was pointed out. Tomey (1986b) reported on the transportation of ornamental fishes from India. An indication on the potentials and trends for live ornamental aquarium fishes and plants largely imported from developing countries to The Netherlands was given by Tomey (1988). International Trade Centre UNCTAD/WTO (ITC, 1995) provided a brief overview of the market for aquarium fishes of European Union, Italy, Japan and the United States of America and detailed about breeding practices, trade channels and business practices.

Madhu (1996a & b) provided details of marketing channels of marine ornamental fishes in Srilanka and explained that ornamental fish export business depended purely on trust among the agents involved right from production till the end user. Elamparathy (1999) pointed out that Indian ornamental fish industry is still in its infant stage and Government should give all assistance for its promotion. Mentioning that ornamental fisheries of West Bengal engaged seven to ten thousand part-time breeders, Mukherjee et *al.*, (1999) stated that the state accounted for more than half of ornamental fish exports from India. A detailed list of problems faced by this industry was also provided. Ekaratne (2000) reported on the status and trends of exported ornamental fish resources and their habitats in Srilanka.

Olivier (2001 & 2003) studied the world trade in various ornamental species, their distribution networks and provided an overview of supply and demand situation. Author pointed out that lack of professionalism and credibility of actors involved in this sector, irregular supply, lengthy channels of distribution, environmental problems due to over exploitation and poor organisation created hindrance to the growth of this industry. Swain *et al.*, (2001 & 2003) identified common aquarium fishes and detailed the prospects of export oriented freshwater ornamental fish culture in India. He suggested that commercial farms with necessary infrastructure facilities and due technical support are necessary to achieve mass production of ornamental fishes.

Gurumayum and Goswami (2002) reported that ornamental fish trade in North Eastern region was unorganised and based on natural collection. Concrete assessment of dimensions of trade was not available. The study claimed that 85 percent of total Indian ornamental fresh water fish trade was from Manipur.

Pramod *et al.,* (2002) studied the pattern, distribution, price structure and availability of Indian tiger barb *Puntius filamentosus* (valenciennes) and Malini's barb *P.mahecola* (valenciennes) and explained their export prospects in various markets.

Larkin's (2003) study on trade, landings and market opinions in the US wholesale marine ornamental fish market in Florida, identified factors that might limit the sales. Larkin *et al.,* (2003) assessed the profitability and value of Marine Aquarium Certified (MAC) queen angelfish (*Holocanthus ciliaris*) using "stated preference analysis" to wholesalers and retailers in the market. Das and Sinha (2003) discussed the nature of ornamental fish trade in India and underlined certain fundamental procedures in breeding, culture, export marketing and research for developing trade. In another recent attempt, Ghosh *et al.,* (2003a) studied the role of various marketing channels in wholesale ornamental fish market in Eastern India. Linkages among hobbyists in various channels were observed. The challenges- lack of permanent location, power supply, standardised price, organised society or co-operatives- faced by the industry were mentioned. Lee (2005) studied new trends in omamental fish trade in Singapore with special reference to quality and environmental certification systems, and the transformation of ornamental fish industry, from traditional one to more sophisticated one. Singh (2005) highlighted the trends in world ornamental fish trade and pointed out the major players, emerging suppliers, and identified new issues and constraints regarding the trade. Leong (2006) mentioned about the status of ornamental fish industry in Malaysia and the role of government in encouraging investment through incentives. Ling and Lin (2006) reported on the status of ornamental fish trade and farming in Singapore. Tissera (2006) examined the growth of ornamental fish industry in Srilanka, tracing back its history and present status, and emphasized that state support is unavoidable for development.

Nair (2006) described the ornamental fish trade in Indian context and gave suggestions to build up a strong sustainable export sector. Sekharan (2006) studied about the prospects of marketing the indigenous ornamental fishes of Kerala. Channels of distribution, pricing, promotion and export aspects of indigenous ornamental fishes of Kerala were studied and finally a SWOT analysis was also conducted. Sekharan and Ramachandran (2006 a&b) identified the market preferred indigenous ornamental fishes of Kerala and in another study they reported about the threats in ornamental fish export from India to Singapore. Authors reported that lesser export fare to Singapore, short duration in export, lack of storage facility, and unhealthy competition among exporters as some of the major reasons. Sekharan and Ramachandran (2007) reported that lack of transportation facilities and information dissemination as the constraints encountered by the marketers in exporting ornamental fish from India.

2.2.1.3 Studies on ornamental fish production

Early studies on the principles of ornamental fish production were more concerned with technical details than socio economic considerations. For instance the study by Brown and Gratzek (1980) examined ornamental fish farming methods with special reference to important technical aspects of fish culture in the United States of America and estimated the farm value. Alikunhi (1982) listed out the problems of commercial production and export of various ornamental fishes and suggested that proper infrastructure facilities at affordable costs to producers are needed for ornamental fish seed production. Mhasawade (1982) provided a detailed list of input requirements and costs for the breeding process of selected varieties of aquarium fish culture. Economic feasibility of selected varieties of domestic aquarium fish culture units was also worked out. Baluyut (1989) reviewed various aquaculture systems practiced in different parts of the world and pointed out that development of an aquaculture system was determined by several factors like, development goals, objectives, target beneficiaries, acceptability, marketability of cultured species, availability and level of technology, inputs, support facilities and services and environmental considerations. Fernando and Phang (1994) explored the history of freshwater ornamental fish culture, the phases of development and production practices of various exotic ornamental fishes in Singapore over the last four decades. Friese (1996; 1997a; 1997b) provided background information of freshwater ornamental fish farming in Singapore and described fish culture systems like floating net cages, concrete tanks for culture operations. The authors noted that favourable climatic conditions and market environment resulted in the growth in ornamental fish trade.

Mayadevi (1999) explained breeding possibilities of ornamental fishes and pointed out that lack of technology was the constraint for mass production. Details about care and nursing during spawning and post spawning were given. Steps to encourage new aquarium fish breeders in the state were detailed. Sunny (1999) discussed certain basic aspects of broodstock management of few selected ornamental fishes. Gopakumar (2006) reported on the culture practices of selected marine ornamental fishes with reference to production systems, feeding and nutrition. Mohan (2006) gave production details of some popular aquarium fishes like livebearers, anabantids, cyprinids, characins and cichlids and expressed that practical experience and skills are important for successful ornamental fish production.

To conclude the major insights of production studies, following observations are worth making. Most of the authors conceptualised production as a natural process and included only natural variables as determinants. From a socio economic perspective, however, production is influenced both by natural and socio-economic parameters. Thus, the major limitations of these studies from an economic perspective are quite obvious. None of these studies could suggest and/or adopt an appropriate theoretical framework to examine production as an economic process.

2.2.2 Economic viability studies

An important reason for these lacunae is the lack of sufficient applied analysis on the economics of ornamental fisheries. Therefore a brief survey of important relevant studies from aquaculture economics for throwing insights on the economic processes of ornamental fisheries is presented below. Other than these development aspects and constraints related to ornamental fishery sector were also reviewed under this head.

2.2.2.1 Economics of ornamental fish culture: A brief review

The first classic attempt to systematically present the basic economic concepts and tools for undertaking economics of various aquaculture systems was done by Shang (1981). The author detailed natural and socio economic determinants of major aquaculture systems, a method to keep accounts of various input and output variables, and the basic framework to analyse economic viability.

Many empirical studies have used these theoretical insights and researchers made several studies in many countries. For instance, Rao and Bali (1983) explained about the prospects of aquarium fish exports, and worked out the economic feasibility of aquarium fish culture for selected species. Srivastava (1985) analysed the brackish water fisheries of India, by comparing three states like Kerala, Karnataka and West Bengal. Socio-economic status of farmers, details regarding the production and marketing are also studied. Economics of operation were studied using cost-return analysis. The role of opportunity costs on farm returns was emphasized.

Ghosh and Pathak (1988) gave three model schemes for studying paddy cum fish culture systems and their financial viability in the North Eastern states of India. Shang (1990) described various economic theories and methods to conduct research on production, marketing and economic feasibility of aquaculture investments. Gupta *et al.*, (1992) studied the socio-economic Impact and farmer's assessment of Nile tilapia (*Oreochromis niloticus*) culture in Bangladesh. Raju (1997) studied on the economic analysis of different aquaculture systems in Kerala using production function approach and cost-return analysis was employed. Pillay *et al.*, (1998) studied technological advancements in shrimp seed production and worked out the economics of two types of hatcheries using cost-return analysis.

Sathiadas and Joseph (2001) analysed different coastal aquaculture production systems in Kerala to assess their cost and earnings and comparative economics. Clifford and Cook (2002) reported about thefts in shrimp farming enterprises, and the various security aspects employed by owners to counter it. Ranjeet and Kurup (2002) analysed how farmers successfully utilised paddy fields for prawn culture and agriculture. The study found that integrated farming of freshwater fish/prawn culture on a rotational basis after rice harvest was helpful in enhancing the revenue of farmers, with profit ranging from Rs 5000 to Rs.20000 per hectare. Sekharan and Ramachandran (2002) explained the economics of indigenous ornamental fish collection and marketing, based on case study from river Chalakudy. Cost and returns study were done to find out the profitability. An appraisal and survey of potential fishery resources, market and economic feasibility and management strategies were detailed. Shyma and Thomson (2002) studied the ornamental fish production in granite quarries in Kerala with special reference to pre and post management practices, social organisation, ownership patterns and economics of operation. The authors found that, people were making use of available local resources to uphold livelihoods. Merkl *et al.*, (2003) studied the prevailing marine ornamentals industry and recommended a business approach for transforming the industry. Study found out that, only a co-ordinated approach could reform the marine aquarium industry. Parks *et al.*, (2003) studied the economics of live rock and live coral aquaculture, in the United States using cash flow analysis. Sensitivity analysis was also conducted to identify thresholds of economic viability. Recommendations were provided to encourage trade. Singh (2003) analysed the economics of fish production and marketing in Bihar. Ghosh and Sureshbabu (2006) discussed various considerations adopted for preparing the techno-economic viability of freshwater ornamental fisheries schemes in West Bengal using a database on a lotus package prepared by NABARD. Economics of breeding cum rearing units were compared to find out financial viability.

2.2.2.2 Development studies

During the course of their studies, natural and social scientists have raised a number of development issues and identified various constraints that affected the process of production, marketing and consumption of ornamental goods and services. An identification of these issues is essential for planning extension and management services to ornamental fish industry in this country. A review of these issues is the focal point in this section. As a matter of fact, studies dealing with extension services and management are scarce. Cholik *et al.*, (1980) reported about the need and constraints for further development of artisanal aquaculture in Indonesia. Ranabal and Delmendo (1980) studied the role of various small-scale aquaculture systems for Asian region. Technical and economic requirements for accelerating development were enumerated, and recommendations for evolving rural institutions and supportive technical and financial assistance were summarised. Rao (1980) stated that credit must be linked to technology, output and price, in order to stimulate growth in small-scale fisheries sector.

Alikunhi (1982) highlighted the problems faced by farmers and enterprises engaged in the commercial production and assembly of exportable ornamental fishes from India and called for Government assistance to develop the sector. Shenoy (1982) analysed the scope for developing export trade of tropical fishes from eastern region, especially, West Bengal. He suggested that, to develop this trade, production has to be increased through organised collection centres with proper Government support. Sane (1982 a&b) gave a brief history of ornamental fisheries development and efforts and stressed the role of various organisations in ornamental fishery development in India and in another study described about the packaging and transport of live tropical aquarium fish. Nopany (1987) emphasised that lack of knowledge in export procedures and exorbitant freight charges to major destinations were problems facing ornamental fish exports.

Pathak and Mohanakrishnan (1988) gave a comprehensive account of the role of financial institutions in fisheries development, procedure and constraints faced to avail loans and remedies to overcome these problems for future development. Andrews (1992) expressed concern over the impacts of excessive growth of ornamental fish trade on the wild population of freshwater and marine ornamental fishes and gave suggestion for conservation.

Pillay (1992) discussed the available information on the environmental and socio economic aspects of various aquaculture systems, ranging from scenic beauty to genetic dilution of aquatic communities. Management measures to reduce environmental problems were suggested. Shariff and Subasinghe (1992) explained various scientifically sound and effective health management programs adapted by aquarium fish farmers and traders in order to maximise gains from ornamental fish industry. Chao (1993) reported on the conservation of Rio Negro ornamental fishes. Pillay (1994) provided a critical appraisal of development experiences of aquaculture industry, for assisting formulation and implementation of future plans and strategies.

Giriappa (1995) reported issues in rural development with special reference to Dakshina Kannada fisheries and suggested that good governance and institutional arrangements were necessary for economic growth. Nash (1995) explained the environmental, social and demand factors, which influence growth in aquaculture. Roy (1996) found that even though ornamental fishery provided livelihoods and foreign exchange earnings in Srilanka, better collective action was essential to manage fishery. Devaraj *et al.,* (1997) reported on the learning from integrated farming of angelfish with aquarium plants and vegetable cultivation in *Chellanam* village of Cochin. The authors found that, demonstration helped villagers to understand the viability of ornamental fish culture. Shang and Tisdell (1997) discussed the relationship among bio-technical, environmental and socio-economic factors for sustainable development of aquaculture at micro (farm) and macro (societal) levels. Tomey (1997) gave a review of the trends and future prospects of development of world's ornamental fish trade. He made an attempt to look into the number of people directly depending on aquarium trade for their livelihoods in tropical developing countries.

Jayasankar (1998) explained the current status and prospects of ornamental fish culture and trade in India and mentioned that more research and development had to be organised to develop this sector. The ornamental fishery development project executed by Kerala State Co-operative Federation for Fisheries Development Ltd (Matsyafed & KSWDC, 1998) was the first and foremost move that spurt ornamental fisheries development in Kerala. Meade (1998) provided guidelines to increase the effectiveness of aquaculture operations.

Jyothilal (1999) described the present status of fisheries development in Kerala. The recent initiatives taken by the Department of Fisheries for promotion of ornamental fishery, particularly aquarium shows and exhibition since 1998, have added momentum for its growth and trade in the state. Nair (1999) suggested that as Kerala has surplus human power and limited land resources, technologies that maximise production and employment from scarce land resource were needed to develop ornamental fisheries. Parameswaran (1999) brought out the prospects and problems of development in Kerala, and stated that technology that could not be applied for small-scale production might become oppressive. Sundararaj (1999) explained management strategies for ornamental fish culture development in India.

Mukherjee, (2000) provided the problems and prospects of aquarium fish trade in west Bengal. The Directory of ornamental fisheries and trade units in Kerala, published by Department of Fisheries (2001) was of immense help to ornamental fish farmers, traders, and researchers for gathering data. Mohanta and Subramanian (2001a) stated that ornamental fish farming is a multi billion-dollar industry, and

Government should extend short and long-term loans, to encourage ornamental fish farming. Shaleesha and Stanley (2001) identified the major marketing channels involved in ornamental fish trade and examined the differences in earnings from fishery between rural and urban areas. They pointed out that the variation was due to lack of linkages between regions and suggested involvements of non-governmental organisations. Matsyafed (2002) evaluated the first phase of ornamental fishery development programme implemented through co-operative societies. The advantages of schemes to provide livelihoods to beneficiaries were stressed. Modayil (2002) explained the role of participatory intervention planning in bridging the gap between technology generation and adoption in fisheries. Nair (2002) briefed on various assistance schemes offered by MPEDA for ornamental fish farming and export. Sobhankumar (2002) explained the objectives and the benefits of ornamental fisheries development projects taken up by Matsyafed in Kerala. Srinath (2002a) reported in detail, activities done by Central Marine Fisheries Research Institute (CMFRI) in homestead production of selected groups of aquarium fishes in *Chellanam*, a coastal village near Cochin.

Ghosh *et.al.,* (2003a) described about *Hatibagan Haat*, the largest wholesale market of ornamental fish in Kolkata. Authors used participatory rural appraisal (PRA) to survey marketing functionaries. Problems faced by the market like unorganised supply, lack of standardisation of prices for fish and accessories and bargaining, were highlighted. The authors concluded that management practices have to be improved for boosting up this promising trade. Kumaran *et al.,* (2003) examined the role of extension in the development of fisheries. He argued that these inputs contributed positively for the promotion and adoption of new technologies, improved organising practices and socio-economic conditions of fish farmers. Kurup (2003) summarized the promotional activities initiated by Kerala government, and its agencies to popularise aquarium keeping, ornamental fish culture and marketing.

Gopakumar (2004) described about the collection, culture and conservation of marine ornamentals. He reported in his study that marine aquarium fishery in Australia was sustainable because of The Marine Aquarium Council (MAC) certification system. Jana and Sena (2004) reported about the overwhelming growth of aquaculture in India and pointed out that, establishing ornamental fish industry as a cottage industry in different regions of country, could boost production and export. Matsyafed (2004) evaluated the second phase of its ornamental fishery development programme, implemented through co-operative societies. The evaluation revealed that small-scale units set up by women beneficiaries in different districts of Kerala under this scheme could play a key role in the commercial production of ornamental fish in the state. The evaluation also confirmed ample demand in domestic market for good ornamental fishes and noted that marketing of products was never a serious problem. The ornamental fishery could be developed as a promising income generating activity through small-scale ventures.

ornamental fishes, lack of financial incentives and credit support to farmers and entrepreneurs were the major constraints to ornamental fishery development in Kerala.

So far we have reviewed studies conducted by individual researchers and research agencies, which identified possibilities and strategies for developing ornamental fisheries. The short review revealed that present initiatives lacked focus and suffered from serious limitations. First, the studies indicated that the process of development strategy was top-down and failed to mobilise enough community participation, essential for success. Second, the present modes of state-sponsored extension services were inadequate. Third, a number of environmental issues had to be considered for evolving sustainable ornamental fishery systems. In short, the survey provided useful insights into various development issues facing ornamental fisheries.

2.3 Summary and Conclusions

A brief survey of studies on various aspects of ornamental fisheries development revealed the complex natural and socio economic processes that guide development of this industry. The survey indicated the need for integrated efforts to develop this activity. However, systematic inter-disciplinary studies dealing with various ecological and socio economic linkages are scarce. As survey revealed, studies conducted especially in India on the production, trade and final consumption of various ornamental fishes are meagre.

Even though few attempts were made to study different types of ornamental fish culture systems in Kerala, no one had studied their inter-connections in detail. Surprisingly, no attempt has been made to study how domestic trade has been carried out in Kerala. Studies detailing major market players, their market share, the backward linkages to domestic production possibilities, the constraints faced by local producers, species composition of domestic ornamental fish trade, trade in plants and accessories, economic viability of firms etc. are not available at all. Even though, most of the people mentioned that demand for ornamental fishes exceeded supply, no reliable supporting data were available. Similarly, no attempt has been so far made to study the demand for ornamental fishes as a preliminary step towards planning production and marketing.

Therefore, the present study has been undertaken to overcome some of the basic research gaps in the study on ornamental fisheries development. As already detailed in the section on research framework and methodology, our objective is to overcome this limitation by undertaking a systematic empirical study on the dynamics of ornamental fisheries development in the state of Kerala.

CHAPTER 3

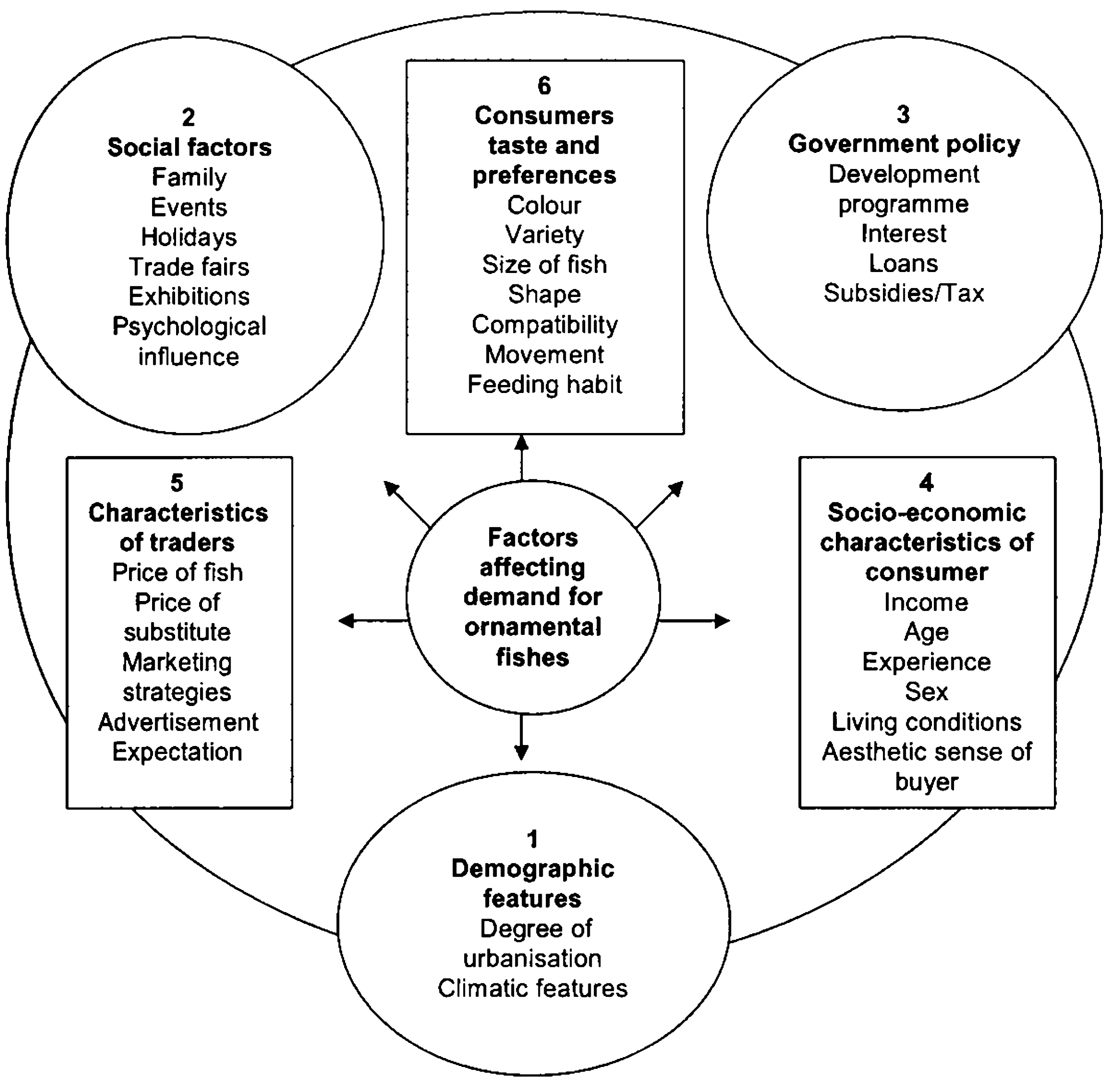
Demand for ornamental fishes in Kerala

The demand for ornamental fishes has been steadily growing in the urban and semi urban regions of the state during the past two decades. Unfortunately, detailed enquiries to identify major factors that motivate various consumer groups to purchase ornamental fish do not exist. Such micro enquiries are however necessary for crafting local initiatives for planning and designing various development programmes. A detailed analysis of the demand for ornamental fishes is presented in this chapter. The chapter is divided into three sections. First section deals with various factors that influence household's demand for ornamental fishes. A brief analysis of how socio-economic status of consumers affects demand is also presented in this section. An estimation of the demand for ornamental fish is attempted in section 2. A brief summary and conclusion follows in section 3.

3.1 Factors influencing household demand

Omamental fishes are purchased by households and non-households like educational institutions, hospitals and hotels. The theory of consumer's behaviour postulates that demand for a commodity is broadly influenced by features unique to buyers and sellers and the social environment where they interact. Thus the demand for ornamental fishes has been influenced by its own price, price of substitutes, income, age, sex, occupation and living conditions of consumers, events like exhibitions, holidays, area of living, population, climate, different fish characteristics such as variety, size, colour etc (Shang, 1981; Kotler, 1995; Salvatore, 1992). These different factors are categorised under six major heads and presented in figure 3.1

Fig 3.1 Factors influencing demand for ornamental fishes



3.1.1 Demographic, urbanisation and climatic features

Ornamental fish markets are normally located in urban areas with high population density. Degree of urbanisation, climatic variations and concentration of industries also influenced demand (George, 1982; Bassleer, 1994; Jana and Sena, 2004). Samuelson and Nordhaus (1998) pointed out that demand for a product is likely to vary over business cycle, over the seasons, on a daily or hourly basis. People preferred visiting shops and purchase ornamental fishes during sunny days and abstained from shops during rainy seasons[1].

Survey revealed that afternoons and evenings were busy times in ornamental pet shops. Most traders experienced increase in sales on saturdays. Of late, some shopkeepers started opening shops even on sundays till noon. Post monsoon (August to November) months were the best season for buying ornamental fishes where all sizes of fishes were available at moderate prices. In pre monsoon season, even though there was demand, fluctuating climatic conditions and less availability of fishes resulted in high prices. In the study area, population was high in corporation areas followed by municipal and panchayath areas. About 50 to 150 persons visited aquarium shops in corporation area daily. About 25-50 persons in municipal areas and about five to twenty five persons in the panchayath areas visited aquarium shops daily.

Tomey (1988) pointed out that in crowded industrial areas of Europe and United States, the demand for ornamental fishes was far stronger in August months. In United Kingdom the demand for ornamental fishes was high during winter and in Finland it was during September-May.

Table 3.1 shows that 50.59 percent of households kept one aquarium, 29.41 percent kept two aquariums and 20 percent kept more than two aquariums in their home.

Table 3.1 Distribution of households keeping aquariums

No. of aquariums	Area of living			Total
	Corporation	Municipality	Panchayath	
1	28	11	4	43 (50.59%)
2	17	7	1	25 (29.41%)
3	9	0	2	11 (12.94%)
>3	6	0	0	6 (7.06%)
Total	60	18	7	85 (100%)

Source: Primary survey

It was interesting to note that 50.59 percent of households kept the same number of aquariums as before, 40 percent kept more number of aquariums, and 9.41 percent of households reduced the number of aquariums, since they began this hobby (Table 3.2).

Table 3.2 Distribution of households who changed their number of aquarium

No. of aquariums	No. of house holds	Recent no. of aquariums kept by households		
		Same as before	More than before	Less than before
1	43	37	0	6
2	25	6	17	2
3	11	0	11	0
> 3	6	0	6	0
Total	85	43	34	8
Percentage	100	50.59	40	9.41

Source: Primary survey

Another interesting fact emerged in the survey was that, although most of the respondents wanted to continue this hobby, they experienced difficulty in keeping aquariums due to poor post marketing services. Table 3.3 shows that 82.35 percent of households did not purchase any aquariums during the previous year. Only 9.41 percent bought one aquarium, 5.89 percent bought two and 2.36 percent bought three aquariums during the previous year. None of them purchased more than three aquariums. This showed that in future, if left uncared, the demand for this hobby would decline.

Table 3.3 Purchase of tanks during last one year

No. of aquariums	No. of households	Percent
0	70	82.35
1	8	9.41
2	5	5.89
3	2	2.36
>3	0	0.00
Total	85	100

Source: Primary survey

Table 3.4 gives issues related to aquarium keeping and majority felt that cleaning tank was the major problem, which prevented them from continuing this hobby.

Table 3.4 Issues related to aquarium keeping

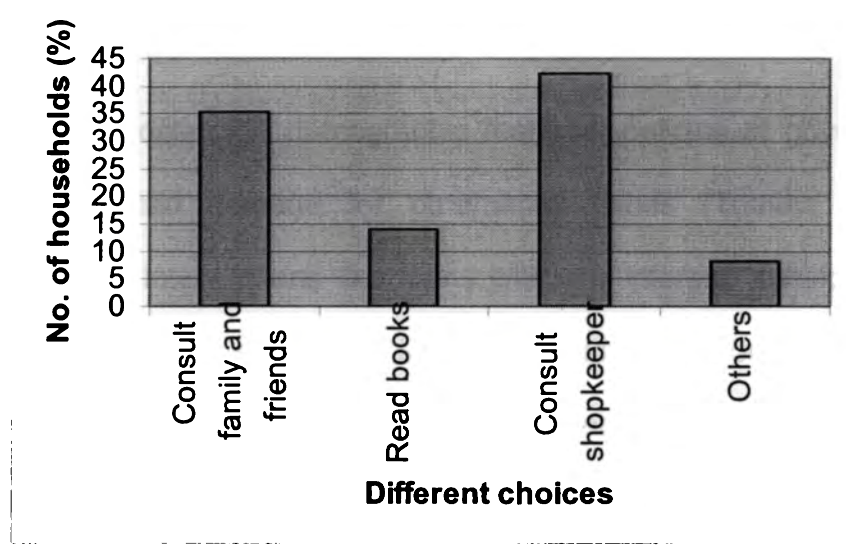
Issues	No. of households	Corporation	Municipality	Panchayath
No problems	21	17	3	1
Cleaning tank	37	25	10	2
Disease	15	10	3	2
Feeding	9	5	2	2
Others	3	3	0	0
Total	85	60	18	7

Source: Primary survey

3.1.2 Social factors

Apart from demographic features, a variety of social factors also influenced buyer's behaviour. For instance, family ties strongly influenced attitudes of buyers and ornamental values of aquariums. Figure 3.2 explains that before introducing an item into aquarium, 35.29 percent of consumers consulted their family, 42.35 percent consulted traders for more information and 14.12 percent made decisions by reading books.

Fig 3.2 Choice for introduction of expensive/ new variety



Source: Primary survey

Few households purchased ornamental fishes just for giving gifts and they agreed that gift giving enhanced inter-personal relations (Lowrey *et al.,* 2004). Majority of them cared for the hobby only during seasons like Christmas, Onam and annual vacations due to social visibility and availability of leisure time for nursing pets. During Christmas, customers purchased expensive items and spent more time to decorate aquariums for enhanced social visibility. During June, sales of ornamental fishes were dull, as consumer's diverted their income for purchasing necessities for education. Lamb *et al.*, (1992) reported that when social visibility of a product increased, time and effort taken by consumers in purchases also increased. Special occasions like birthdays, social gatherings and parties increased ornamental fish demand, as guests visited houses during that time. Aquarium shows associated with exhibitions, trade fairs, agriculture shows and flower shows also activated demand for aquarium fishes.

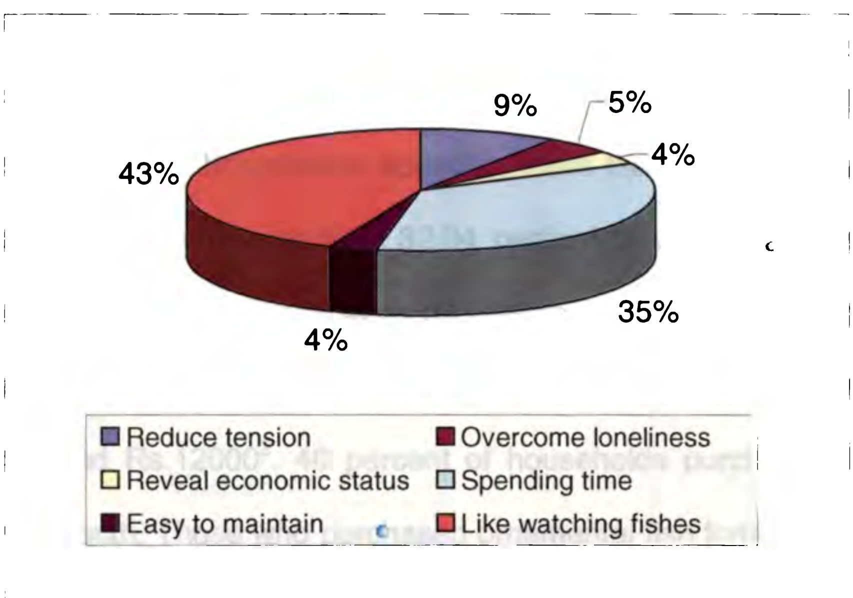
3.1.3 Government policy

Apart from social and demographic features, policies of government also influenced demand for ornamental fishes (Tomey, 1986a). Government interventions like loans with low interest, subsidies, tax concessions and extension inputs produced favourable forward movements in ornamental fish trade in recent years. Sales promotion programmes like aquarium shows created product awareness amongst prospective customers and helped introduction of new products. Aquarium shows acted as external stimuli and resulted in a sudden increase in the demand for ornamental fishes. *Matsya Alankar*, the first all India aquarium show conducted by the Government during the year 1998 promoted this hobby in Kerala. It increased demand for ornamental fishes sharply during that year. The trend continued in succeeding years.

3.1.4 Socio economic characteristics

Households turn to the hobby of keeping ornamental fishes to satisfy their diverse needs. For instance, 43 percent of sample households were interested in watching them while 35 percent turned to this hobby for spending time. This hobby reduced tension and helped to overcome loneliness for nine and five percent respondents respectively. Four percent preferred ornamental fishes as it was relatively easy to maintain aquariums and for another four percent the hobby was a status symbol. Figure 3.3 provides the details.

Fig 3.3 Reasons for keeping ornamental fishes



Source: Primary survey

Survey revealed that major consumers of ornamental fishes belonged to the age group of 16-30 years (51.76 percent) and persons above 60 rarely visited shops. Table 3.5 provides details.

91.76 percent of consumers were men. Only 8.24 percent of women visited shops due to lack of time either to buy fish or to maintain aquarium. Cultural traditions and local customs played a vital role in determining to what extend women were involved (Felsing *et al.*, 2000).

Most of the buyers were educated and students. 23.53 percent of the buyers were employed in private sector while 15.29 percent were in business and seven percent were government employees. The rest were unemployed or retired persons.

There has been a growing popularity in ornamental fish keeping in recent years. 62.35 percent of households started keeping ornamental fishes recently (within five years) and only 2.35 percent was involved in this hobby for more than 20 years.

51.76 percent of households had a monthly expenditure of Rs.50 towards this hobby. Households spending more than Rs.100 towards this hobby per month were few. 32.94 percent of respondents who purchased ornamental fishes were middle-income group that earned between Rs. 6000 and Rs. 9000 and 21.18 percent earned between Rs. 9001 and Rs.12000[2]. 40 percent of households purchased fish, once in a month. Those who purchased ornamental fish fortnightly and once in 2-4 months were comparatively less.

[2] The results confirmed earlier findings. Schiffman and Kanuk (1998) explained that education, occupation and income tend to be closely correlated in almost a cause-effect relationship. Tomey (1988) reported that major customers of ornamental fishes were the middle class people.

Table 3.5 Influence of socio economic status of sample households on demand for ornamental fishes

Attributes		No. of households	Percentage
Age			
	Upto 15	9	10.59
	16-30	44	51.76
	31-45	20	23.54
	46-60	10	11.76
	61 & above	2	2.35
Gender			
	Male	78	91.76
	Female	7	8.24
Education			
	Up to SSLC	16	18.82
	Plus one	22	25.88
	Degree	38	44.71
	PG	9	10.59
Occupation			
	Students	37	43.53
	Pvt. employees	20	23.53
	Govt. servants	6	7.06
	Unemployed	5	5.88
	Own business	13	15.29
	Retired persons	4	4.71

Experience			
	Less than 5 yrs	53	62.35
	5-10 yrs	24	28.24
	10-20 yrs	6	7.06
	More than 20 yrs	2	2.35
Income			
	Upto Rs.3000	10	11.77
	Rs. 3001-6000	14	16.47
	Rs. 6001-9000	28	32.94
	Rs. 9001-12000	18	21.18
	Rs.12001-15000	11	12.94
	Rs. 15001 above	4	4.70
Expenditure			
	Upto Rs.50	44	51.76
	Rs. 51 - 100	21	24.71
	Rs. 101-150	7	8.24
	Rs. 151- 200	5	5.88
	Rs. 201 above	8	9.41
Frequency of buying	Fortnightly	9	10.59
	Once in a month	34	40.0
	2-4 months	26	30.59
	4-6 months	12	14.12
	Others	4	4.7

Source: Primary survey

The study noted that, those people having less experience in this hobby visited the shops and bought fish more frequent than the people who had been in this hobby for long years. Study also found that experienced consumers do not spend much on this hobby and if they spend more, then the frequency of buying may be wider. Mattila and Wirtz, (2001) explained that novice customers exhibited higher levels of willingness to buy the advertised product than the experienced customers.

3.1.5 Characteristics of traders

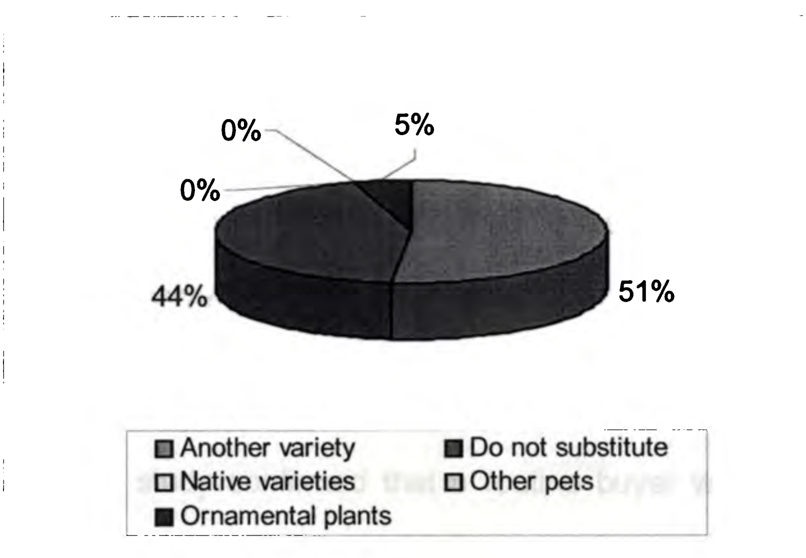
As 70 percent of shops were located in corporation area, consumers who were price sensitive moved from one shop to another to choose least cost varieties that maximised their needs. Commodities like background scenery and posters were in demand because of their ability to reduce consumer's time cost. These ancillary items were very popular in industry due to their low cost and long lasting nature. In the case of ornamental fishes, a substantial increase in price resulted only in a small reduction in quantity demanded and the demand was inelastic. There was very little consumer response to variations in price. As there were no good substitutes available for ornamental fish, price rise did not induce consumers to switch over to other products. Non-availability of a substitute was another indicator of inelastic demand. Demand tends to be inelastic for goods and services that accounted for only a small portion of total expenditure (Shang, 1981).

Price of fish and substitutes

The study noted that consumers took instantaneous decisions to substitute fishes of their choice. 51 percent of respondents substituted their favourite choice with another, 44 percent did not substitute and waited till that particular fish came to the market and only five percent substituted fishes with ornamental plants. Sekharan and Ramachandran (2002) and Chhapgar (1982) explained the advantages of indigenous varieties over exotic ones. However, the survey did not come across any one who substituted exotic with indigenous varieties. Figure 3.4 shows the nature of consumer's preferences for substitution

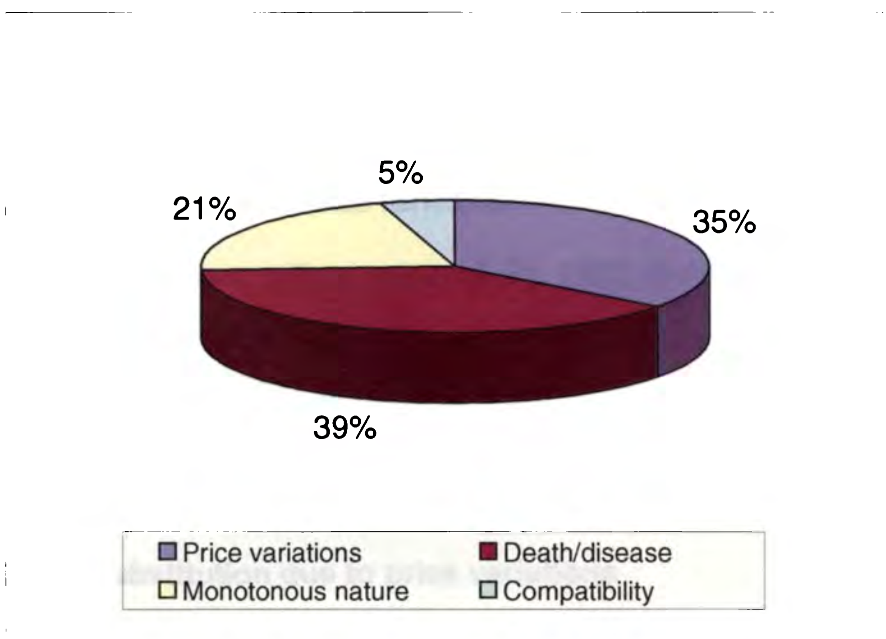
A variety of circumstances like price variation, disease/death of fish, monotonous nature, and lack of compatibility, contributed to the process of substitution. 39 percent of consumers substituted their fishes, when it died due to diseases. 21 percent rated monotonous nature as reason for substitution and 35 percent, price variations. Only 5 percent substituted fishes, due to lack of compatibility (Figure 3.5).

Fig 3.4 Consumers preferences for substitution



Source: Primary survey

Fig 3.5   Reasons for substitution



Source: Primary survey

Table 3.6 shows how consumers substituted different varieties of ornamental fishes due to price variations that occurred due to changes in size, variety or availability. Survey found that golden carp acted as a substitute for gold fish. Red platy and molly were substitutes for red sword and ordinary varieties substituted veil tail ones. Survey also noted that consumers opted for large numbers of less costly colourful fishes, which filled the aquarium to overcome the risks associated with death of expensive varieties. This was one of the reasons, why livebearers were selling more.

Therefore the study confirmed that a routine buyer would substitute other fishes of same price or with low price fishes of suitable sizes.

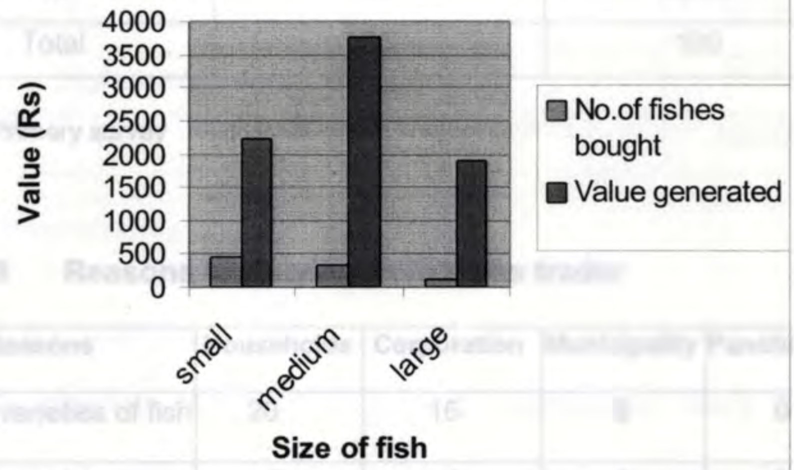
Household consumers preferred small and medium size fishes to large size ones, as they were less costly. Figure 3.6 compares various sizes of fishes bought by the households and the value generated. Respondents bought 460 no. of small size fishes having a value of Rs.2224, 334 no. of medium size fishes having value Rs.3763 and 109 no. of large size fishes with a value of Rs.1907, during the survey period.

Table 3.6 Substitution due to price variations

Size	Preferred Variety	Substituted variety	Size
Small	Ordinary goldfish	Golden carp	Small
Small	Ordinary goldfish	Golden carp	Medium
Medium	Ordinary goldfish (Veiltail)	Ordinary goldfish	Medium
Large	Ordinary gold fish	Golden carp	Medium
Small	Red swordtail	Red platy	Small
Small	Red swordtail	Red molly	Small
Small	Hifin swordtail	Ordinary swordtail	Small
Medium	Red swordtail	Red platy	Small
Small	Delta guppy	Ordinary guppy	Medium
Large	Delta guppy	Ordinary guppy	Large
Small	Balloon molly	Black molly	Large
Small	Veiltail angel	Ordinary angel	Small
Large	Veiltail angel	Ordinary angel	Large
Medium	Moonlight gourami	Blue gourami	Medium
Small	Corydoras	Sucker	Small

Source: Primary survey

Fig 3.6 Comparison between size of ornamental fish and its value



Marketing strategies

Traders always kept long-term understanding with consumers. Every buyer was given the best possible attention to motivate further visits. Table 3.7 shows that only 69.41 percent of consumers preferred buying from same seller while 30.59 percent changed traders frequently. Among the former group, 34 percent households preferred to buy from same seller, as the traders kept different varieties of fish in their shop and 24 percent rated known persons as the reason (Table 3.8). Majority of households (71 percent) in panchayath areas preferred same seller due to proximity with their living place. Regular customers got concessions, which encouraged them to buy from the same trader.

Table 3.7 Preference for buying from traders

Preference	No. of households	Percent
Yes	59	69.41
No	26	30.59
Total	85	100

Source: Primary survey

Table 3.8 Reasons for buying from same trader

Reasons	Households	Corporation	Municipality	Panchayath
Diverse varieties of fish	20	15	5	0
Low price	5	4	1	0
Availability of fish	4	2	2	0
Good quality	6	4	2	0
Known persons	14	11	3	0
Proximity	10	3	2	5
Total	59	39	15	5

Source: Primary survey

Non-availability of sufficient varieties of fish in the shop (42.31 percent), negative approach of the trader towards customers (30.77

percent) and high price were major reasons for changing traders frequently[3] (Table 3.9).

Table 3.9 Reasons for not buying from same trader

Reasons	No. of house holds	Percent
Less varieties	11	42.31
Negative approach of trader	8	30.77
High price	7	26.92
Total	26	100.00

Source: Primary survey

Most of the customers were unaware about the requirements of aquarium keeping and they consulted shopkeeper every time a problem arose in feeding, disease and exchange of water. Traders should answer consumer's queries and give skilled advices whenever they needed. Actually traders are the agents of technology transfer. They had set library of aquarium keeping to transfer knowledge free of cost and attract customers. Display of fully furnished aquariums in the shop was another marketing strategy. Traders sold other pets and plants along with ornamental fishes to absorb price fluctuations. Price discrimination was also practiced especially in trading fancy ornamental fishes where sellers managed to extract high price from buyers due to information asymmetries.

[3] **Selvarajah and Bathula, (2001)** pointed out service quality, personalised service, convenient location and access as dimensions relating to maintain loyalty. For long run prospects of the industry, the customer and trader should maintain good understanding.

Advertisement

Until recently, advertisement did not play any role to influence demand. Of late, as competition arose, customers were attracted with advertisements through newspapers and electronic media. Main advertisement in ornamental fish industry was through distribution of visiting cards and hanging of boards/ cut-outs. Display of aquariums in public places, participation in exhibitions and by word of mouth were other methods of advertisement. Advertisement conveyed information about the availability of various varieties in the shop and services offered to customers that helped them to make more informed choices. Marketing strategies are explained in detail in chapter 6.

Expectation

Expectations of traders could be formed through past experiences, dealer supplied information such as advertising, statement from sales people and by word of mouth (Spreng *et al.,* 2001). When consumers expect future price of a product to rise/fall, its current demand would change. In the year 2000 and 2001, traders bought large volumes of ornamental fish in anticipation of huge demand during exhibition season, which was later postponed, causing huge losses. Producers also lost fortunes, as there was a time gap between planning and final production of fish. Lots of producers who expected huge exhibition-induced demand during these years incurred huge loses.

3.1.6 Taste and preferences of consumers

Tastes and preference of consumers were important determinants of demand. The preferences changed rapidly in response to advertisements, fads and customs. During the survey, traders used to sell piranhas and African catfishes in the market at reasonable prices. Later, when promotional schemes were adopted by Kerala Government, production and selling of these fishes were banned in market on the ground that their introduction caused serious threats to indigenous fish fauna. The awareness created by government caused curiosity among customers and there was a sudden increase in demand for keeping these fishes, which subsequently resulted in high price due to short supply. Later the initial enthusiasm died and change in preferences caused a decrease in demand. Similarly, when fresh water sharks (tiger sharks and silver sharks) were introduced into the market, many consumers preferred buying them, as they resembled marine sharks. Later, when tiger sharks started growing oversize, consumers could not keep them in aquarium due to lack of space. Hence shift in preference resulted in the decrease in demand. Tiger oscars and suckers were also subjected to shift in preferences. Survey noted that preferences for plants also changed.

Demand for ornamental water plants increased over the past five years. Earlier, plants were not in much demand among consumers. The normally demanded variety, vallisneria, lost its popularity when other plants like, cabomba, banana plant and Amazon sword were introduced into the market leading to a price crash from one rupee to fifty paise (See chapter 6 for details). Similar trend was noted with cabomba also.

3.1.6.1 Characteristics of ornamental fishes

Colour

Dey (1996) described that ornamental fishes could be defined on the basis of attractive colouration, peaceful nature and tiny sizes. Among the factors influencing purchase of ornamental fishes, colour played a major role. Colour also played an important role in the selection of brood stock. Consumers were attracted to fishes having deep colours and colour combinations. The popularity of guppy is due to its tiny size and the varied colour pattern it exhibited. Survey noted that fishes coming from neighbouring states were more colourful than fishes cultured locally, as they were tank-raised, compared to fishes raised in earthern ponds in our state. Hence, there was more demand for ornamental fishes coming from neighbouring states.

Variety

Tomey (1997) reported that guppy was the most demanded ornamental fish variety in Japanese market. It represented 28 percent of the total ornamental fish market in Japan. He also reported that guppies were popular since they are not expensive, beautiful in colour and easy to look after even for beginners. Madhu (1996a) and Friese

(1997a) commented that guppies are the world's most popular aquarium fish.

Experienced customers always looked for new varieties. About 200-250 varieties of ornamental fishes were available in Kerala market over different seasons. Among these, gold fish was found having a permanent demand. Its popularity was due to colour, appearance and esteem in other countries. 69 percent of respondents bought gold fish, during the survey. Varieties next in demand were livebearers like guppy, molly and swordtails, followed by angels, gouramies, barbs and tetras[4].

Table 3.10 Purchasing behaviour of households

No. of varieties bought	No. of households	Percent
1	16	18.81
2	23	27.06
3	24	28.24
4	13	15.29
5	6	7.07
6	3	3.53
Total	85	100

Source: Primary survey

Table 3.10 shows the number of ornamental fish varieties bought by consumers during the survey. 28.24 percent of consumers bought three varieties at a time, closely followed by 27.06 percent who purchased two varieties. More than six varieties were bought by only 3.53 percent of sample respondents.

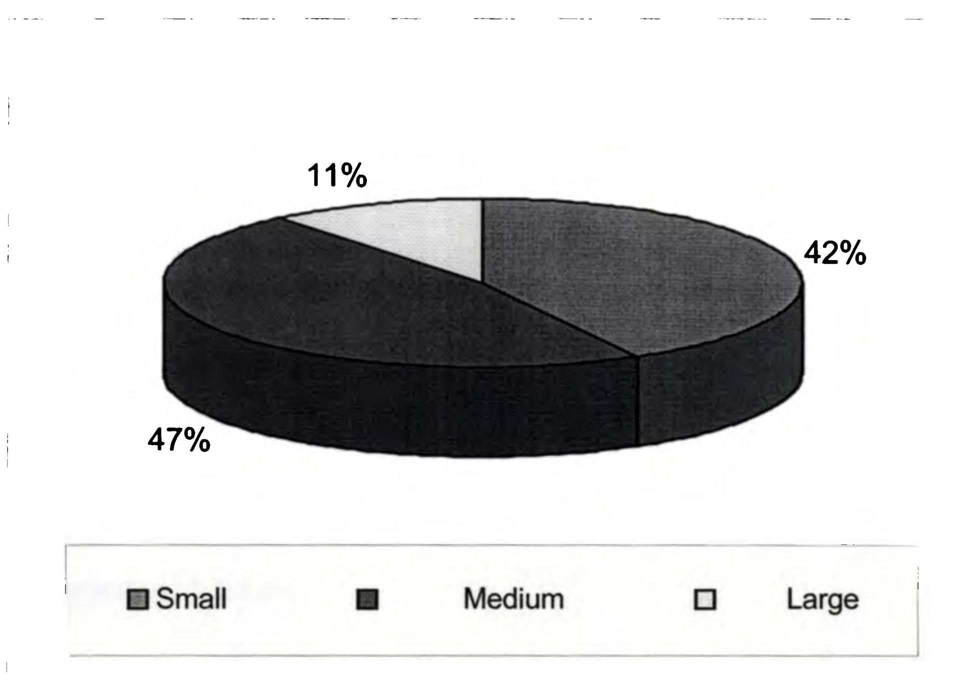
[4] See chapter 6, section 6.2 for details

Size

Another factor that contributed to demand was the size of fish. Small size fishes were cheaper than medium and large size fishes. A small increase in the size of ornamental fish would cost hobbyist more money, and so they always had to make wise purchasing decisions. The size of fish varied according to seasons and all sizes of fishes were not available round the year. Small size fishes were abundant during monsoon, whereas medium size fishes were available during post monsoon. Large size fishes were abundant during pre monsoon.

Figure 3.7 shows that usually small (42 percent) and medium (47 percent) size fishes were preferred by consumers. As large size fishes occupied more space in the aquarium, only 11 percent consumers demanded them.

Fig 3.7 Size preference of ornamental fishes for households



Source: Primary survey

Shape, fin size and other attributes

Ornamental fishes are of varied shapes. Cichlids like angelfish and discus were loved for its peculiar shape and peaceful nature. Veil tail fishes were preferred to ordinary short tailed ones. The introduction of veil-tail koi carps during the survey period, resulted in a weak market for ordinary koi carp. Males of guppy, swordtail and fighter, were preferred over their female ones, due to attractive features. Feeding habits, compatibility, peaceful and hardy nature were other attributes of consumer preferences. Since consumers value various attributes of ornamental fishes in a variety of ways, factors influencing purchase of ornamental fishes have to be analysed in detail.

3.1.6.1.1 Factors influencing purchase of ornamental fish

The various factors influencing purchase of ornamental fishes were analysed adopting Garrets Ranking Technique (Garret and Woodworth, 1966)[5]. Table 3.11 gives consumer's preferences on various factors of demand.

[5] See chapter 1 page 12 for detailed methodology

Table 3.11 Consumer's preference regarding various factors of demand

Rank→ / Features↓	Number of respondents												Total
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Income	14	14	13	10	7	5	3	6	7	2	3	1	85
Price	22	20	8	8	1	4	3	3	1	5	4	6	85
Substitute's price	0	1	5	2	4	3	3	6	7	10	21	23	85
Fish size	2	4	14	16	16	9	6	6	5	2	1	4	85
Health	2	1	3	6	4	10	13	11	10	5	8	12	85
Feeding habit	1	0	1	1	4	7	11	9	11	14	13	13	85
Colour	23	18	22	11	5	3	0	1	1	0	0	1	85
Shape	0	4	5	4	5	10	4	10	3	14	14	12	85
Fin attributes	0	8	7	7	7	11	11	5	7	8	8	6	85
Variety	21	10	4	10	8	9	5	6	9	3	0	0	85
Movement	0	0	2	5	5	5	12	14	11	14	11	6	85
Compatibility	0	5	1	5	19	9	14	8	13	8	2	1	85

Source: Primary survey

It could be inferred from the Table 3.12 that colour was the most alluring factor that motivated purchase of ornamental fishes. Following, Garret's rankings it was observed that consumer's motivations were influenced by price, variety, income, fish size, compatibility, fin attributes, health, shape, movement, feeding habit and substitute's price.

Table 3.12 Garrets ranking showing factors influencing purchase of ornamental fish

Sl. No	Features	Total Score	Rank
1	Colour	5851	1
2	Price	5221	2
3	Variety	5189	3
4	Income	5117	4
5	Fish size	4596	5
6	Compatibility	4109	6
7	Fin attributes	4011	7
8	Health	3592	8
9	Shape	3439	9
10	Movement	3436	10
11	Feeding habit	3165	11
12	Substitute's price	2849	12

Source: Primary survey

3.2 Estimation of demand

The survey revealed the basic determinants of consumer preferences. Understanding these forces gave background knowledge to traders to make pricing decisions, forecast sales, and formulate marketing strategies. Market prices brought conflicting forces of supply and demand into balance. If the quantity supplied exceeded quantity demanded by consumers, price would decline until surplus was eliminated. On the other hand, if the quantity demanded by consumers exceeded quantity supplied, price would rise until shortage was eliminated (Gwartney and Stroup, 1987). To estimate demand, data for each variable that influenced demand was collected from consumer surveys.

After examining different varieties of ornamental fishes purchased by consumers during the survey, it was found that ordinary gold fish has been invariably purchased by most of them. None of the other varieties gave this much representation. Hence, it might be considered as a proxy and was taken for estimating demand. Time series data consists of period–by-period (monthly) observations in a specific market for each of variables that affect demand. It consists of quantity demanded, income, price, tastes and preferences and other attributes for retail markets during the study period. Data exhibited variations from season to season and it was used to estimate relationships between quantity demanded and other variables. Variables that influenced demand were economic factors like price of fish, income of consumer, price of the substitute and other attributes like, age and experience of the consumer, variety and size of fish, and seasons.

The demand equation could be written as

$$\boxed{\mathbf{Y_D = f\,(X_1, X_2, X_3, X_4, X_5, X_6, X_7)}} \qquad \text{Eqn (1)}$$

Where,

Y_D = Quantity of ornamental fish demanded

X_1 = Price of fish

X_2 = Size of fish

X_3 = Income of consumer

X_4 = Age of consumer

X_5 = Experience of consumer

X_6 = Season of buying fish

X_7 = Price of substitute

Equation 1 suggests that there is a correspondence between quantity demanded and variables on the right hand side. However, the equation implies that these are general relationships only. To find out the magnitude and nature of each variable to quantity demanded, a linear form was chosen to represent the equation of market demand.

The linear form is shown in equation 2

$$\boxed{Y_D=\alpha+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7} \quad \text{---Eqn 2}$$

α represents the combined influence of all the other determinants of demand and $\beta \geq 0$. Coefficients, β_1 to β_7 indicate the change in quantity demanded for one unit change in the associated variables. Demand for the popular ordinary gold fish variety was calculated using multiple linear regression and the results are given below. While estimating, season was taken as a dummy variable of demand. d=0 for monsoon and d=1 pre monsoon and d=2 for post monsoon season.

3.2.1 Demand for ordinary gold fish

Multiple linear regressions have been employed to estimate the regression parameters. The regression equation was estimated for small, medium, and large size ordinary gold fish separately and for all sizes together. The results were checked for multi-colleniarity and found to be nil. The results are given below.[6]

For Small size gold fish, estimated regression equation was

Y (ssgf) =	**(7.7737)- (0.0574) Price- (3.3250) Size+ (0.0000) Income+(0.0644) Age -(0.0886) Experience -(0.3133) Season +(0.3826) Substitute's price**

The total variability explained by this regression was 81 percent, which was significant at $p<0.01$ (Table 3.13). The regression coefficients associated with all the explanatory variables like income, age of consumer, and price of substitute were positive and coefficients associated with price of fish, size of fish, experience of consumer and season of buying remain negative. Even though the coefficient for income remain positive, it was non significant, which showed that the income of consumer had little influence on purchase of small size ornamental fish. The coefficient of price in the regression was negative which showed that if the price of small size gold fish increased, the quantity demanded would decrease.

[6] Y (ssgf) represents quantity demanded for small size gold fish
Y (msgf) represents quantity demanded for medium size gold fish
Y (lsgf) represents quantity demanded for large size gold fish
Y (asgf) represents quantity demanded for all sizes of gold fish

Survey revealed the substitutability of golden carp for small size gold fish (see table 3.6). With the increase in size of fish and experience of consumers, the quantity demanded would decrease.

For medium size gold fish, estimated regression equation was

Y (msgf) =	**3.8024+ (0.0892) Price- (0.7503) Size+ (0.0001) Income- (0.0092) Age+(0.0297) Experience+(0.2783) Season -(0.0442) Substitute's price**

The total variability explained by this regression was 78 percent, which was highly significant at $p<0.001$ (Table 3.14). The regression coefficients associated with all the explanatory variables except size of fish, age of consumer, and price of substitute are positive. The coefficients associated with, income of consumer, price of fish, experience of consumer and season of buying remain positive.

Even though the coefficient for income remained positive, it was non significant, which showed that the income of consumer had only little influence on the purchase of medium size gold fish. With the increase in size of fish and age of consumer, the quantity demanded for medium size gold fish would decrease. Similarly with the increase in price of fish and experience of consumer the quantity demanded would increase.

For large size gold fish, estimated regression equation was

Y (lsgf) =	**-2.0589+ (0.0442) Price+(0.3983) Size- (0.0001) Income+(0.0175) Age+(0.1107) Experience- (0.0724) Season -(0.0458) Substitute's price**

The total variability explained by this regression was 99 percent, which was significant at $p<0.05$ (Table 3.15). The regression coefficients associated with all the explanatory variables except income of consumer, price of substitute and season of buying were positive. The coefficients associated with, size of fish, price of fish, age of consumer, and experience of consumer remained positive. The coefficient for income remained negative. It was mentioned earlier in section 1 that high-income class consumers who purchased ornamental fishes were negligible compared to middle-income class consumers. With the increase in size of fish, age and experience of consumers, the quantity demanded for large size gold fish would increase.

For all sizes of gold fish, estimated regression equation was

Y (asgf) =	**4.2958+ (0.1339) Price- (0.8309) Size+ (0.0001) Income+(0.0196) Age- (0.0349) Experience- (0.1408) Season -(0.1051) Substitute's price**

The total variability explained by this regression was 60 percent, which was highly significant at $p<0.001$ (Table 3.16). Regression coefficients associated with all the explanatory variables except price of fish, age of consumer and income of consumer were negative. The coefficients associated with experience of consumer, price of substitute, size of fish, and season of buying, remained negative. Even though coefficient for income remained positive and very small, it had only little influence. As the coefficient of regression for price of fish was positive and its substitute showed negative sign, this meant that as the price of gold fish increased, price of substitute decreased. In general, even if the price of gold fish increase, the quantity demanded would also increase. With the increase in size of fish and experience of consumer the quantity demanded would decrease. In certain seasons, due to non-availability of gold fish, the quantity demanded would decrease.

Table 3.13 Results of the regression analysis between independent variables and quantity demanded for small size gold fish (n=19)

	Coefficients	Standard Error	t Stat
Intercept	7.7737	3.3505	2.3202
Price of fish (X_1)	-0.0574	0.3782	-0.1517
Size of fish (X_2)	-3.3250	1.6541	-2.0102
Income of consumer (X_3)	0.0000	0.0001	0.0635
Age of consumer (X_4)	0.0644	0.0459	1.4037
Experience of consumer (X_5)	-0.0886	0.1232	-0.7186
Season of buying (X_6)	-0.3133	0.6211	-0.5043
Price of substitute (X_7)	0.3826	0.4754	0.8049

R^2 = 0.8052 Significance F = 0.003335

Table 3.14 Results of the regression analysis between independent variables and quantity demanded for medium size gold fish (n=28)

	Coefficients	Standard Error	t Stat
Intercept	3.8024	1.5255	2.4926
Price of fish (X_1)	0.0892	0.0970	0.9193
Size of fish (X_2)	-0.7503*	0.2475	-3.0310
Income of consumer (X_3)	0.0001	0.0001	1.0273
Age of consumer (X_4)	-0.0092	0.0241	-0.3806
Experience of consumer (X_5)	0.0297	0.0680	0.4368
Season of buying (X_6)	0.2783	0.2713	1.0260
Price of substitute (X_7)	-0.0442	0.1230	-0.3595

R^2 = 0.7844 Significance F = 1.7821E-05

* Significant at 1 percent level

Table 3.15 Results of the regression analysis between independent variables and quantity demanded for large size gold fish (n=9)

	Coefficients	Standard Error	t Stat
Intercept	-2.0589	0.5293	-3.8896
Price of fish (X_1)	0.0442	0.0074	5.9933
Size of fish (X_2)	0.3983	0.0900	4.4250
Income of consumer (X_3)	-0.0001	0.0000	-6.9115
Age of consumer (X_4)	0.0175	0.0015	11.5094
Experience of consumer (X_5)	0.1107	0.0122	9.0478
Season of buying (X_6)	-0.0724	0.1060	-0.6836
Price of substitute (X_7)	-0.0458	0.0081	-5.6517

R^2 =0.9997 Significance F=0.034718

Table 3.16 Results of the regression analysis between independent variables and quantity demanded for various sizes of gold fish (n=56)

	Coefficients	Standard Error	t Stat
Intercept	4.2958	0.6697	6.4144
Price of fish (X_1)	0.1339*	0.0454	2.9478
Size of fish (X_2)	-0.8309**	0.1331	-6.2412
Income of consumer (X_3)	0.0001*	0.0000	2.4995
Age of consumer (X_4)	0.0196	0.0179	1.0928
Experience of consumer (X_5)	-0.0349	0.0539	-0.6479
Season of buying (X_6)	-0.1408	0.2415	-0.5829
Price of substitute (X_7)	-0.1051*	0.0518	-2.0293

R^2 = 0.5958 Significance F= 1.08E-07

* Significant at 5 percent level ** Significant at 1 percent level

3.3 Summary and conclusions

In the present chapter consumer's behaviour was analysed to understand demand for ornamental fishes. Demand factors were broadly classified as demographic features, social factors, government policy, characteristics of traders, consumer's taste and preferences and socio economic characteristics of buyers. The analysis of socio economic features revealed that majority of consumers were new to this hobby and they belonged to middle income group and their monthly expenditure towards this hobby was Rs.50. Less experienced customers made frequent purchases than experienced customers. The analysis of qualitative factors like colour, size, and variety confirmed that these factors influenced demand for ornamental fish, other than the price of individual varieties. Estimation of demand for various sizes of gold fish revealed that for small size gold fish, the price of substitute influenced its demand, whereas for medium and large size fishes it was not an influencing factor. In all the cases, income had only little influence on the purchasing of ornamental fishes. In certain seasons, due to restricted availability of gold fish, the quantity demanded would change. The analysis indicated that lack of information and variation in consumer knowledge showed different intensities of demand, which are characteristics of this trade. Consumer survey reported that poor post-marketing facilities restraint the entry of potential consumers into this hobby.

CHAPTER 4

Present status of ornamental fish culture systems in Kerala

As already indicated ornamental fish culture has been undertaken in Kerala largely by small-scale producers in homestead earthen ponds or cement tanks under diverse ecological conditions. Farmers also integrated ornamental fish culture activities with agriculture /coconut /rubber /floriculture or ornamental aquatic plants. Traditional culture systems are therefore scattered mainly along plains and coastal areas. Many farmers practiced methods with low stocking density and low level of husbandry. They belonged to the economically weaker sections of the society and ornamental fish culture was a part time activity for supplementing household income.

Unfortunately, there exists no methodical documentation on the various types of systems used to culture ornamental fishes in various parts of Kerala. This chapter provides a detailed description of these diverse systems with special reference to their technical and ecological features in section one. After providing a brief note on the methodology adopted for system descriptions, the technical organisations of various systems and the manner by which producers undertook ornamental fish culture were detailed in section two. Section three provides the summary and conclusions.

4.1 Spatial distribution of ornamental fish culture systems in Kerala

Since ornamental fish culture systems in Kerala are diverse and scattered, a base line survey was initially organised in all districts for selecting representative case studies under various ecological conditions. Based on this survey, the major ornamental fish culture systems were classified using established scientific principles proposed by Shang (1981). Eight case studies were finalised and data on ecological and technical features collected. After the preliminary survey it was noted that Kerala could be divided into three zones viz., south, central and north zones, based on the concentration of ornamental fish culture farms. The distribution of ornamental fish farms and major systems practiced in Kerala is marked in figure.4.1. Zone wise distribution of ornamental fish farms, showing major locations and type of systems used for culture are summarised in table 4.1

Fig 4.1 Map showing ornamental fish production centres and major systems practiced

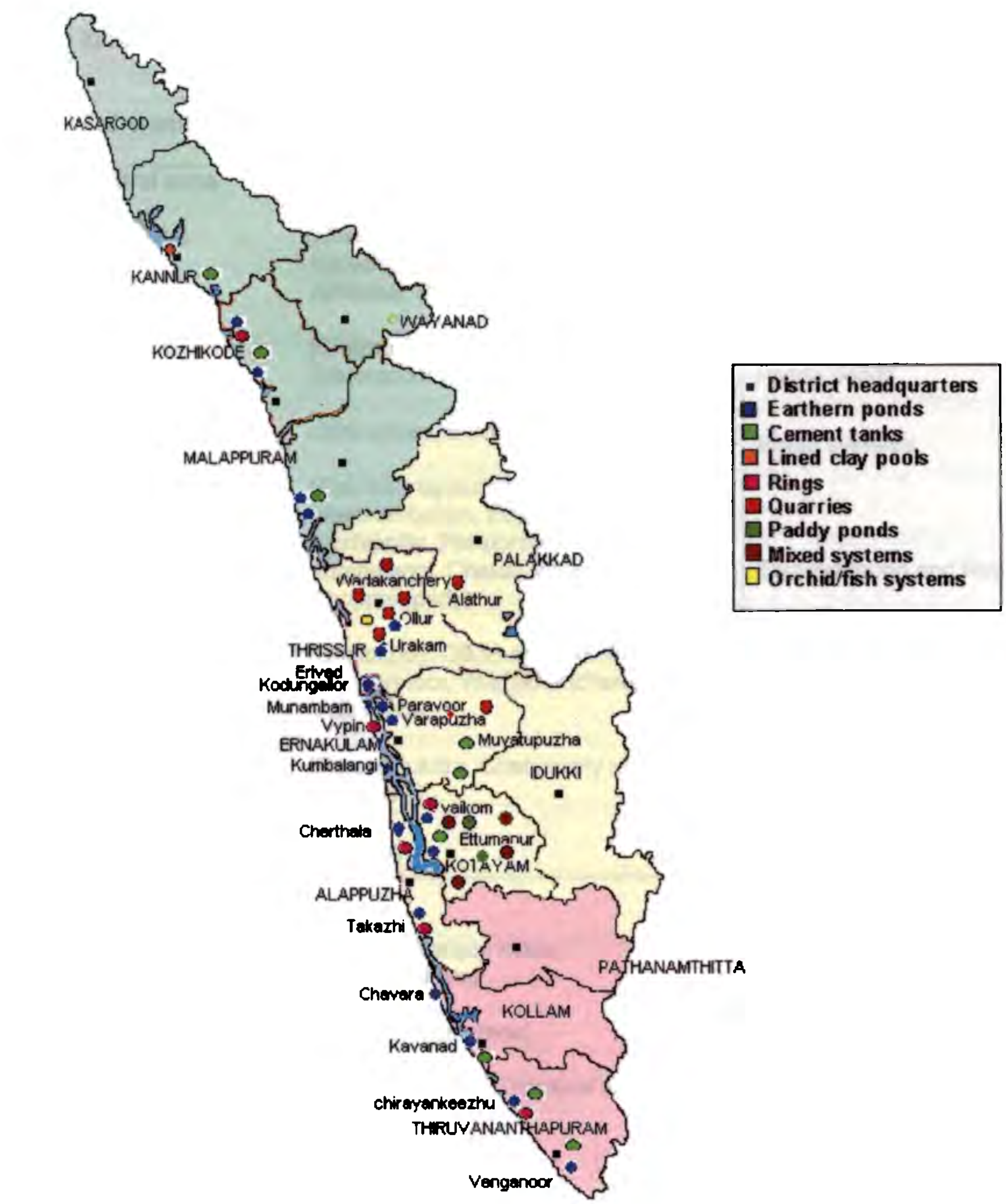


Table 4.1 Spatial distribution of ornamental fish farms in Kerala

District	Major locations	Type of system
South zone		
Thiruvananthapuram	(Pozhiyoor, Poovar, Venganoor, Chirayinkeezhu, Attingal and Vithura)	Cement tanks and Earthern ponds
Kollam	(Perinad, Kavanad, Ramankulangara, Thevalli and Chavara)	Earthern ponds
Pathanamthitta	(Intermittent)	Not popular
Central zone		
Alappuzha	(Cherthala, Pazhaveedu, Pattanakkad, Kanichukulangara, Thuravoor, Arthinkal, Punnapra and Thakazhy)	Earthern ponds and Rings
Kottayam	(Cherpunkal, Vaikom, Kumarakom, Ettumanoor and Udayanapuram)	Earthern ponds and Paddy ponds
	(Athirampuzha and nearby areas)	Mixed systems
Ernakulam	(Elamkunnappuzha, Njarakkal, Nayarambalam, Edavanakkad, Kuzhippilly, Pallipuram, Chellanam, kumbalangi, Cherai, Varapuzha and Thoppumpady)	Earthern pond and Rings
Thrissur	(Chalakudy, Ollukkara, Oorakom, Chowannoor, Wadakkancherry and Vellurkara)	Quarry
	(Puranattukara, Cherussery and Mannuthy)	Earthern pond
Palakkad	(Alathur)	Cement tanks (integrated culture) and quarry
North zone		
Malappuram	(Ponnani, Veliyamcode, Padinjarekkara)	Cement tanks and Earthern ponds
Kozhikode	(Along coastal areas)	Earthern ponds
Kannur	(Kannur, Chalad, Chirakkal and Thalikavu	Lined clay pool Cement tanks
Wayanad	(Intermittent)	Not popular
Kasaragode	(Intermittent)	Not popular

Source: Primary survey

Omamental fish culture has never been a major economic activity in south zone. However, a section of poor rural communities, especially along the coastal areas and fresh water bodies periodically undertook omamental fish culture in earthern ponds and cement tanks[1]. The present survey indicated that households settled in Pozhiyoor, Poovar, Venganoor, Chirayinkeezhu, Attingal and Vithura in Thiruvananthapuram district and Perinad, Kavanad, Ramankulangara, Thevalli, Chavara in Kollam district were engaged in this activity. Omamental fish farming was undertaken on a lower scale in Pathanamthitta district. Most of the ornamental fish farms were concentrated in central Kerala. In Kottayam district, earthern ponds dug in paddy field were popular around Cherpunkal, Ettumanoor, Vaikom, Kumarakom, and Udayanapuram regions. These paddy ponds were very small, varying from 0.25 cents to 4.00 cents with depth ranging from three to seven feet. In Alappuzha district, ornamental fish culture ponds were seen in Cherthala, Pazhaveedu, Pattanakkad, Kanichukulangara, Thuravoor, Arthinkal, Punnapra and Thakazhy[2]. Maximum numbers of small-scale, part time producers were seen in Emakulam district, especially along its northern coastal belt. In Thrissur district, ornamental fish culture was practiced mainly in quarries and

[1] Department of Fisheries (2001) made an attempt to collect data regarding ornamental fishery. Authentic information on the number of households undertaking ornamental culture in Kerala, are not available.

[2] Apart from earthern ponds, rings were also popular through out the coastal regions of the state. Rings of various diameters and height - two feet to six feet diameter and two to three feet height- were available in the market. In some areas two rings were placed one above the other to attain desirable height. The bottom of the ring also varied from flat to concave. There were rings with and without outlets. Usually, livebearers and live food organisms were cultured in rings.

earthern pond systems were also seen. Culture quarries were seen in and around Chalakudy, Ollukkara, Oorakom, Chowannoor, Wadakkancherry and Vellurkara regions and earthen ponds were popular in Puranattukara, Cherussery and Mannuthy. In Palakkad district on the other hand, large-scale ornamental fish culture in an integrated way was practiced in cement tanks. In northern Kerala, ornamental fish culture in earthern ponds, cement tanks and rings were popular in Kozhikode, Malappuram and Kannur districts while very few undertook these activities in Kasaragode and Wayanad districts. Recently few farmers have resorted to lined clay pools for culture (Winterwood, 2003; Anon, 2001).

4.2 Classification of major ornamental fish culture systems in Kerala

Ornamental fishes are cultured in earthen ponds, cement tanks and rings mostly by combining with other agricultural crops or as mixed systems. Ornamental fish culture practices are divided into pre-stocking, stocking and post-stocking activities. Pre-stocking comprises pond preparation, fertilization of system etc; stocking involved introduction of fishes into ponds for further rearing activities during a desirable period and post-stocking included water management, feeding, other management practices and harvesting (Bardach *et al.*, 1972). A brief description of these practices is presented below.

4.2.1 Ornamental fish culture in earthern ponds

Earthern ponds, locally known as *kulams* are popular in coastal regions and culture depended on seasonal availability of water. Therefore, some farmers terminated their operations when water was scarce while few others made arrangements to draw water from the nearby major water canals. Size of earthern ponds varied from two to five cents. During rainy seasons hose was used to pump out excess water.

Apart from these major ponds, cement tanks of various dimensions were also built in the farm for stocking, acclimatising, spawning, and conditioning brood stock. Figure 4.2 depicts pictorial view of a typical earthern pond system.

During the survey year, the selected respondent cultured angels, gold fish, livebearers, barbs and oscars. Pond preparations began in March /April and culture started by the end of May. Pond preparation included cleaning, dewatering, de-weeding, bund strengthening and side compacting. Ponds were drained fully by pumping out water and clay was removed fully. Lime was applied to ponds at the rate of one kg /cent to eliminate pathogens and unwanted organisms. Organic (cow dung at the rate of four kg/cent)) and inorganic fertilizers (urea, ammonium phosphate) were applied to stimulate growth of natural plankton. After fertilization, water level was gradually increased to one meter. The system specification and variety cultured in earthern ponds of the sample respondent is provided in table 4.2. Table 4.3 gives the production details of selected varieties in earthern ponds.

Table 4.2 System specifications and variety cultured in earthern ponds

Characteristics	Earthern ponds					Cement tanks		
	No.1	No.2	No.3	No.4	No.5	No.1	No.2	No.3
Area	2 cents	3 cents	4 cents	4 cents	5cents	25x8 ft	30x15 ft	35x12 ft
Depth	1.2 m	3.6 m	3.6 m	3.6 m	3.6 m	5 ft	5 ft	5 ft
Age	5 yrs	30 yrs	30 yrs	30 yrs	30 yrs	15 yrs	12 yrs	10 yrs
Shape	Circular	Circular	Circular	Circular	Circular	Rectangular	Rectangular	Rectangular
Variety cultured	Zebra angel Leopard angel Diamond angel Sword tail	Koi angel Delta guppy Platy Balloon molly Black molly	Diamond angel	Koi carp Gold fish Tiger barb Sword tail	Albino Oscar Red Oscar	Acclimatisation and breeding purpose	Acclimatisation and breeding purpose	Acclimatisation and breeding purpose

Table 4.3 Production process for the selected varieties in earthern ponds

Variety selected	Average production from a fish (No)	Average survival rate (%)	Fishes used for breeding purpose (No)	Frequency of breeding (Times)
Angel fish	400	85	13	3
Livebearers	80	70	64	4
Gold fish	1000	30	10	2
Barb	100	30	12	1
Oscar	350	58	2	1

Source: Primary survey

Water column was effectively utilised through polyculture and by stocking different sizes of fishes. Stocking density for angels varied from 200-300 fishes per cent, whereas for livebearers it varied from 300-400 fishes per cent. Stocking density depended upon the variety and size of the fish selected for culture. Live feeds (tubifex worms, earthworms, mosquito larvae and minced shrimp meat) were used to feed brood stock while groundnut oilcake was used in grow-out ponds. As ponds were fertile and productive, the fish feeds on planktons in the pond. A water depth of one and half to two meters was always maintained in the pond for optimum growth of fish. Water quality was ensured through daily visual examination and measured only when variations were noticed (Shyma and Thomson, 2002). Water was

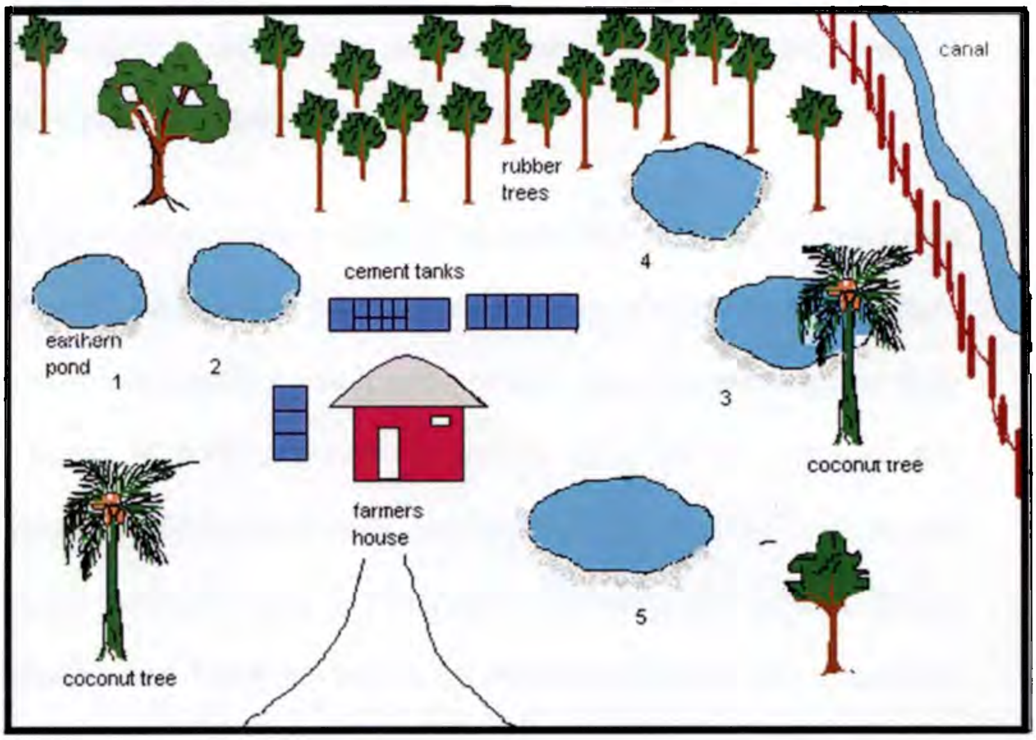


Fig 4.2 Pictorial representation of earthern pond system

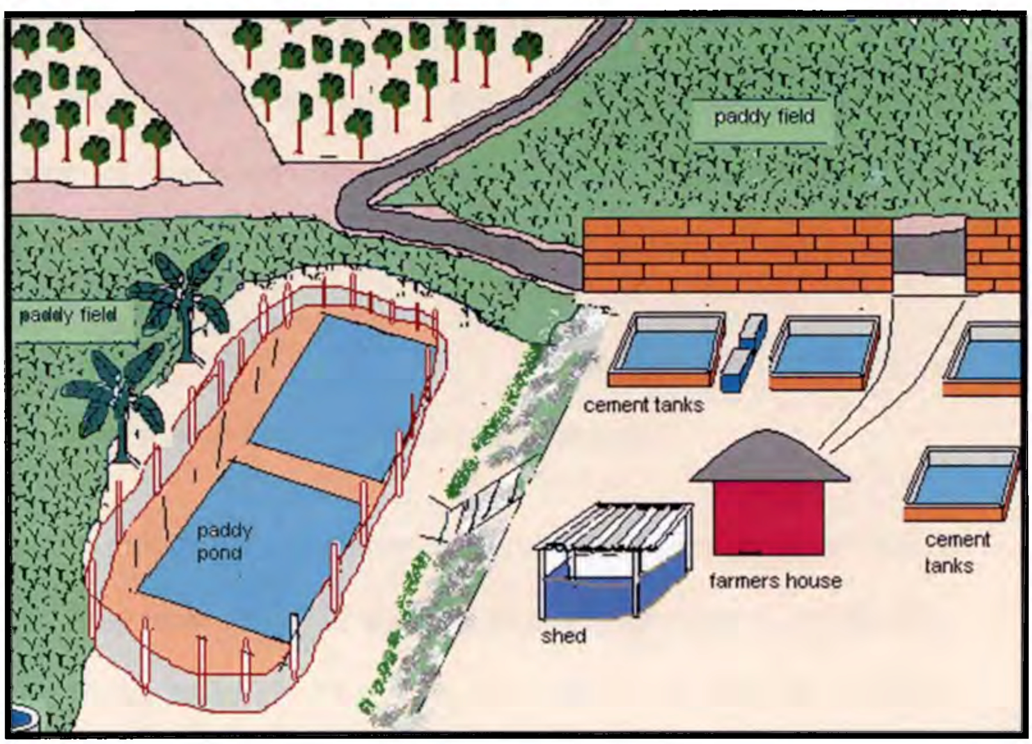


Fig 4.3 Pictorial representation of paddy pond system

exchanged when quality deteriorated. Effective methods were used to prevent loss of fish and spread of disease. It was reported that diversification in culture was an effective measure against threat of disease (Manush *et al.*, 2001).

Cultured varieties were monitored closely and regularly to determine their growth and general health, during feeding. Ornamental fish culture was risky and needed watch and ward to prevent poaching. Similarly the threat of predators has been very high. In the case of this respondent, during the survey year, the entire crop (Koi carp) in one pond got destroyed due to miscreants poisoning the system. Partial harvesting was practiced based on demand. Trained and technically skilled labourers were hired to capture ornamental fish. These skilled labourers were paid higher than unskilled workers. Partial harvesting was done using cast nets and scoop nets. Final harvesting was done during March, by draining pond, using pump. Screens were placed at the end of the hose to prevent escape of fish. All fishes were acclimatised before transporting. Fishes were packed in oxygenated tin containers and sent to markets.

4.2.2 Ornamental fish culture in paddy ponds

Unused paddy fields were often converted into ornamental fish culture ponds. They were similar to earthern ponds in all respects except farm characteristics and technology (Figure 4.3 and table 4.4). Respondent cultured ornamental fishes in two paddy ponds of three cents each having a depth of 2.4 meters. Both paddy ponds were connected using an underground pipe to maintain same water height. The farm was connected using PVC pipes to a nearby perennial earthern pond to ensure availability of water. Table 4.5 gives details about the major varieties selected for farming and their production process.

Table 4.4 System specifications and variety cultured in paddy ponds

Characteristics	Paddy Ponds		Cement tanks		
	No.1	No.2	No.1	No.2	No.3
Area	3 cents	3 cents	7x3.5 ft	7x3.5 ft	7x3.5 ft
Depth	2.4 m	2.4 m	5 ft	5 ft	5 ft
Age	3 yrs	3 yrs	6 yrs	6 yrs	6 yrs
Shape	Rectangular	Rectangular	Rectangular	Rectangular	Rectangular
Variety cultured	Gold fish Swordtail Black molly Guppy	Gold fish Sucker Swordtail Silver molly	Gold fish	Gold fish	Gold fish

Table 4.5 Production process for the selected varieties in paddy ponds

Variety selected	Average production from a fish (No)	Average survival rate (%)	Fishes used for breeding purpose (No)	Frequency of breeding (Times)
Gold fish	1000	85	46	1
Livebearers	70	63	85	3
Sucker	100	51	20	2

Two grow out ponds separated by bund were dug side by side. Water level in paddy ponds was always maintained at a height of 1.5 metres. All intakes were carefully screened with wire mesh to ensure safety of stock. Netting was done both on top and sides of the pond. In addition to these, three cement tanks were dug on the elevated land. Water in cement tank was always maintained at a depth of four feet. The cement tank was used for raising fry to fingerling stage. To manure the pond, cow dung, super phosphate and lime were used. Fishes were introduced after seven to eight days. A mixture of lime and cow dung was poured over the pond uniformly for enhancing plankton growth and for correcting water pH.

The respondent selected only moderately priced fast moving varieties such as fantail gold fish, shubunkin, and delta guppy for culture. Common varieties like ordinary gold fish, swordtail and black molly were also cultured. Stocking density varied from 1000-1200 fingerlings per cent. Polyculture was practiced for effective utilisation of water column. Abandoned freezer panes were used for breeding gold fishes and juveniles were transferred to cement tanks after a week. They were later siphoned off to paddy ponds where they grew. Stocking was usually done in the evening to avoid temperature fluctuations. Low stocking densities in the pond was practiced as the farmer sold majority of his stock at medium size. Apart from natural food organisms in water, farm-prepared feeds were also given to the fish, twice a day, as supplementary feeding. Cattle feed was given to growers at the rate of two kilograms per day. Supplementary feeding was increased as stocking rate increased. Disease was prevented by periodic checking and proper application of medicines like methylene blue and tetracycline. Proper sanitization of cement tanks with potassium permanganate once in two months eliminated disease-causing organisms.

Young adults with great vigour and vitality were selected from one batch of production (runners) as brooders and these stocks were efficiently managed. Entrepreneurs who converted paddy fields to ornamental fish ponds had faced severe resistance from nearby farmers over the use of water, especially during summer. However the tendency of such transfers was fast increasing due to the crisis in agriculture sector and the high profits aquaculture brings (Ranjeet and Kurup, 2002). Harvesting was periodically done using a Chinese model net[3]. Cleaning of pond for next culture operations was done during January, when water table was very low. Conversion of land, which was used for agricultural practices like paddy cultivation into aquaculture ponds, raised, conflict between labourers and pond owner.

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[3] These nets are similar to the Chinese net, with the difference that pulley and strings are used to haul the net whenever necessary. Other than these, the farmer used large and small scoop nets, made by him. Feed trays with feed are placed on the Chinese net and immersed in the water and when sufficient stock had been caught the farmer pulled the string and transferred the catch into a bucket of water.

4.2.3 Ornamental fish culture in lined clay pools

The study site where ornamental fish was cultured in lined pools (Fig. 4.4) was located in 23 cents of elevated land in Kannur district.

Culture operations were carried out in small clay pools, lined with poly ethylene/ plastic sheets, using well water (Belsare, 1982). Newly dug structures were filled with water, before lining with plastic sheets and kept for three days for strengthening. System preparations were done usually on lean seasons from January to May, when breeding activities were less. During this time, maintenance of lined pools viz., replacing damaged poly sheets with new ones, filling the cracks fallen on the pond dikes using newly dug clay from the site itself, and even construction of new structures were carried out. Ordinary angels and veil tail angels were the main varieties cultured. Other than these, four different types of gourami- three spot (blue), snow white, golden and honey gouramies- and neon tetras were also cultured on a minimum scale. The culture period was usually from June till November when environmental conditions were suitable. The system characteristics and the major varieties cultured in lined clay pools are provided in table 4.6. Table 4.7 gives the production process for the selected varieties in this system.

Table 4.6 System specifications and variety cultured in lined clay pools

Characteristics	Lined clay pools			Rings
Number of pools	No.1 (7 No)	No.2 (9 No)	No.3 (5 No)	N0.4 (17 no)
Area	12x 3 ft	5x3 ft	8 x 3 ft	4 ft diam
Depth	1 ft	1 ft	1 ft	5 ft
Age	2 yrs	2 yrs	2 yrs	2 yrs
Shape	Rectangular	Rectangular	Rectangular	Circular
Variety cultured	Angel	Gourami	Gold fish	Live feed culture Brood stock

Table 4.7 Production process for the selected varieties in lined clay pools

Variety selected	Average production from a fish (No)	Average survival rate (%)	Fishes used for breeding purpose (No)	Frequency of breeding (Times)
Gold fish	800	50	3	1
Gourami	2000	30	5	4
Angel	700	72	7	4
Neon tetra	85	90	8	3

Stocking density varied from 600-700 angels of one centimetre in a single lined pool. After one month, they were halved and transferred to another pool depending on the size of the fish. Angels were bred once in four months and fingerlings were sold after two and half months. As the space was less and stocking density more, fishes took more time to reach large size which forced farmer to sell stock even at small sizes.

Neon tetras are cultured in small cement tanks and took four months for reaching marketable size. Live feeds were cultured in the farm itself and fed to brood stock and other fishes based on the requirements. From second week onwards, supplementary feeding was carried out. Water was exchanged as and when required[4]. As the system was having only one feet depth, shade was provided, either using shade nets or coconut leaves or water plants such as lemna. Brood stock was properly taken care of by farmer and male and female brooders were kept separately and fed properly. Fertilization of the system was not needed, as it was polythene-lined structure.

As in the case of other systems, skilled persons were not needed for harvesting. 90 percent of work in the farm was performed by the entrepreneur himself. Harvesting was done using scoop nets and the fish was acclimatised before being transported. Poaching had been a major challenge to this system also. As there were no drains provided farmer monitored the system to regulate overflow and temperature fluctuations. During hot summer, enough shade was provided to keep a cool temperature.

4.2.4 Ornamental fish culture in mixed systems

Mixed systems combined earthern ponds, cement tanks, aquarium tanks, lined ponds and channels for culturing ornamental fishes and

[4] About one-fourth of water was siphoned from each lined pool during two days interval. During siphoning, the waste and dirt formed on the bottom were also removed. The systems were replaced with oxygenated water from nearby well and wastewater was used for agriculture purpose.

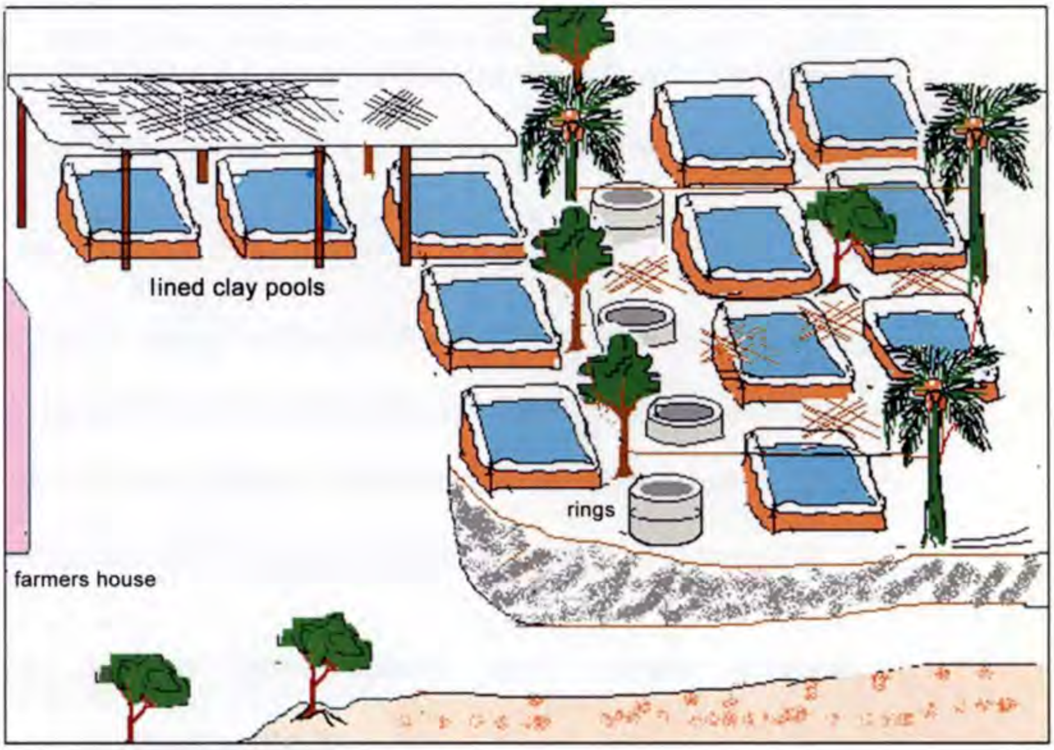

Fig 4.4 Pictorial representation of lined clay pool system

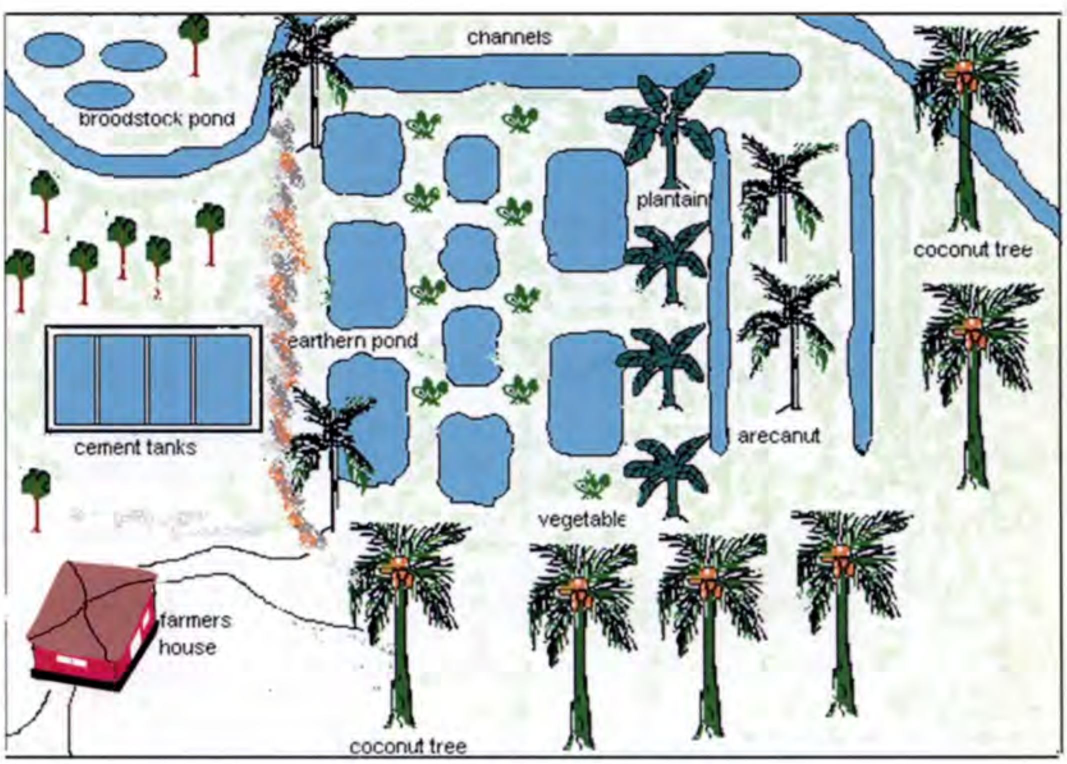

Fig 4.5 Pictorial representation of mixed systems

platforms and levees for cultivating other crops. This semi-intensive, integrated, small-scale ornamental fish culture was seen in many places in Kerala. Figure 4.5 provides pictorial view of such a system. It was a complex cultivation practice evolved by the farmer in a 40 cents rice field.

As seen in figure, several varieties of vegetables were planted along the sides of ponds to earn supplementary income. A small water canal runs through this field. System characteristics and variety cultured are summarised in table 4.8. Production details are provided in table 4.9

Table 4.8 System specifications and variety cultured in mixed systems

Characteristics	**Earthern ponds**					**Cement tanks**	**Long channels**
No. of ponds	2	1	3	1	2	5	3
Area	2 Cents	0.75 Cents	0.5 Cents	1.75 Cents	2.5 Cents	8x4 m	50x4 ft
Depth	1.2 m	1.2 m	1.2 m	1.2 m	1.8 m	1 m	3 ft
Age	4 yrs	4 yrs	4 yrs	4 yrs	4 yrs	2 yrs	4 yrs
Shape	Rectangular	Square	Square	Rectangular	Rectangular	Rectangular	Rectangular
Variety cultured	*Sucker & Guppy *Gold fish	Gold fish	*Sword tail *Delta guppy *Angel	Angel	Gold fish	Gold fish	*Gold fish *Tiger shark

* Variety cultured in each pond

Table 4.9 Production process for the selected varieties in mixed systems

Variety selected	Average production from a fish (No)	Average survival rate (%)	Fishes used for breeding purpose (No)	Frequency of breeding (Times)
Gold fish	800	38	25	5
Livebearers	40	58	600	8
Sucker	1000	56	5	2
Tiger sharks*	350	30	Rearing	-

*Fingerlings are bought from traders for rearing purpose

Bunds of ponds were tightened using turf to decrease seepage during rain. Inlets and outlets were not provided; instead, water was pumped in and out using pump. Proper netting of the pond was done using good quality nylon material. In addition to these five cement tanks for culturing goldfish, three separate brood stock ponds of one cent each were also dug on the farm. Water was drawn from the earthern pond both for culture and for household uses. The period of culture extended from May to January.

Preparation of ponds began in May and was similar in many ways to that adopted for earthern ponds. After draining the pond and removing clay, bleaching powder was applied at the rate of 250 grams /cent. After the effect of chlorine was lost, lime was added at the rate of one kg /cent. A day later, cow dung (four kg/cent) and super phosphate

(400 gm/cent) were applied to the pond and allowed to stay as such for the growth of zooplankton. After seven to eight days, fishes were introduced. Fertilization of ponds was repeated when fresh batch of stock was introduced in the pond. Live feeds and supplementary feeds were given to fish at regular intervals. Cement tanks were cleaned once in two months using bleaching powder.

Main variety cultured was fantail gold fish, other varieties being sucker, swordtail, delta guppy, ordinary angel and tiger shark. Stocking density of goldfishes varied from 800-1000 fishes per cent. Fingerlings of tiger shark were bought from local traders for rearing and later sold after attaining marketable size. Polyculture was practiced for all fish varieties except angels. Except goldfish, all fishes were bred in grow out earthem ponds. Cement tanks were used for breeding gold fishes. Fingerlings were transferred to grow out ponds and sold from third month onwards, when they reach the size of four inch. Lined ponds were used for culturing livebearers and gold fishes during pre monsoon. Other than these, male guppies were culled when they reached one month growth and put in separate earthen ponds, and females were left there either for further breeding or as live feed for brood stock. Brood stock was kept in separate ponds and proper protection was given. Fishes were harvested as and when they reached marketable size.

This system provided great scope for replication as it represented local adaptations of farmers for livelihoods. However, lack of capital and inadequate extension services were the main constraints that prevented expansion of this farming system. Risks attached to the occurrence of floods and accidental introduction of weed fishes were also raised as emerging problems.

4.2.5 Ornamental fish culture in cement tanks

Ornamental fish culture in cement tanks as practiced by the respondent of this case study depended on continuous water supply from fresh water bodies. A typical lay out of the selected case is shown in figure 4.6. As specified, concrete tanks of various shapes and sizes were built as backyard structures for keeping ornamental fishes. Other than these, rings were also used. Table 4.10 gives the major features of the system, along with the details of variety cultured. Table 4.11 provides the detailed production process of the varieties selected for culture.

Table 4.10 System specifications and variety cultured in cement tanks

Characteristics	Cement tanks					Rings		Earthern pond
	1	2	3	4	5	1	2	
No. of tanks	23	12	6	5	5	5	5	1
Area	3x4.5 m	1.2x1.2 m	1.5x1.5m	1.2x3 m	1.2x3 m	2.4 m dia	2 ft dia	2 cents
Depth	1 m	1 m	1 m	1.2 m	1.5 m	3 ft	2 ft	1.8 m
Age	2 yrs	2 yrs	2 yrs	2 yrs	2 yrs	2 yrs	2 yrs	2 yrs
Shape	Rectangular	Square	Square	Rectangular	Rectangular	Circular	Circular	Circular
Variety cultured	All varieties	Breeding tanks	Live bearers	Gourami	Angel	Live bearers	Live bearers	Live bearers Angels

Table 4.11 Production process for the selected varieties in cement tanks

Variety selected	Average production from a fish (No)	Average survival rate (%)	Fishes used for breeding purpose (No)	Frequency of breeding (Times)
Livebearers	40	80	142	8
Angel	600	50	6	3
Gold fish	1000	62	16	5
Fighter	500	45	2	4
Gourami	1800	38	15	3

The farm had 51 cement tanks, many rings, an earthern pond in two cents and a shed for breeding purpose. A water depth of three feet was always maintained in the system. Each cement tank had an outlet and an overflow at one side. According to the growth of fingerlings, stocking density was reduced by transferring half of them to other tank. Two-third of water was exchanged weekly. Large outdoor cement tanks were usually covered with nylon nets to prevent predation by birds and frogs, whereas in small cement tanks, shade and protection were provided by growing pistia. The earthern pond had a depth of 1.8 metres and was used for grow out operations. Hapa of three feet depth was used for rearing. Cleaning of earthern pond was undertaken once in two years. Fertilization of cement tanks was carried out using lime, cow dung and super phosphate. Lime at the rate of one

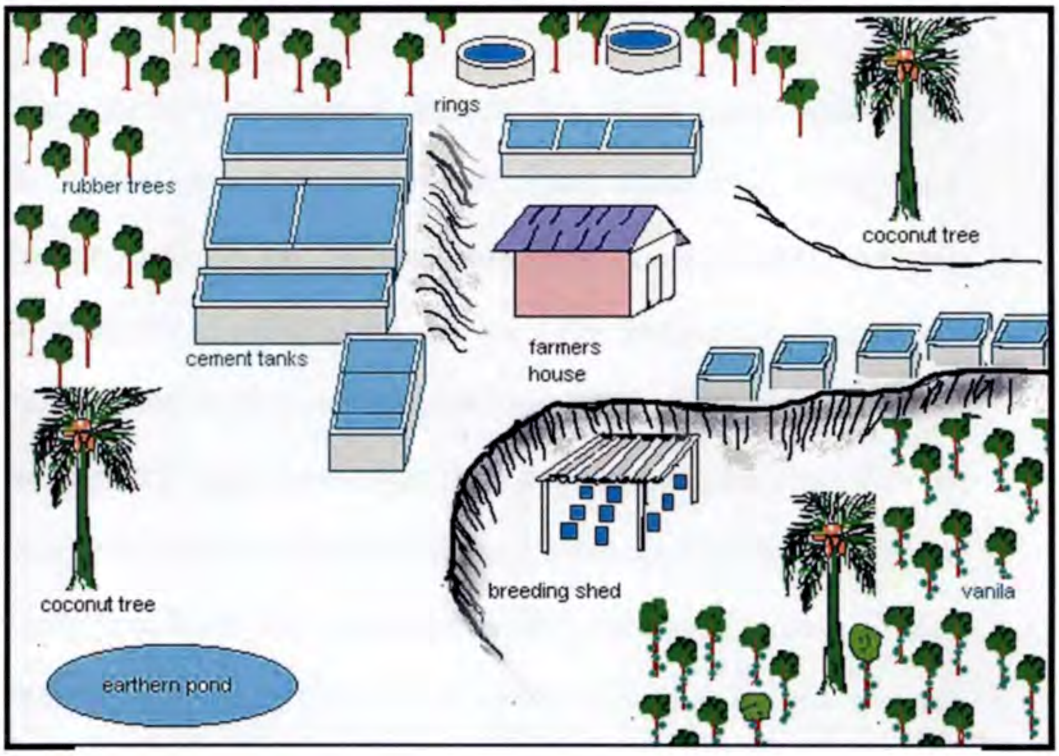

Fig 4.6 Pictorial representation of cement tank system

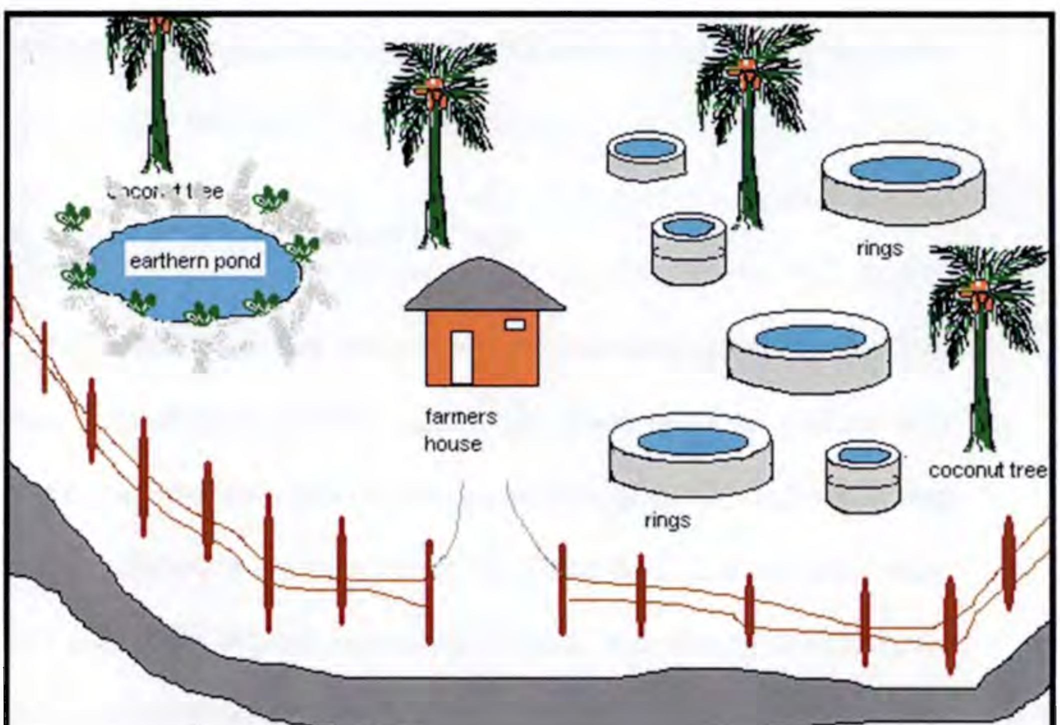

Fig 4.7 Pictorial representation of ring system

kilogram/cent, cow dung at a rate of five kilogram/cent and super phosphate around 200 grams/cent were applied

Ordinary gold fish, ordinary shubunkin, fan tail varieties, black moor, angel, fighter, gouramies (moon light, snow white, blue, honey and golden gouramies), live bearers (platy, delta guppy, sword tail and black molly) were selected for culture. The farmer experienced 40 percent mortality during culture operations. Feed prepared locally using wheat, ragi and eggs were given daily and vitamins, minerals, fish oil and colouring pigments were given three times a week. Brooders were fed with live feeds like earthworms and mosquito larvae. Proper sanitization of cement tanks were undertaken once in two months using potassium permanganate, which eliminated disease causing organisms. Hired labour was necessary for harvesting. Complete harvesting was done by draining tanks. Occasional harvesting was also practiced by the farmer.

4.2.6 Ornamental fish culture in rings

The respondent had five rings and an earthern pond. Under this system, rings having different diameters were used to culture only livebearers. Pictorial view of this system is given in figure 4.7 and major characteristics are summarised in Table 4.12. During heavy rain, excess water was drained out using a hose, one side of it was tightly covered using fine net. Earthern pond of five cents was used to culture different varieties of angel like ordinary angel, marble angel, diamond angel and veil tail angel. The earthern pond was provided with natural shade using pistia.

Table 4. 12 System specifications and variety cultured in rings

Characteristics	Rings					Earthern pond
	1	2	3	4	5	
Diameter	10 ft	5 ft	5 ft	6 ft	6 ft	Area 5 cents
Depth	3 ft	2.5 ft	2.5 ft	3 ft	3 ft	3 m
Age	5 yrs	3 yrs	3 yrs	3 yrs	3 yrs	25 yrs
Shape	Circular	Circular	Circular	Circular	Circular	Circular
Variety cultured	Live bearers	Live bearers	Live bearers	Live bearers	Live bearers	Angel Live bearers

Source: Primary survey

Pond preparation was done during January/February after draining water in the pond and culture was undertaken from May with the onset of monsoon. Culture period extended till December. Just before introducing brooders, the respondent fertilized the pond with lime, cow dung and super phosphate. The pond preparation which included cleaning, dewatering, de-weeding, bund strengthening, side compacting etc. was similar to that of any earthern pond described in section 4.2.1. Polyculture of four different varieties of angels was practiced in earthern ponds. Table 4.13 give the production details of selected varieties in the system.

Table 4. 13 Production process for the selected varieties in rings

Variety selected	Average production from a fish (No)	Average survival rate (%)	Fishes used for breeding purpose (No)	Frequency of breeding (Times)
Livebearers	40	65	33	5
Angel	125	62	10	3

Source: Primary survey

Various angel varieties and livebearers were allowed to breed at subsequent intervals in the rings and fingerlings were transferred to earthem ponds and left there for two months, where they attained fast growth. Stocking density of angels in earthern ponds varied between 400 to 500 fingerlings per cent. Fingerlings of livebearers were retained in the rings for one and a half month, before being transferred. Stocking density for livebearers varied from 90-100 fishes per ring. Poly culture was practiced as the fishes efficiently utilised the water column. Fishes of marketable sizes were stocked in rings and partial harvesting was followed based on demand. Trained and skilled workers were employed for harvesting ornamental fishes from earthern ponds. Partial harvesting was done by using very large scoop nets made by the farmer himself. Final harvesting was done by draining the pond if necessary or by using scoop nets if the water table was very low. All the fishes were acclimatised before transporting. As the farm was situated in an interior region, transportation of the stock to main market was a constraint for the farmer.

4.2.7 Ornamental fish culture in quarries

Quarries are open excavations used for the extraction of building stone (AGI, 1962). The bottom of quarry was uneven and depth varied within. Most of the quarries were situated on steeply elevated lands. However, farmers selected quarries close to their house so that they could easily access and control them. Transportation facilities, availability of water and water-storing capacity of the quarry were also considered for site selection. Photograph of a quarry is given in plate 4.1.

Construction costs were almost nil for quarries as these were abandoned after granite mining. Major specifications of quarries selected in this study and varieties cultured are given in table 4.14. Major variety cultured was angels. This respondent operated five quarries of various shapes and sizes. Besides, the farmer had four cement tanks (5 ft x 3 ft x 3 ft) wherein he stocked fishes for acclimatisation, conditioning brood stock and for holding fish before transportation. Aeration was provided to brood stock when necessary. Table 4.15 gives the production details of major varieties cultured by the sample respondent.

Table 4.14 System specifications and variety cultured in quarries

Characteristics	No.1	No.2	No.3	No.4	No.5
Area	35 cents	4 cents	50 cents	51 cents	50 cents
Depth	9 m	3 m	10 m	8 m	6 m
Age (years)	20	10	5	15	12
Shape	No specific shape	No specific shape	No specific shape	No specific shape	No specific shape
Variety cultured	Angels Gold fish Shark	Gold fish Barb Tetra Shark Livebearers	Angels	Angels	Angels Shark
Culture period	May-March	May-March	May-November	May- March	May-March

Source: Primary survey

Table 4.15 Production process for the selected varieties in quarries

Variety selected	Average production from a fish (No)	Average survival rate (%)	Fishes used for breeding purpose (No)	Frequency of breeding (Times)
Livebearer	60	80	50	3
Angel	1000	80	55	2
*Gold fish	13000	70	Rearing	-
*Tetra	1500	90	Rearing	-
*Shark	5450	82	Rearing	-
*Barb	1125	80	Rearing	-

* Fingerlings are bought from local traders for rearing purpose.

To commence operations, the farmer drained quarries about a month before the onset of monsoon. After dewatering aged water, lime (at the rate of four kg/cent), dried cow dung (at the rate of six kg/cent) and super phosphate (at the rate of 0.2 kg/cent) were applied. The pond was left under these conditions for 15 days and brooders were introduced. Salt and lime at lesser concentrations were also added as and when required. Quarry was covered using nets to prevent predation by birds. It was estimated that the loss due to predation was about 20 to 30 percent of stock (Shyma and Thomson, 2002). Quarries were stocked by keeping the level of water at about 1.5 meters.

Angels and livebearers were bred and the remaining varieties were reared in farms. In order to ensure year-round supply of ornamental fishes into various markets, farmers had also adopted lagged multiple stocking and harvesting procedures. Staggered stocking was done at intervals that replaced stocks harvested to ensure production and sale on continuous basis.When seeds were brought from traders for rearing purpose, farmer quarantined fishes by isolating them for two weeks in cement tanks before stocking in quarries. Water quality parameters were checked by visual observations. Fingerlings fed on natural organisms like daphnia in the water. Local feeds were given only after two weeks[5]. Final harvesting needed trained and technically skilled persons. Minimum three persons were engaged for harvesting fishes in

[5] All types of feed were given to fishes. Feeding was done regularly in backyard quarries, whereas in distant farms, occasional feeding was practiced and in some farms, no feeds were given at all.

Plate. 1 Photograph of a quarry

Plate. 2 Photograph of orchid cum ornamental fish system

a quarry and labour employed would increase according to quantity stocked. Occasional harvesting was done by *Koruvala* (Shyma and Thomson, 2002) and final harvesting was done using specially designed mosquito nets[6]. Large size ornamental fishes were harvested when they reached marketable size. Smaller fishes were added when stocks thinned out. The process of continuous harvesting and stocking not only thinned out and improved growth of the remaining younger stocks in ponds but also provided the farmer high price and steady flow of income. Traders collected fishes from the farm itself. Final pond harvesting was done according to the tie-up with the wholesaler. During summer local people demanded more water from quarries for household activities and domestic consumption and the farmer could not drain in two of his quarries, to prepare for next culture operations. Poaching and introduction of weed fishes were the issues the farmer had to face during the survey year.

4.2.8 Culture practices in orchid cum ornamental fish system

This case study was conducted in the coastal village of Valappad, Trichur district where the respondent undertook his activities in his backyard farm of 25 cents area (Plate 4.2). The entire farm was fully cemented, concrete slabs erected and tiles were paved above concrete slabs to culture orchids. Orchids were grown on 15 rows, of width four

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[6] Sticks were tied to the two sides of the mosquito nets, horizontally and inverted to form like a hapa and waded through water with the help of two persons. Strings passed along the length of the net on the topside allowed to adjust the length, after fishes are being caught. These mosquito nets have a length of five to seven feet and breadth one meter and depth three to four feet. Sticks prevented the net from being collapsed while fishing, which otherwise would damage the tail and skin of angels.

feet each, with a gap of two feet in between each row. These gaps were walkways for nursing orchids, collecting flowers, applying fertilizers and for removing weeds. The farmer divided his farm into four compartments, by concrete partitions on the floor and ornamental fishes were cultured in these chambers after filling water. Water depth was always maintained at 30 cm. Each compartment had inlet-outlet structures made of PVC pipes. Inlets and outlets were properly covered using fine meshed nets to prevent loss of fish. Fish varieties selected were hardy in nature and were able to withstand the environmental conditions of orchid cum ornamental fish system. Selected varieties of fish for culture include angels, and livebearers like mollies, guppies, and swordtails. As angels exhibited parental care, there was no difficulty in rearing them. Stocking density of angels varied from 300-350 per cent, and for livebearers, it was 800-1000 per cent. Table 4.16 and table 4.17 provides the system characteristics and production process for the selected varieties respectively.

Table 4.16 Specifications and variety cultured in orchid cum ornamental fish system

Characteristics	**Orchid cum ornamental fish system**			
Compartments	1	2	3	4
Area of each compartment	6.25 cents	6.25 cents	6.25 cents	6.25 cents
Depth	40 cm	40 cm	40 cm	40 cm
Age (years)	5	5	5	5
Shape	Rectangular	Rectangular	Rectangular	Rectangular
Variety cultured	Angels Live bearers	Angels Live bearers	Angels Live bearers	Live bearers

Table 4.17 Production process for the selected varieties in orchid cum ornamental fish system

Variety selected	Average production from a fish (No)	Average survival rate (%)	Fishes used for breeding purpose (No)	Frequency of breeding (Times)
Livebearers	55	80	800	5
Angel	400	75	5	6

The farmer ensured the availability of good quality water round the year by filtering ground water through a PVC pipe fitted underground. This water was collected and used for culture. Watering orchids using mist system, allowed water to leach out to cement compartments where fishes were cultured and the old water was siphoned out. The whole structure was protected under a green house. Suckers were introduced into the system for removing algae. Algae were removed manually also. Clay and other sediments were washed out of the floor. Proper tank cleaning was necessary for growth, immunity, colour and health of fish. Water exchange was undertaken after stopping feeding fishes for a day. Good quality brooders were brought from local farmers. Prior to introduction of fishes into tank, quarantine measures were done to ensure the safety and quality of the stock. Fungicides and pesticides used for orchids did not harm the ornamental fish production. It was applied on early morning. Feeding was done in morning at regular intervals at calculated amounts by trial and error method. Home prepared feeds, egg yolk, kitchen waste, cooked rice and dried prawn powder were given besides readily available fish feeds bought from the market. Live feeds included mosquito larvae and earth worms which were collected from the farm itself.

Quarantining new fishes purchased from other sources in separate tanks was done for at least two months and this arrangement allowed farmer to manage stock in good and healthy condition. Since orchid was the main crop under this system, fish culture had to adapt to the conditions and requirements of orchid crop. Fishes were harvested using mosquito nets and scoop nets.

4.2.9 Constraints

Ornamental fish farmers in our state have been undertaking this fishery as a livelihood option and various case studies have highlighted a number of issues that limit production of ornamental fish under various systems. First, the studies reminded of the unpredictability of environmental and climatic conditions in the production of ornamental fishes in Kerala. Second, although, farmers were willing to invest on ornamental fishery bearing risks and uncertainties described in case studies, lack of finance remained as a major constraint for the expansion of culture operations. A number of other researchers have also made similar observations (Rao, 1980; Gupta *et al.,* 1992; Kumar, 2002). Most of the farmers used own financial resources or borrowed from their friends/relatives. As private banks did not lend money for ornamental fisheries, farmers procured loans citing other purposes with heavy interest rates. As Mathew (2004) pointed out, "low cost credit and affordable credit" were needed for the growth of cottage industries. Third, study found that the level of technological adoption was low due to lack of such standardised practices and non-availability of liquid cash for investments (Liao, 2001). Study pointed out that in some cases, traders financed small-scale farmers and exploited them by buying ornamental fish at a pre-determined price decided at his choice (Subrahmanyam and Anjaneyulu, 1992). Four, lack of sufficient information on resources, potential, technologies existing and data on economics of ornamental fishery operations delayed official procedures of government agencies and financial institutions. (Sinha and Randhir, 1980). Fifth, Poor literacy rate among ornamental fish farmers prevented them to take right decisions and handle risks at right time. Similar observations were also made by Williams (1997). Six, all respondents admitted product theft or poaching as a serious threat to the fishery, which resulted in substantial losses (Clifford and Cook, 2002).

Seven, serious limitations to introduce economic principles for increasing outputs have also been reported. For instance, scattered locations of farms, unorganised breeding activities, remoteness of breeding farms, climatic variations and seasonality like monsoon and heavy rain have limited the introduction of viable economic principles to enhance scale of production under various systems (Olivier, 2001; Chauhan, 2002; Soman, 2002). Eight, since ornamental fish production in Kerala suffers from lack of standardised technology packages and transfer mechanisms in breeding practices of egg laying species, unavailability of enough stocking material for grow out operations forced farmers to depend heavily on fishes from other states and such dependency weakened local production.

Nine, the study clearly projected limitations of the present extension activities for imparting scientific training and extension materials in local language to producers. None of the farmers had any rapport with fishery extension officials. Most of the respondents relied heavily on limited perceptions and fellow farmer's experiences, which resulted either in under-utilisation or over-utilisation of inputs. Many studies also raised similar issues (Dixitulu and Srikishen, 1992; Srinath, 2002b; Kindleberger and Herrick, 1977).

4.3 Summary and conclusions

In this chapter eight major ornamental fisheries systems in Kerala were described in detail to provide a comprehensive view of production. These systems were diverse and scattered. Case studies revealed that ornamental fish systems, as in any other aquaculture/agriculture systems were prone to major risks that arose due to natural calamities like drought, flood, extreme winter, temperature fluctuations and poaching. The study revealed that majority of ornamental fish farms were small-scale and owner operated. Family labour was employed in almost all the systems. Land was either owned or leased in. The owner managed operations on daily basis with the help of family members and some permanent or seasonal labour. Traditionally, farmers undertook ornamental fisheries as a part time activity and combined these activities with agricultural crops to attain economic viability. Majority of the ornamental fish farmers depended on their expertise in food fishery and gained advices from fellow farmers, rather than from extension agents. Hence the systems were under-utilised or over-utilised.

As these systems are still important for livelihood security of rural communities in Kerala, institutional support is required for its promotion. Unfortunately, the scattered nature of these systems and its various local adaptations prevented systematic flow of institutional support to farmers. Despite local efforts, lack of credits, extension inputs, standardised technology, technology transfer and information asymmetries, restrained future growth of this sector.

CHAPTER 5

Production organisation and economic viability of ornamental fish culture systems in Kerala

Since ornamental fish culture has been organised in Kerala under diverse ecological and technological conditions by the weaker sections of society, the industry has not taken off as expected by planners and development practitioners. This was due to many reasons. First, the unorganised and scattered individual units did not produce synergies of clusters and economies of large-scale production. Second, the linkages between primary producer and other agents in the supply chain were extremely weak and often exploitative causing instabilities in production. Moreover, there was not enough tangible institutional support to the industry by the Government. Despite these limitations, case studies narrated in chapter four revealed that the primary producers were ready to face uncertainties and prepared to take risks, for economic returns.

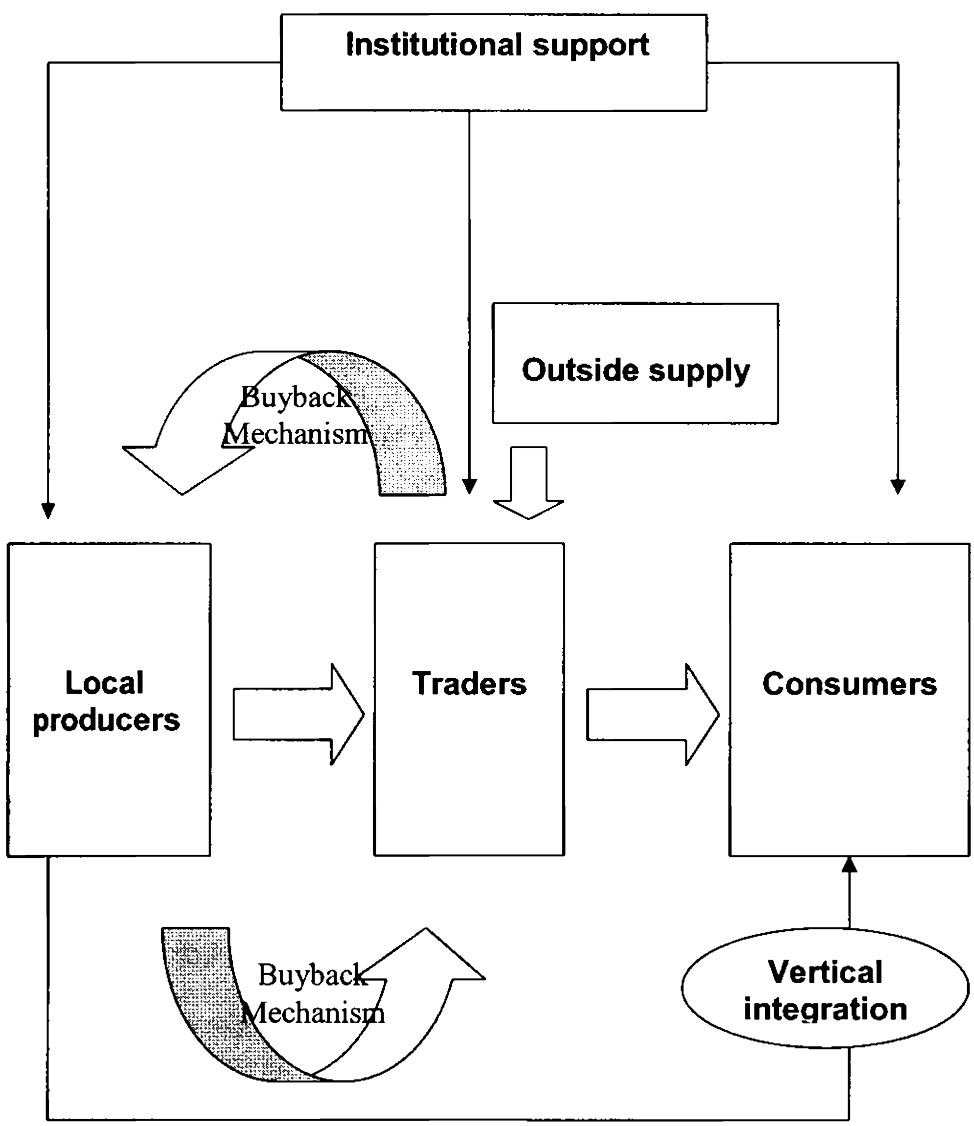
To provide more light into these challenges, the structure of ornamental fish industry and the economic viability of different systems in Kerala need to be examined. The purpose of this chapter is to analyse the costs and earnings of selected ornamental fish culture systems in Kerala. The chapter is divided into three sections. After giving a brief note on the evolving structure of domestic ornamental fish industry and the diversity and magnitude of output produced under various systems in section 1, a detailed examination of the investments and other fixed and variable costs incurred by farmers for production under various ornamental fish culture systems were described in section 2. An economic viability analysis is also undertaken in this section. Summary and conclusions to the chapter are provided in section 3.

5.1 Structure of ornamental fish industry

Business enterprises have well-defined principles for various operations, and entrepreneurial functions vary according to the changes in these features. This section attempts to recapitulate the evolving structure of ornamental fish industry in Kerala based on the case studies presented in the previous chapter. Case studies clearly established that ornamental fish industry in Kerala was highly scattered and the linkages in production and exchange activities among various agents were highly weak. These inter-linkages are presented in Figure 5.1. Primary producers harvested ornamental fishes and sold stock to different traders based on personal relations, who in turn sold it to final consumers. Some entrepreneurs sent their consignments to other Indian states also. None of them were exporting to other countries. Local traders on the other hand bought fishes from other states and entrusted the task of rearing to local producers. These were later bought back at market prices. It was interesting to note that this practice was universal especially in the growing stages of the industry in many other countries of the world (Lee, 2005).

In the case of ornamental fisheries, goods produced by farmers move from producers to consumer through intermediaries like wholesalers, wholesaler cum retailers and retailers. The study found out that farmers bought fingerlings from traders, rear in their farms until they reach certain size and sold back to the same trader. This buy-back mechanism shared risks and ensured better prices to both farmers and traders. By entering into such a contract, the trader made sure that he got continuous supply of fish through out the season while the farmer ensured steady market and fair price with minimum risks involved. In some cases, trader could even decide when to harvest fish.

Unlike in agrarian markets where traders insisted on pre-conditions, ornamental fish farmers sold their fishes to different traders to increase the average price and revenue. The study also noted that collective bargaining reduced number of transactions, transaction costs, regulated supply of fish and gave greater price stability to farmers. In areas where farmers resorted to collective bargaining, they could influence markets and get better prices. Unorganised producer's relations with traders had been the most risky, for the fact that after a series of transactions, traders consolidated their position and offered lower prices. Under such circumstances, these farmers started direct selling to consumers. This was done by opening retail outlets attached to their farms/houses. This pattern permitted producers to compete with traders by selling through their own retail stores. All the requirements for the shop were produced in the farm itself. Thus, vertical integration gave these farmers control over their products and resulted in the growth of industry (Cramer and Jensen, 1988). One of the most recent developments has been the active institutional support offered by the State in the form of incentives, subsidies, extension services and exhibitions. Despite these promotional measures, local producers could not respond to the growing demand, which facilitated arrivals of ornamental fishes from neighbouring states.



Source: Primary survey

Fig 5.1 Existing structure of ornamental fish sector in Kerala

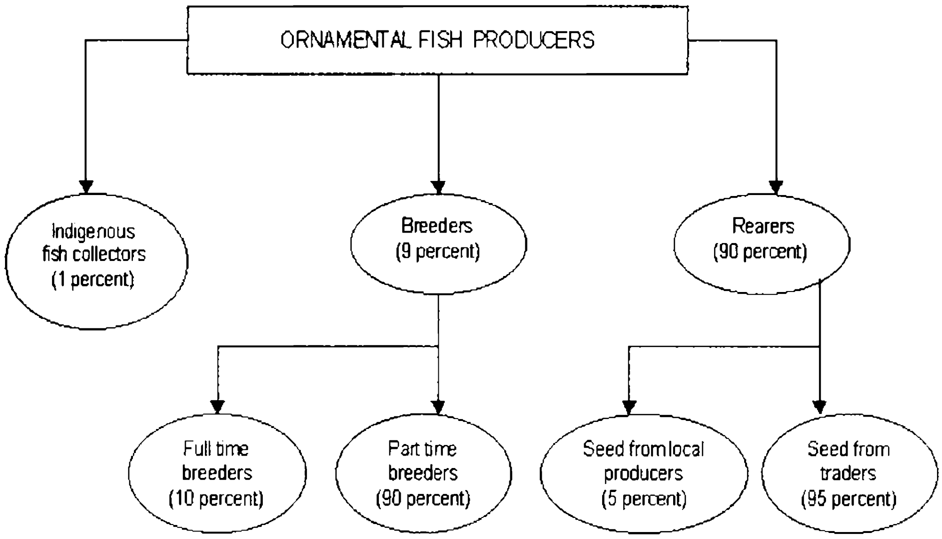
5.1.1 Classification of ornamental fish producers in Kerala

Ornamental fish producers in Kerala could be classified into three broad categories like ornamental fish collectors, breeders and rearers. Individuals who collected ornamental fish from local water bodies- fresh, marine and brackish water- are indigenous fish gatherers/ collectors.

Breeders are experts in the art of ornamental fish breeding technology and are engaged on either full time or part-time basis. Preliminary survey revealed that only 10 percent of breeders were engaged in ornamental fishery on full time basis and knew breeding techniques of almost all fishes. Part time cultivators are usually non-professionals engaged in the fishery on part time basis, who knew only the breeding techniques of limited variety of fishes, mainly livebearers. They constituted 90 percent of the total breeders in the state. As breeding was a risky and required skill, most of the ornamental fish producers concentrated on rearing. Rearers bought small size fish from local traders, procured from outside state, reared them to suitable sizes and later sold to the same trader[1]. Figure 5.2 summarises the findings.

[1] More over, seeds are obtained from neighbouring states at a cheaper rate. 95 percent of rearers bought ornamental fish from outside traders for size augmentation and only less than 5 percent depended on breeders within the state for buying fingerlings.

Fig 5.2 Classification of ornamental fish producers in Kerala



5.1.2 Social organisation of ornamental fish culture

Social organisation of ornamental fish production has been influenced by ownership patterns, modes of granting and regulating access to the production systems, involvement of family members in fishery operations, occupational mobility, educational level of farmers and modes of payment. These features are described below.

Ownership patterns

Two types of ownership patterns- owned and leased-in structures- were mainly observed. In the case of owner operated units individual household undertook farming and managed operations on daily basis with the help of family members. The owner also employed experienced and skilled casual male workers especially for fencing and harvesting. In the case of leased-in units, the lessee, normally operated pond himself and incurred all the pond specific investments and operational expenditures. Occasionally the lessees entrusted grow out operations to the lesser himself by assuring a viable buyback mechanism. In this case, the lessee incurred all operational expenses including the supply of juveniles. In some cases the lessee sold fingerlings to the lesser who were expected to undertake watch and ward and related petty expenses.

The leasing in of ponds showed the progress in market. Due to poor dissemination of technology, low level of production was noted and hence people who knew breeding technology leased-in all available local resources. Other than these, some people carried out culture operations on friends and relatives ponds purely on the basis of good relationship. Here culture was done either individually or on partnership basis. Leasing in was mainly noticed in natural systems. Most of the households in coastal areas had one or two earthern ponds in their backyard and these ponds were used for household purpose only. Some ponds were left unused for long time. As the demand for ornamental fish increased, people started leasing in ponds on minimal rate to start grow out operations.

Access

Most of the natural water bodies used to culture ornamental fishes, irrespective of ownership patterns, were traditionally used by local communities for various purposes like drinking, irrigation, washing clothes and utensils, bathing and cattle rearing. The farmer respected such traditional rights over the use of water to avoid social conflicts. Such access rights reduced the farmer's general supervision time and ensured the safety of his stock.

Family involvement in ornamental fishery

Majority of ornamental fish farms were small-scale and owner operated enterprises. The owner managed the operations on a daily basis, usually with the help of family members and a few permanent or seasonal labours. The financial organisation of the farm was based on a simple structure with the farmer and his family owning all shares of the enterprise. For efficiency of operations, there was division of labour among family members. The study noted that without change from family level organisation, very limited number of large and medium scale farms also evolved. This may be due to the past experiences gathered from food fish aquaculture. The study found that the family involvement was higher, in ornamental fishery, which contributed to the success of the system. The present finding was substantiated by works of Cramer and Jensen (1988).

Table 5.1 gives a clear picture of family involvement in this particular fishery. Among different production systems studied all except natural earthern pond exhibited high presence of family labour. In the case of natural earthern pond, the farmer hired labour as he was old and his family members were not available for work. Family labour costs constituted more than 70 percent in all other systems and it went up to 94.38 percent in lined clay pools. On the whole, the study revealed active involvement of family labour in the production of ornamental fish.

Table 5.1 Family involvement in various ornamental fish production systems

Units: in Rs.'000

Systems	Earthern ponds	Paddy ponds	Lined clay pools	Mixed systems	Cement tanks	Rings	Quarries	*Orchid cum ornamental fish systems
Family labour costs	1.80 (27.03)	5.55 (87.4)	10.57 (94.38)	15.70 (72.35)	8.70 (90.06)	2.35 (83.93)	32.05 (82.6)	141.60 (75.88)
Hired labour costs	4.86 (72.97)	0.80 (12.6)	0.63 (5.62)	6.00 (27.65)	0.96 (9.94)	0.45 (16.07)	6.75 (17.4)	45.00 (24.12)
Total labour Costs	6.66 (100)	6.35 (100)	11.20 (100)	21.70 (100)	9.66 (100)	2.80 (100)	38.8 (100)	186.60 (100)

Source: Primary survey * Costs for 5 years

(Figures in brackets are percentage of family/hired labour costs to the total labour costs in each system)

Occupational shift

Ornamental fish industry being a cottage industry employed large numbers of people directly and indirectly for the production of feed, medicine and net making. 75 percent of people undertook ornamental fish farming during peak season as a sub occupation and they shifted back to their occupations (agriculture, quarry mining, wage work, livestock, own family business etc.) as and when such activities resumed. Ornamental fish culture was also the best means of alternate livelihood for fishermen. Study found that the present generation farmers in ornamental fishery were those who shifted occupations from food fish culture or due to business failures or due to unemployment.

Education level of ornamental fish farmers

Education level of the farmer played a major role in the development of ornamental fisheries. 70 percent of people engaged in this fishery had only basic education. Case studies revealed that those farmers having a combination of younger age and higher education acquired maximum knowledge gain and they had the capacity to face risks in production. Similar finding was noted by Nair and Kandoran (1992). Only 15 percent of farmers got training in ornamental fishery.

Mode of payment

Orders for fishes were given by traders over phone a couple of days before, based on which packing was carried out by farmer. Trader collected orders himself or the farmer delivered orders at the shop.

Payment as cash was done at the farm site itself. Credits were never entertained due to risks associated with the business like mortality of fish, decrease in sales or stock of inventory. Traders from outside state ensured the supply of certain fishes mainly angels, from our producers by a form of credit tying linkage, like sending demand draft seven to eight months earlier, and the production was carried out accordingly. Credit tying mechanism worked only when the farmer had accumulated trust or goodwill and had long lasting good relationship with the trader. For new entrants, the farmer demanded immediate cash payment.

5.1.3 Diversity and distribution of ornamental fish produced under various systems in Kerala

The foregoing section revealed the weak structure of Kerala's domestic ornamental fish industry. However, individual farms expressed potential for development, provided sufficient measures were taken for its promotion. In order to explore the potential of these systems it was therefore essential to study the flow of goods and services from individual farms. The objective of this section is to describe the seasonal flow of various goods produced under selected systems of ornamental farms.

5.1.3.1. Supply of ornamental fishes to traders under various production systems in Kerala

Table 5.2 gives the distribution of the physical volume and sales value of ornamental fish by mode of sales under selected systems in Kerala.

In the case of earthern ponds, goods were sold mainly to regular customers. 68.34 percent of farm produce was sold as retail within the state whereas 26.67 percent were sold as wholesale to outside Kerala and 4.99 percent were direct farm sales. The value generated from wholesale was 33.3 percent, from retail sales was 57.99 percent and from direct farm sales was 8.71 percent of the total.

In the case of paddy ponds, farmer supplied fishes to two wholesale cum retail and five retail shops in Pathanamthitta, Alappuzha, Kottayam and Ernakulam districts. Fishes were delivered by him to shops in Kottayam and Ernakulam while traders in the interior regions collected goods from farm site. The farmer produced quality stocks and sold 65.33 percent of the total quantity produced in farm as wholesale, which fetched him, 70.18 percent of the total sales value of fish. 34.28 percent was sold to regular retailers and occasional direct farms sales accounted for 0.39 percent.

In lined clay pools, fishes were sold only to regular customers, mainly one wholesaler cum retailer and four retailers in Kannur district. 73.91 percent of the stock was sold as wholesale and remaining 26.09 percent was sold as retail. No direct sales from the farm were encouraged as they increased the risk of poaching.

In mixed systems marketing to one wholesaler cum retailer and three retailers were carried out on a regular basis and these traders came and collected fishes from the farm site. All the fishes were sold locally within Kerala, to districts like Kottayam, Kollam, Alappuzha and

Ernakulam. 67.6 percent of the total quantity produced was sold in wholesale and 32.09 percent as retail. Direct farm sales were not allowed, except for the brooders, i.e. about 0.31 percent of total quantity, which contributed 0.83 percent of the total sales value.

In case of cement tank system, fishes were supplied to wholesale and retail markets in Ernakulam and Thrissur. Orders were confirmed one week before, and if trader needed small quantities previous information was given. Brokers were present during the initial phase of study and the farmer enjoyed more bargaining power with them and in due course of time that channel became extinct. About 71.16 percent of the stock was sold as wholesale and 22.51 percent as retail and 6.33 percent was direct farm sales. Credit sales were not allowed due to perishable nature and risks. Except for brood stock, direct farm sales were not encouraged, due to lag in time and increase of transaction cost. Retailers collected fish from the farm site, whereas farmer himself transported the fish to wholesale shops.

In Rings, only few retailers collected the stock from the farm. In other circumstances, the farmer himself transported the fish to the traders shop. The farmer encouraged direct farm sales, due to the conflict with the traders. More over the farmer was in weak bargaining position with traders and carried out culture operations on part time basis. 43.31 percent of total production was sold as wholesale and 37.52 percent as retail sales. About 19.17 percent of the total stock was sold directly to customers, which gave a sales value of 28.18 percent of the total.

In quarries, majority of the stock were sold as wholesale to markets in Thrissur and Ernakulam districts. Direct farm sales were not encouraged. In orchid cum ornamental fish culture system, the entire farm produce was sold as wholesale and no retail and direct farm sales were encouraged by the farmer, as it increased the risk of poaching.

In all the cases, bulk of the goods produced was sold as wholesale and the quantities sold directly to customers were meagre. The sales value generated from direct farm sales showed high proportion when compared to wholesale and retail sales.

Table 5.2 Distribution of ornamental fish by mode of sales under various production systems in Kerala

Quantity: in No.'000
Value : in Rs.'000

System → / Mode of sales ↓		Earthern ponds	Paddy ponds	Lined clay pools	Mixed systems	Cement tanks	Rings	Quarries	*Orchid cum ornamental fish systems
Wholesale	Quantity	8.99 (26.67)	33.67 (65.33)	21.32 (73.91)	103.40 (67.60)	86.68 (71.16)	2.72 (43.31)	86.80 (79.97)	183.24 (100)
	Value	80.16 (33.3)	223.02 (70.18)	74.36 (66.83)	404.79 (62.98)	232.27 (53.86)	6.84 (33.69)	661.01 (78.65)	366.30 (100)
Retail	Quantity	23.05 (68.34)	17.66 (34.28)	7.53 (26.09)	49.09 (32.09)	27.42 (22.51)	2.36 (37.52)	21.74 (20.03)	0.00 (0.00)
	Value	139.58 (57.99)	92.12 (28.99)	36.90 (33.17)	232.61 (36.19)	152.21 (35.29)	7.74 (38.13)	179.43 (21.35)	0.00 (0.00)
Direct farm sales	Quantity	1.70 (4.99)	0.20 (0.39)	0.00 (0.00)	0.48 (0.31)	7.71 (6.33)	1.20 (19.17)	0.00 (0.00)	0.00 (0.00)
	Value	20.96 (8.71)	2.64 (0.83)	0.00 (0.00)	5.30 (0.83)	46.78 (10.85)	5.72 (28.18)	0.00 (0.00)	0.00 (0.00)
Total	Quantity	33.74 (100)	51.53 (100)	28.85 (100)	152.97 (100)	121.81 (100)	6.28 (100)	108.54 (100)	183.24 (100)
	Value	240.7 (100)	317.78 (100)	111.26 (100)	642.70 (100)	431.26 (100)	20.30 (100)	840.44 (100)	366.30 (100)

Source: Primary survey

*Average production/year

(Figures in parenthesis indicate the percentage to respective totals in each system)

5.1.3.2 Distribution of quantity and value of different ornamental fish by size under various production systems in Kerala

Table 5.3 gives the distribution of quantity and value of different ornamental fish by size under various production systems in Kerala. The producers sold three major grades of fish in the market; they are small, medium and large. Price varied highly depending upon the gain in size by the fish. Majority of the farm production were sold by the farmers in bulk quantities as small size, as they had to make room for the next culture operations, at the most suitable environmental conditions. Only a very less quantity was reared to large size and the rest was sold as medium size.

In earthern ponds 68.91 percent of the total volume produced was sold at small size, which fetched 44.11 percent of total sales value. 29.09 percent of the total volume produced was sold at medium size, which fetched 47.23 percent of total sales value. Quantity of large fishes sold was only two percent, which generated a sales value of 8.66 percent.

In paddy ponds majority of the stock was sold as medium (52.45 percent). In lined clay pools more than eighty percent of the total volume produced was sold at small size and only less than ten percent was reared to large size due to lack of space. Neon tetras were sold at small size, as it took more time for reaching medium size, and bigger sizes would not give the expected returns. Angels were harvested once in two and half months when they reached the marketable size.

In mixed systems majority of the stock was sold at medium size. 45.57 percent of fishes were sold at medium, 34.21 percent at small and 19.91 percent at large size. In cement tank system 50 percent of the stock were sold as medium, 48.29 percent, small size and only 0.97 percent was sold as large.

In rings and orchid cum ornamental fish system majority of the stock was sold as medium whereas in the case of quarries majority of the stock was sold as large. During the study period, only three case studies (paddy pond, cement tanks and mixed system) undertook sale of brooders. Study noted that sales of brooders gave good returns to the producers and it could be taken up as an income generating activity.

Table 5.3 Distribution of different ornamental fish by size under various production systems in Kerala

Quantity : in No.'000
Value : in Rs.'000

System → / Size of fish ↓		Earthern ponds	Paddy ponds	Lined clay pools	Mixed systems	Cement tanks	Rings	Quarries	*Orchid cum ornamental fish systems
Small	Quantity	23.25 (68.91)	14.14 (27.45)	23.69 (82.09)	52.32 (34.21)	58.82 (48.29)	2.18 (34.76)	0.00 (0.00)	0.00 (0.00)
	Value	106.17 (44.11)	49.73 (15.65)	78.75 (70.78)	108.17 (16.83)	169.20 (39.23)	4.37 (21.53)	0.00 (0.00)	0.00 (0.00)
Medium	Quantity	9.82 (29.09)	27.03 (52.45)	2.94 (10.20)	69.72 (45.57)	60.90 (50.00)	2.60 (41.43)	43.40 (39.99)	183.24 (100)
	Value	113.68 (47.23)	140.72 (44.28)	20.26 (18.21)	340.69 (53.01)	245.45 (56.92)	8.59 (42.32)	297.95 (35.45)	366.30 (100)
Large	Quantity	0.67 (2.00)	7.61 (14.76)	2.22 (7.71)	30.45 (19.91)	1.19 (0.97)	1.50 (23.81)	65.14 (60.01)	0.00 (0.00)
	Value	20.85 (8.66)	70.62 (22.22)	12.25 (11.01)	188.54 (29.34)	5.99 (1.39)	7.34 (36.15)	542.49 (64.55)	0.00 (0.00)
Brooder	Quantity	0.00 (0.00)	2.75 (5.34)	0.00 (0.00)	0.48 (0.31)	0.90 (0.74)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	Value	0.00 (0.00)	56.71 (17.85)	0.00 (0.00)	5.30 (0.82)	10.62 (2.46)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Total	Quantity	33.74 (100.00)	51.53 (100.00)	28.85 (100.00)	152.97 (100.00)	121.81 (100.00)	6.28 (100.00)	108.54 (100.00)	183.24 (100)
	Value	240.70 (100.00)	317.78 (100.00)	111.26 (100.00)	642.70 (100.00)	431.26 (100.00)	20.30 (100.00)	840.44 (100.00)	366.30 (100)

Source: Primary survey

*Average production/year

(Figures in parenthesis indicate the percentage to respective totals in each system)

5.1.3.3 Distribution of quantity and value of different varieties of ornamental fishes under various production systems in Kerala

Survey revealed that livebearers, angels and gold fish were the major ornamental fish varieties cultured by the farmers in the state. In earthern ponds, 41.8 percent of the total quantity produced was livebearers followed by angel, which constituted 37.74 percent. The sales value generated from livebearers were comparatively less (21.38 percent) than angels (49.51 percent). Gold fish production from this farm was 18.23 percent contributing 13.2 percent towards total sales value. Tiger barb contributed only negligible amount (0.65 percent). Even though oscars were produced in less quantities (1.16 percent of total production) the sales value was 15.26 percent of the total. Detailed picture of the distribution of quantity and sales value of different ornamental fish varieties under various production systems in Kerala is given in figure 5.3 and table 5.4 respectively.

In paddy ponds, output volume of farm produce was contributed mainly by gold fish varieties (74.32 percent), of which ordinary gold fish contributed 40.36 percent. Livebearers contributed 21.69 percent of total farm production, of which the main contribution was by swordtail. The farmer also cultured suckers.

In lined clay pools, the total quantity of ornamental fish produced was 28850 numbers, which generated a total sales value of Rs. 111260. 47.89 percent of the farm produce was angel fish with ordinary angel constituting 28.84 percent of the total. 41.59 percent of total farm produce was constituted by various species of gouramies, which provided 28.22 percent of total sales value. Costly neon tetras constituted 6.36 percent of total farm produce, with a contribution of 12.87 percent towards total sales value.

In mixed systems, of the various varieties cultured, 72.07 percent of the farm produce was livebearers with delta guppy constituting 43.29 percent and swordtail with 28.78 percent. The contribution of sales value from swordtail was high (23.49 percent) compared with delta guppy (14.89 percent). Ordinary gold fish, which provided 51.47 percent of total sales value, constituted 24.26 percent of farm produce. Sharks and suckers were also reared in the farm.

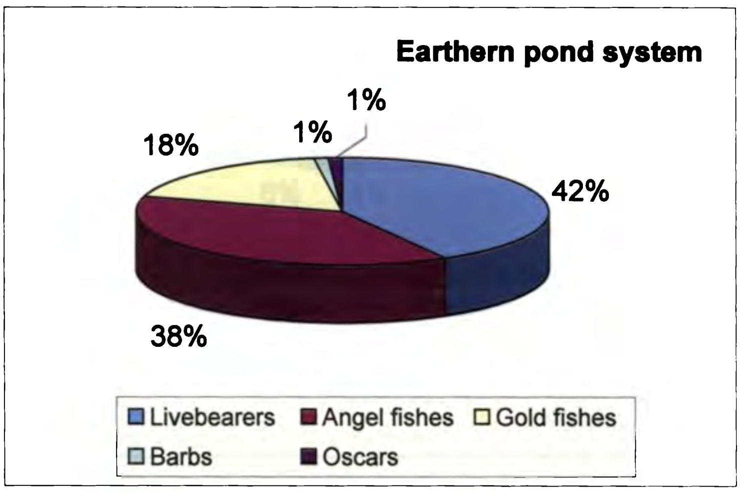
In cement tanks, gold fish constituted 40.7 percent of farm production, followed by 29.68 percent livebearers. Gold fish contributed 56.46 percent of total sales value and only 14.16 percent was contributed by livebearers. 24.09 percent of production quantity was gourami, contributing 17.09 percent of total sales value. Even though, angels were only 4.09 percent of total production, their contribution to sales vale was little bit higher with 10.11 percent.

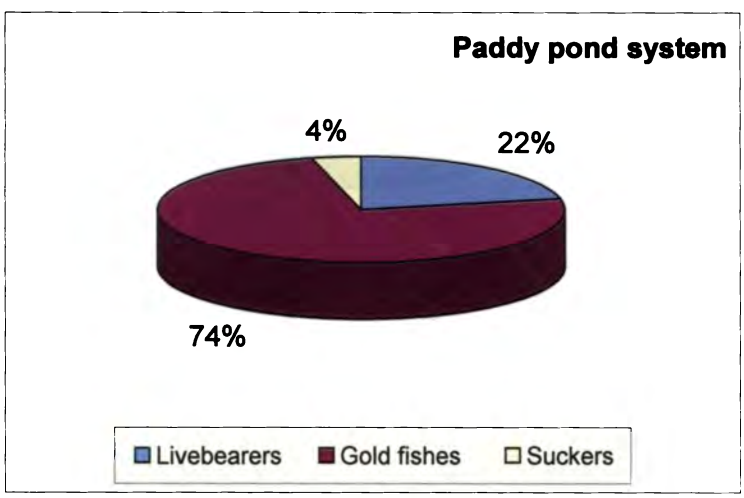
In ring system, livebearers and angels were the main varieties cultured and they contributed 63.38 and 36.62 percent respectively of the total quantity produced.

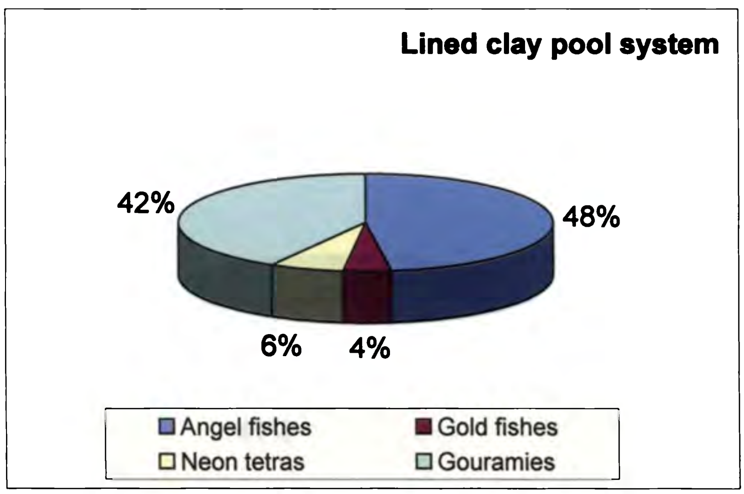
In quarries among the different varieties cultured, angels constituted 78.82 percent of total production, contributing 65.47 percent to the total sales value. Among other varieties, sharks constituted 4.1 percent contributing 19.57 percent of total sales value. Other than these, livebearers, gold fish, barbs and tetras were also cultured by the farmer.

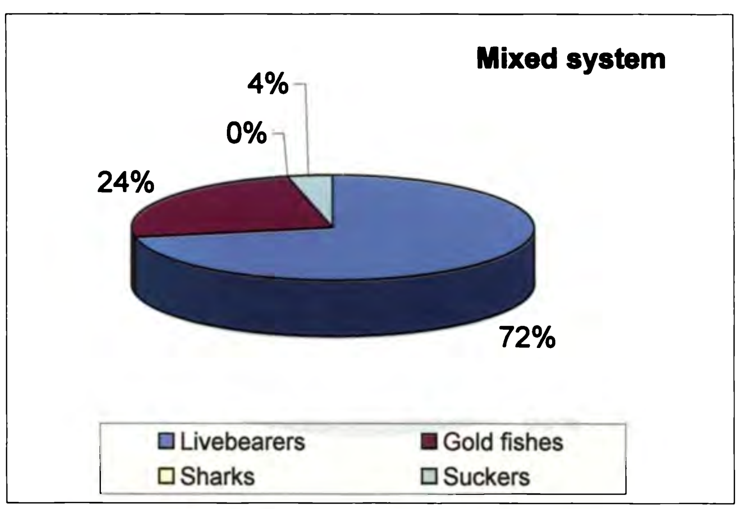
In orchid cum ornamental fish system, livebearers and angels were the main varieties cultured. Livebearers formed 95.28 percent of total farm production. Mollies constituted 47.15 percent of total quantity of livebearers produced, followed by guppy, with 33.40 percent, swordtail with 14.73 percent. Regarding sales value, mollies contributed 47.17 percent of total sales value, followed by swordtail with 18.43 percent, and guppies, with 16.71 percent. Production of angels was only 4.72 percent, but their value contribution compared to livebearers was higher with 17.69 percent. Output volumes and sales value of different varieties of ornamental fishes in selected case studies in Kerala is given in Appendix 5.1

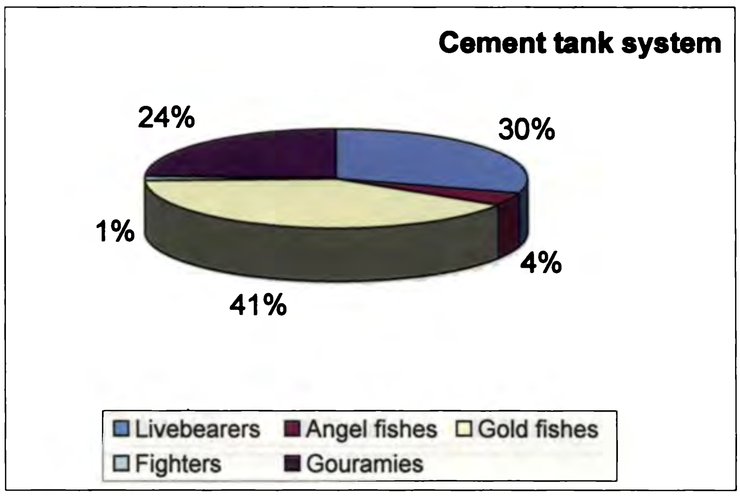
Fig 5.3 Distribution of quantity of different ornamental fish varieties under various production systems in Kerala

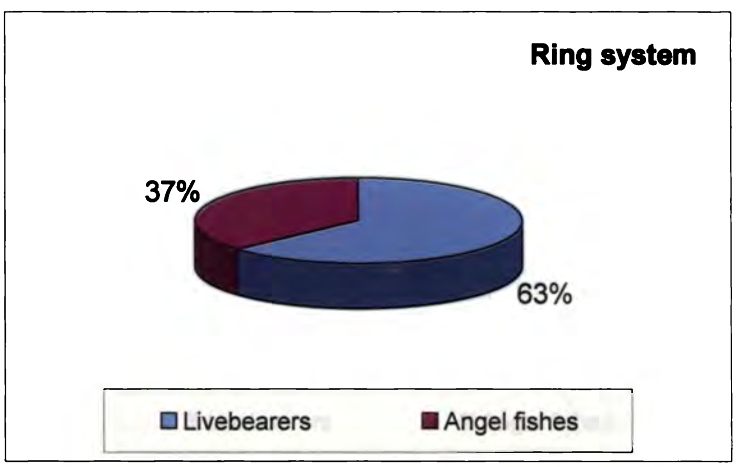


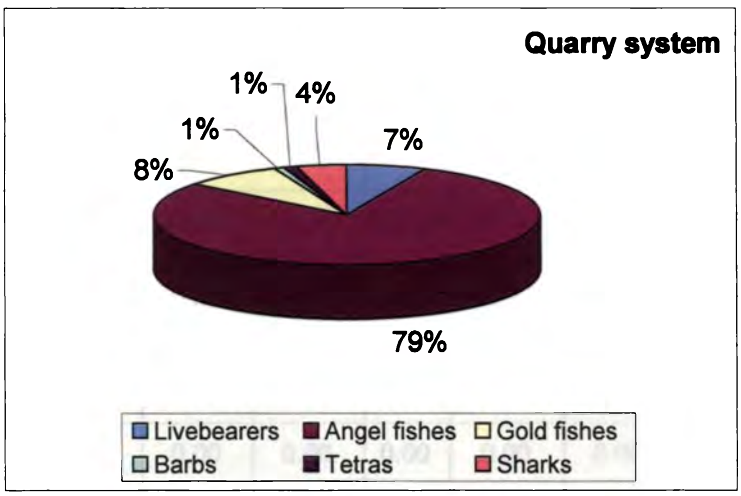



Lined clay pool system
42%
48%
6%
4%
Angel fishes
Gold fishes
Neon tetras
Gouramies


Mixed system
4%
0%
24%
72%
Livebearers
Gold fishes
Sharks
Suckers


Cement tank system
24%
30%
1%
4%
41%
Livebearers
Angel fishes
Gold fishes
Fighters
Gouramies


Ring system
37%
63%
Livebearers
Angel fishes


Quarry system
1%
4%
1%
7%
8%
79%
Livebearers
Angel fishes
Gold fishes
Barbs
Tetras
Sharks

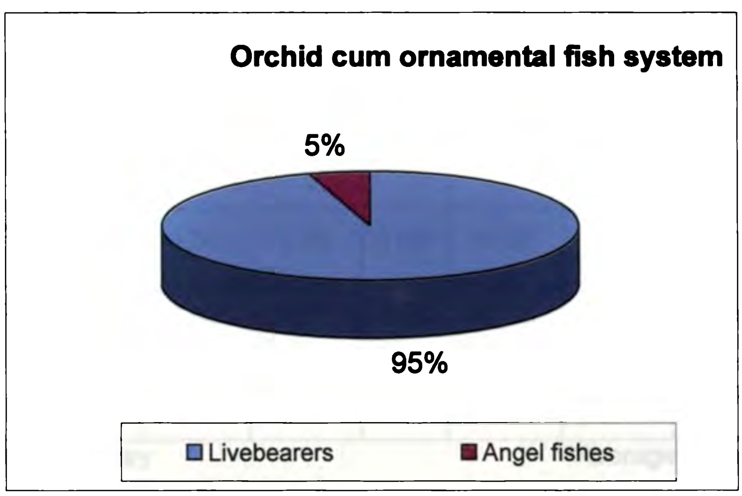

Orchid cum ornamental fish system
5%
95%
Livebearers
Angel fishes

Table 5.4 Distribution of sales value of different varieties of ornamental fish under various production systems in Kerala

Value: in Rs'000

Ornamental fish varieties	Earthern ponds	Paddy ponds	Lined clay pools	Mixed systems	Cement tanks	Rings	Quarries	*Orchid cum ornamental fish systems
Livebearers	51.48	35.94	0.00	246.65	61.07	7.05	14.40	301.50
Angel	119.14	0.00	60.47	0.00	43.58	13.24	550.27	64.80
Goldfish	31.77	249.91	5.12	330.80	243.48	0.00	102.63	0.00
Barb	1.56	0.00	0.00	0.00	0.00	0.00	3.30	0.00
Tetra	0.00	0.00	14.32	0.00	0.00	0.00	5.50	0.00
Shark	0.00	0.00	0.00	1.15	0.00	0.00	164.35	0.00
Sucker	0.00	31.92	0.00	64.10	0.00	0.00	0.00	0.00
Oscar	36.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fighter	0.00	0.00	0.00	0.00	9.43	0.00	0.00	0.00
Gourami	0.00	0.00	31.36	0.00	73.70	0.00	0.00	0.00
Total	240.70	317.78	111.26	642.70	431.26	20.29	840.44	366.30

Source- Primary survey *Average production/year

A careful analysis of above production processes revealed that due to favourable natural conditions, local producers were active during June to November. Hence seasonal variations in the supply of ornamental fish from local production were noticed. Figure 5.4 shows the seasonal availability of various ornamental fishes in Kerala.

Fig 5.4 Seasonal variation in the availability of major ornamental fish varieties

rieties ultured	Months											
	May	June	July	August	Sept	Oct	Nov	Dec	Jan	Feb	March	April
old fish	XX	XXX	XXX	XXX	XXX	XXX	XXX	XX	X	X	XX	XX
Carp	XX	XXX	XXX	XXX	XXX	XXX	XXX	XX	X	X	XX	XX
Barb	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XX	XX	XX	XX	XXX
Tetra	XXX	XXX	XXX	XXX	XXX	XXX	XXX	X	X	X	XX	XX
Angel	X	XX	XXX	XXX	XXX	XXX	XXX	XX	X	X	X	X
ebearers	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XX	XX	XX	XXX	XXX
ourami	X	XX	XXX	XXX	XXX	XXX	XXX	XX	X	X	X	X
Fighter	X	XX	XXX	XXX	XXX	XXX	XXX	XX	X	X	X	X

Source: Primary survey XXX- Available more XX-Less available X-Scarce.

5.1 Economics of ornamental fish production systems

As mentioned in the introductory chapter, ornamental fish farmers incurred various kinds of costs to procure inputs for undertaking production activities. The expenditures incurred in fish production are categorised into fixed and variable costs. The major production costs in ornamental fish culture were for construction of farm, stocking seeds and brooders, labour, feeding, electricity and fuel. These costs varied from region to region because of the differences in climatic and topographical conditions, differences in technology, distance from markets and input prices. It also varied from farm to farm within the same region because of the difference in management skill, farm size and technology **(Shang, 1981)**. Table 5.5 presents the cost structure of farmers undertaking ornamental fish culture under various systems.

5.2.1 Structure of costs for the culture of ornamental fishes in earthern ponds

Total investment for setting up earthern pond for ornamental fish culture was Rs. 73.21 thousands, of which 54.64 percent was for pond preparation. Total fixed costs were Rs. 17.5 thousands. Total variable costs were Rs. 23.84 thousands, of which higher percentage was for incidental costs, which accounted 34 percent followed by labour costs with 27.94 percent. Total costs were Rs. 41.34 thousand.

Table 5.5 Structure of costs for different ornamental fish culture systems in Kerala

Units : in Rs.'000

tial investment	Earthern ponds	Paddy ponds	Lined clay pools	Mixed system	Cement tanks	Rings	Quarries	*Orchid cum ornamental fish systems
nd and building	10.00 (13.66)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	16.00 (6.62)	0.00 (0.00)	250.00 (75.27)	0.00 (0.00)
Unit preparation	40.00 (54.64)	35.95 (69.63)	7.54 (35.18)	177.00 (87.14)	189.00 (78.14)	2.75 (30.86)	17.80 (5.36)	599.00 (97.71)
Equipments	23.21 (31.70)	15.68 (30.37)	13.89 (64.82)	26.13 (12.86)	36.87 (15.24)	6.16 (69.14)	64.33 (19.37)	14.05 (2.29)
tal investment costs	**73.21 (100)**	**51.63 (100)**	**21.43 (100)**	**203.13 (100)**	**241.87 (100)**	**8.91 (100)**	**332.13 (100)**	**613.05 (100)**
Fixed costs								
Depreciation	5.91 (33.77)	9.54 (31.34)	5.44 (36.58)	14.51 (15.51)	25.96 (39.46)	1.44 (17.48)	24.21 (31.58)	370.34 (41.91)
terest on initial investment	6.59 (37.66)	8.90 (29.24)	1.93 (12.98)	29.83 (31.89)	30.23 (45.95)	0.80 (9.71)	31.46 (41.03)	463.37 (52.43)
Others	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	42.00 (44.90)	0.00 (0.00)	0.00 (0.00)	9.00 (11.74)	20.00 (2.26)
pportunity costs	5.00 (28.57)	12.00 (39.42)	7.50 (50.44)	7.20 (7.70)	9.60 (14.59)	6.00 (72.82)	12.00 (15.65)	30.00 (3.40)
tal fixed costs	**17.50 (100)**	**30.44 (100)**	**14.87 (100)**	**93.54 (100)**	**65.79 (100)**	**8.24 (100)**	**76.67 (100)**	**883.71 (100)**
ariable costs								
Feed	1.59 (6.67)	5.66 (22.97)	3.39 (12.86)	5.40 (6.72)	4.22 (12.48)	0.50 (7.32)	3.56 (1.83)	30.25 (2.54)
Fertilizer	0.21 (0.88)	1.65 (6.70)	0.10 0.38)	2.42 (3.01)	0.55 (1.63)	0.06 (0.88)	6.56 (3.38)	42.60 (3.58)
Seed	2.93 (12.29)	6.68 (27.11)	1.05 (3.98)	8.24 (10.25)	6.06 (17.92)	0.64 (9.36)	116.66 (60.09)	412.70 (34.65)
Fuel/Electricity	1.49 (6.25)	2.20 (8.93)	9.15 (34.7)	3.97 (4.94)	5.71 (16.88)	0.15 (2.20)	18.11 (9.33)	14.50 (1.22)
arketing costs	2.86 (12.00)	0.70 (2.84)	1.48 (5.61)	2.40 (2.98)	4.72 (13.96)	2.10 (30.75)	5.94 (3.06)	130.04 (10.91)
cidental costs	8.10 (33.97)	1.40 (5.68)	0.00 (0.00)	36.25 (45.10)	2.90 (8.57)	0.58 (8.49)	4.50 (2.32)	374.30 (31.43)
Labour	6.66 (27.94)	6.35 (25.77)	11.20 (42.47)	21.70 (27.00)	9.66 (28.56)	2.80 (41.00)	38.80 (19.99)	186.60 (15.67)
Total variable costs	**23.84 (100)**	**24.64 (100)**	**26.37 (100)**	**80.38 (100)**	**33.82 (100)**	**6.83 (100)**	**194.13 (100)**	**1190.99 (100)**
Total costs	**41.34**	**55.08**	**41.24**	**173.92**	**99.61**	**15.07**	**270.80**	**2074.70**

Source- Primary survey * Costs for 5 years

(Figures in parenthesis indicate the percentage to respective totals in each system)

5.2.2 Structure of costs for the culture of ornamental fishes in Paddy ponds

Total investment costs for paddy pond was Rs. 51.63 thousands, of which 69.63 percent was for unit preparation. The farmer constructed the system on inherited land. Total fixed costs were Rs. 30.44 thousands and total variable costs, Rs. 24.64 thousand, of which seed costs accounted for 27.11 percent followed by labour costs with 25.77 percent. Total costs were Rs. 55.08 thousand.

5.2.3 Structure of costs for the culture of ornamental fishes in lined clay pools

Total investment costs for lined clay pool was Rs. 21.43 thousands, of which 64.82 percent was for buying equipments, mainly polyethylene sheets. As the farmer has constructed the system on his own/ inherited land and used a portion of his house for related activities, there were no costs for land and building. Total fixed costs were Rs.14.87 thousands of which opportunity costs were more than 50 percent. Total variable costs were Rs. 26.37 thousand, of which labour costs accounted for 42.47 percent. In this system water was exchanged every two days, which resulted in high electricity costs with 34.7 percent of total variable costs. Total costs were Rs. 41.24 thousand.

5.2.4 Structure of costs for the culture of ornamental fishes in mixed systems

Total investment costs for mixed system was Rs. 2.03 lakhs, of which majority was spent for unit preparation. There were no investment costs for land and building as the farmer had constructed the system on his own land. Total fixed costs were Rs. 93.54 thousands. Total variable costs were Rs. 80.38 thousand, of which incidental costs accounted for 45.10 percent. During the study period, the farm was subjected to heavy flood, which incurred a loss of Rs. 36.25 thousand. Other than incidental costs, labour costs accounted for 27 percent. Total costs were Rs. 1.74 lakhs.

5.2.5 Structure of costs for the culture of ornamental fishes in cement tanks

Total investment costs for cement tanks were Rs. 2.42 lakhs, of which Rs.1.89 lakhs was spent for unit preparation. Total fixed costs were Rs. 65.79 thousands. Total variable costs were Rs. 33.82 thousand, of which labour costs accounted for 28.56 percent. Total costs were Rs. 99.61 thousands.

5.2.6 Structure of costs for the culture of ornamental fishes in rings

Total investment for setting up the system was Rs. 8.91 thousands, of which 69.14 percent was for buying equipments. Total fixed costs were Rs. 8.24 thousands. Total variable costs were Rs. 6.83 thousands, of which labour costs, accounted for almost 41 percent. Marketing costs were higher (30.75%) for the system (refer chapter 4, section 4.2.6). Total costs were Rs. 15.07 thousands.

5.2.7 Structure of costs for the culture of ornamental fishes in quarries

Total investment for setting up quarries for ornamental fish culture was Rs. 3.32 lakhs, of which the costs for land acquisition (75.27 percent) were higher. Costs for unit preparation were less as quarries are built in structures. Total fixed costs were Rs. 76.67 thousands. Total variable costs were Rs. 1.94 lakhs, of which seed costs, accounted for 60.09 percent. Seed costs were higher as the farmer concentrated on grow out operations. Total costs were Rs. 270.80 thousands.

5.2.8 Structure of costs for the culture of ornamental fishes in orchid cum ornamental fish system

Total investment costs for orchid cum ornamental fish system was Rs. 6.13 lakhs of which majority was spent for unit preparation. There were no investment costs for land as the farmer had constructed the system on inherited land. Total fixed costs were Rs. 8.84 lakhs. Total variable costs were Rs 11.91 lakhs. Total costs were Rs. 20.75 lakhs. As the production cycle of orchids was for 5 years, cost and return analysis of this system was conducted for this entire period.

5.2.9 Profitability analysis

Revenue obtained from farming operations, net profit, pay back period, net profit as percentage of total cost, ratio of variable cost to investment, rate of return on investment and total costs are given in table 5.6. While considering the net profit, all the systems showed positive returns, even though the net profit from rings were very low. By increasing the production capacity, either by adding in more rings or by leasing in of more ponds, the system could function better than before. Ratio of net profit to total cost has worked out to be highest for earthern pond (4.82) followed by paddy ponds (4.78).

Ratio of total variable cost to investment worked out to be 1.23 for lined clay pools. It was noted less for rings (0.77), paddy ponds (0.48), quarries (0.58), mixed systems (0.39) earthern ponds (0.33) and least with cement tanks (0.14). The variable cost and investment ratio as given above indicated that lined systems were subjected to intensive utilisation of capital investment. In general, lower the relative ratio of variable cost to investment less will be the efficiency of capital utilisation. Both investment and variable cost complement each other, in reaching the efficiency level of output. A very high initial cost and very low variable cost lead to less efficient use of capital and consequently low efficiency in production.

Table 5.6 Cost and earnings of different production systems

Units: in Rs.'000

Items	Earthern ponds	Paddy ponds	Lined clay pools	Mixed systems	Cement tanks	Rings	Quarries	*Orchid cum ornamental fish systems
Investment costs	73.21	51.63	21.43	203.13	241.87	8.91	332.13	613.05
Revenue	240.70	317.78	111.26	642.7	431.26	20.3	840.44	2871.50
Total variable costs	23.84	24.64	26.37	80.38	33.82	6.83	194.13	1190.99
Total fixed costs	17.5	30.44	14.87	93.54	65.79	8.24	76.67	883.71
Total costs	41.34	55.08	41.24	173.92	99.61	15.07	270.80	2074.70
Net profit	199.36	262.70	70.02	468.78	331.65	5.23	569.64	796.80
Pay back period (yr)	0.36	0.19	0.28	0.42	0.68	1.34	0.56	0.53
Ratio of profit to total cost	4.82	4.78	1.7	2.7	3.33	.35	2.10	.38
Ratio of variable costs to investment	0.33	0.48	1.23	0.39	0.14	0.77	0.58	1.94
Rate of return (%)								
On Investment	272.32	508.86	326.72	168.71	146.7	56.45	171.51	129.97
On Total cost	482.22	476.94	169.76	269.54	332.95	34.70	210.36	38.41

Source: Primary survey *Cost and earnings for 5 years

Profitability analysis indicated that all the cases studied generated positive returns. The variable costs were low for almost all the systems. Positive returns were mainly due to the presence of opportunity costs in the form of family labour costs.

5.2.10 Constraints

Case studies revealed that most of our farmers were cultivating only common varieties of ornamental fishes. Lack of technology know-how, breach of sales contract and price cuts dictated by traders restricted producers from experimenting with new varieties. Study also noted that farmers, other than those experienced, were in a weak bargaining position with traders. Even though production capacities existed, they were under-utilised due to absence of assured domestic market and tough competition and inflow of ornamental fishes from neighbouring states. Production levels in fish farms could be doubled or even tripled through the application of improved techniques if various constraints on expansion were solved. During final harvesting the producer was forced to dispose off fishes at whatever price prevailing due to lack of storage facilities. This was not often reflected in wholesale and retail prices. As size and quality of ornamental fish matters, proper grading of fish was necessary for receiving better returns (Arora *et al.,* 1993; Patil and Kumar, 1993; Talukdar and Bhowmick, 1993). The survey found that, most producers sold their stock without grading, which resulted in poor returns to them. 70 percent of producers did not grade fish before selling to traders. Grading was done only when stock was sold directly to consumers.

5.3 Summary and conclusions

The above analysis revealed that production of ornamental fishes was organised both in their own farms and leased-in structures. Farmers normally granted access to local people to their farms to reduce poaching and to ensure safety of stock. Majority of ornamental fish farms were small-scale enterprises. Family labour costs constituted more than 70 percent in all most all the systems. On the whole, the study revealed active involvement of family labour in the production of ornamental fish, which contributed to the success of the system. However, people engaged in this fishery had only basic education. Study revealed flow of goods from breeder to consumer through a chain of intermediaries. Other than this, emerging tendencies like buy back mechanisms, collective bargaining and vertical integration were also noticed. Ten percent of breeders were engaged in ornamental fishery on full time basis and for others this was a sub occupation. Producers insisted ready cash payments, and credits were never entertained due to risks associated with the business.

Regarding the supply of goods produced, fishes were sold mainly to regular customers. Most farmers sold bulk quantity to wholesalers and minimum to retailers. Price varied highly depending on grades and the gain in size by the fish. Only a small quantity was reared to large size and the rest was sold as medium size. Moreover most of the farmers concentrated mainly on four to five common varieties of fishes, while a few resorted to high priced varieties.

Profitability analysis indicated that all the cases studied generated positive net returns. The variable costs were low for almost all the systems. Some of the farms had no investment costs for land as they were doing culture operation in inherited land. Positive returns were mainly due to the presence of opportunity costs in the form of family labour. The foregoing analysis indicated the economic viability of establishing freshwater ornamental fish farms as a supplementary source of income. The analysis also indicated that small-size ponds were sufficient to generate supplementary income for farmers.

Appendix 5.1

Output volume and sales value of different varieties of ornamental fish in selected case studies.

1. Output volume and sales value of different ornamental fish varieties produced in earthern ponds

Quantity: in No.'000
Value : in Rs.'000

Variety	Quantity	Sales value
Angel		
Zebra angel	1.7	19.30
Leopard angel	1.03	11.27
Diamond angel	2.81	27.19
Koi angel	3.08	29.33
Marble angel	4.11	32.03
Livebearers		
Swordtail	3.03	12.19
Delta guppy	3.03	10.31
Platy	3.79	12.78
Balloon molly	1.59	7.26
Black molly	2.66	8.95
Gold fish	6.15	31.77
Tiger barb	0.36	1.56
Oscars		
Albino Oscar	0.15	18.38
Red Oscar	0.25	18.38
Total	**33.74**	**240.70**

Source: Primary survey

2. Output volume and sales value of different ornamental fish varieties produced in paddy ponds

Quantity: in No.'000
Value : in Rs.'000

Variety	Quantity	Sales value
Gold Fish		
Ordinary gold fish	15.46	98.15
Fantail gold fish	14.64	94.41
Shubunkin	8.2	57.36
Livebearers		
Guppy	1.99	4.98
Swordtail	4.52	18.44
Black molly	3.73	9.29
Silver molly	0.94	3.23
Sucker	2.05	31.92
Total	**51.53**	**317.78**

Source: Primary survey

3. Output volume and sales value of different ornamental fish varieties produced in lined clay pools

Quantity: in No.'000
Value : in Rs.'000

Variety cultured	Quantity	Sales value
Angels		
Ordinary angel	8.32	28.06
Veil tail angel	5.50	32.40
Gourami		
Blue gourami	3.31	7.22
Snowhite gourami	3.20	7.01
Golden gourami	3.10	9.80
Honey gourami	2.40	7.33
Gold Fish	1.20	5.12
Neon Tetra	1.83	14.32
Total	**28.85**	**111.26**

Source: Primary survey

4. Output volume and sales value of different ornamental fish varieties produced in mixed system

Quantity: in No.'000
Value : in Rs.'000

Varieties	Quantity	Sales value
Ordinary gold fish	37.11	330.8
Livebearers		
Guppy	66.2	95.68
Swordtail	44.03	150.97
Sucker	5.53	64.1
Tiger shark	0.1	1.15
Total	**152.97**	**642.7**

Source: Primary survey

5. Output volume and sales value of different ornamental fish varieties produced in cement tanks

Quantity: in No.'000
Value : in Rs.'000

Variety	Quantity	Sales value
Gold fish		
Ordinary gold fish	23.96	112.9
Fantail-Shubunkin	10.88	55.55
Ordinary-Shubunkin	10.14	33.96
Blackmoor	4.6	41.07
Gouramies		
Moonlight gourami	3.1	12.47
Honey gourami	3.87	11.88
Blue gourami	7.72	14.93
Snowhite gourami	7.72	14
Golden gourami	6.92	20.42
Angel	4.98	43.58
Fighter	1.75	9.42
Livebearers		
Platy	6.02	7.91
Guppy	10.05	10.89
Swordtail	10.05	22.37
Black molly	10.05	19.91
Total	**121.81**	**431.26**

Source: Primary survey

6 Output volume and sales value of different ornamental fish varieties produced in rings

Quantity: in No.'000
Value : in Rs.'000

Variety	Quantity	Sales value
Angel		
Marble angel	1	6.05
Ordinary angel	1.05	4.9
Veil tail angel	0.1	0.79
Diamond angel	0.15	1.5
Livebearers		
Guppy	1.84	2.8
Swordtail	0.5	1.1
Black molly	1.64	3.16
Total	**6.28**	**20.3**

Source: Primary survey

7 Output volume and sales value of different ornamental fish varieties produced in quarries

Quantity: in No.'000
Value : in Rs.'000

Variety	Quantity	Sales value
Angel		
Koi angel	30.32	221.07
Jewel angel	13.64	82.06
Marble angel	38.08	220.88
Koi-jewel	1.75	14
Marble- jewel	1.75	12.25
Livebearers		
Swordtail	7.2	14.4
Gold fish	9.1	102.63
Tiger barb	0.9	3.3
Tetra		
Black widow tetra	0.9	3.2
Albino widow tetra	0.45	2.3
Sharks		
Tiger shark	3.75	114.75
Rainbow shark	0.14	3.7
Silver shark	0.42	42.4
Red tail shark	0.14	3.5
Total	**108.54**	**840.44**

Source: Primary survey

8 Output volume and sales value of different ornamental fish varieties produced in orchid cum ornamental fish system

Quantity: in No.'000
Value : in Rs.'000

Variety	Quantity	Sales value
Livebearers		
Guppy	61.2	61.2
Molly	86.4	172.8
Swordtail	27	67.5
Angel	8.64	64.8
Total	**183.24**	**366.3**

Source: Primary survey

CHAPTER 6

Structure and composition of ornamental fish marketing in Kerala

In previous chapters an attempt was made to explore demand for ornamental fishes in Kerala and how various entrepreneurs responded to the growing markets by producing required bundle of goods and services. As a matter of fact, markets for ornamental fishes at present are concentrated in certain urban centres. Promotional support systems and formal institutions also target these urban centres and markets. That being the case, this chapter attempts a detailed analysis of various aspects of marketing of ornamental fishes and ancillary products in Kerala. The chapter is divided into 3 sections. Section 1 explains how ornamental fish marketing is organised with special emphasis on the nature of market structure, marketing channels, business practices and marketing strategies. Second section examines composition of ornamental fishes and other supplementary goods that arrived into various markets in Kerala. The analysis was based on primary data collected from 30 traders consisting of one wholesaler, eight wholesaler cum retailers and 21 retailers. Summary and conclusions are provided in section three.

6.1 Organisation of ornamental fish markets in Kerala

Most of the aquarium shops in Kerala are multi-product outlets selling ornamental fishes, aquarium plants and related accessories, birds and other pet animals. It was already mentioned that ornamental fishes traded in various markets in Kerala arrived from local producers and outside the state. Traders normally had own backyard production units attached to their house or shop. Fishes brought from neighbouring states were kept in backyard units for size augmentation and later sold.

6.1.1 Classification of traders

Local ornamental fish traders are classified into wholesalers, wholesaler cum retailers, consolidators and retailers.

Wholesale trader

Wholesale trader (wholesaler) procured ornamental fishes in bulk quantities both from local and outside sources and supplied to sub agents like wholesaler cum retailers and retailers. No products were sold directly to final consumers. The study could identify only one wholesaler in the state during the survey period. Located at Thrissur (central zone), the wholesaler carried out trade as a family business and controlled 7.44 percent of ornamental fish traded in the entire State[1]. Wholesalers aided producers by ordering fishes well ahead of season and by paying bills on time. It was noted that in some cases

[1] See table 6.16 for details

wholesaler financed small-scale farmers and purchased fish at a pre-determined price to ensure supply[2].

Wholesale cum retail traders and consolidators

Wholesale cum retail traders (wholesaler cum retailers) sold more quantities to retailers and few quantities to consumers. Study found out that most of the traders in this category sold 75 percent of the total stock as bulk to retailers and 25 percent to direct consumers. The pricing adopted in these modes of selling varied. For bulk sales, they charged 25-35 percent margin and for direct sales the margin was 50-75 percent. The consolidators are a special category of wholesale cum retail traders, who purchased ornamental fishes in bulk according to the needs of a group of retailers. Consolidators placed orders to suppliers from other states after receiving orders from local retailers. This arrangement had been useful as consolidator shouldered all business risks in transportation, mortality, payment defaults and changes in orders. The consolidators also owned shops with all facilities needed for business, where usual transactions took place.

Retailers

Omamental fish retailers acted as purchasing agents who procured commodities by anticipating customer's needs. 88 percent of the total trading units in Kerala were retail outlets and their number was 171 during the study period. Retailers stocked less quantity of fishes to

2 Subrahmanyam and Anjaneyulu (1992) had substantiated the above view.

minimise risks in mortality. The selling price set by retail trader was double than that of a wholesaler. Retailers in urban areas who supplied goods to rural retailers were known as primary retailers while those in the rural areas were known as secondary retailers.

Brokers

Brokers entered in ornamental fish business in the early phase of its development. During those days, some of them purchased fishes from neighbouring states in bulk, while other brokers procured fishes from local producers in rural areas. During study period, brokers were mainly noticed in the south zone. Initial investment was very low for this group of people. Established traders had excellent facilities to acclimatise and treat imported fish whereas brokers lacked such facilities and experience. Brokers knew the location of production centres and according to the orders placed, forwarded consignments to traders in rural areas and therefore incurred low operating expenses. As brokers could not offer quality products and post-marketing services to customers, this system has eroded and vanished.

The above discussions revealed that there were many categories of traders involved in ornamental fish trade with distinct roles and functions and except brokers most of the other categories are still active. Figure 6.1 gives a schematic representation of various channels in ornamental fish marketing.

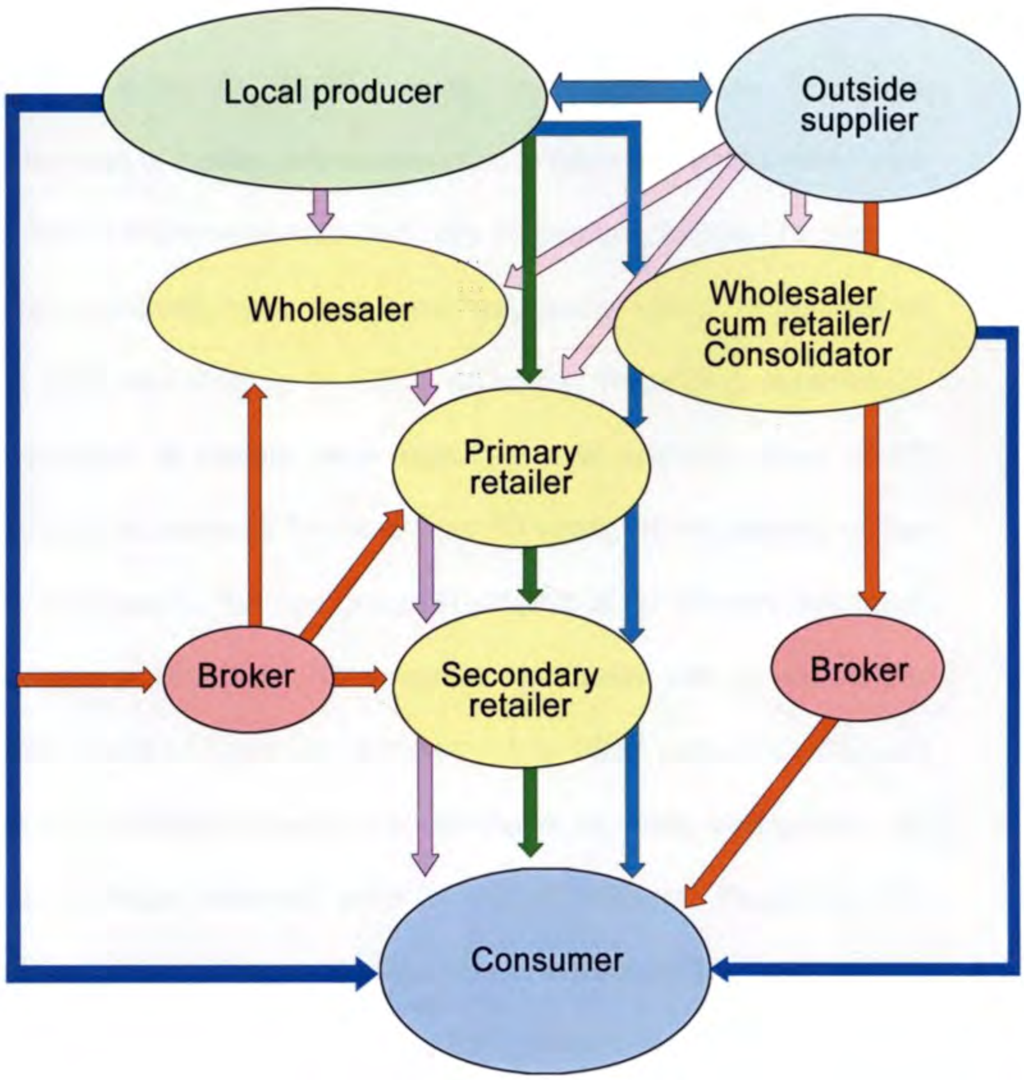


Fig 6.1 Marketing channels in ornamental fish industry of Kerala

6.1.2 Socio economic characteristics of traders

As noted in chapter 1, there were 194 ornamental fish traders in the state, of which 30 dealers were surveyed. Socio economic characteristics of traders are summarised in table 6.1. It was noted that 90 percent of them were male and only 10 percent, female. 70 percent of traders received more than basic education, while 30 percent of traders had education up to SSLC or below. Regarding experience, 73.33 percent of traders were relatively new entrants while 26.67 percent was in business for more than 10 years. 46.67 percent of the traders belonged to the age group 31-45 and 26.67 percent belonged to the age group 46-60. Ornamental fish trade was a secondary occupation for 83.33 percent of traders while 16.67 percent of the total traders had adopted ornamental fish trade as main occupation. 60 percent of shops surveyed were in rented buildings. Regarding the type of ownership, 50 percent of the shops were individual units, 43.33 percent were family enterprises and 6.67 percent were on partnership basis.

Table 6.1 Socio economic status of ornamental fish traders in Kerala

Sl.no	Attributes		No. of traders	Percent
1	Age (Years)	Upto 30	7	23.33
		31-45	14	46.67
		46-60	8	26.67
		61 & above	1	3.33
2	Gender	Male	27	90
		Female	3	10
3	Education	Up to SSLC	9	30
		Pre degree	12	40
		Degree and above	9	30
4	Occupation	Main occupation	5	16.67
		Sub occupation	25	83.33
5	Experience (Years)	Less than 5	13	43.33
		5-10	9	30
		More than 10	8	26.67
6	Nature of ownership	Own	10	33.33
		Rented	18	60
		Others	2	6.67
		Lease	0	0
7	Type of ownership	Family enterprise	13	43.33
		Individual	15	50
		Partnership	2	6.67
		Society	0	0
		Co-Operative	0	0

Source: Primary survey

6.1.3 Business practices

Business practices of ornamental fish trading units refer to the popular practices that they adopt to enhance profits. These include placing orders, frequency of holding stock, advertisement, transportation, labour and employment pattern, marketing strategies and identification of market segments and target groups.

6.1.3.1 Placing orders

Trade in ornamental fish was based more on personal relationships and orders were generally arranged through telephone or sending demand draft (DD) in advance through post. 85.71 percent of experienced traders transacted business through telephone. 68.75 percent of less experienced traders sent DD in advance for obtaining orders (Table 6.2).

Table 6.2 Mode of obtaining orders

Mode of obtaining orders	Experienced traders	Less experienced traders	Total number of traders
Phone	12 (85.71)	2 (14.29)	14 (100)
DD Advance	5 (31.25)	11 (68.75)	16 (100)

Source: Primary survey

(Figures in parenthesis indicate the percentage to respective totals)

6.1.3.2 Confirmation of orders

Consignments arrived within a week, after the orders were placed. However, these orders had to be frequently monitored for delivery, as cheating was quite common in this market. Table 6.3 gives the frequency of confirmation of orders by different traders. 46.67 percent of traders received stock within a week after placing orders, while 26.68 percent got stock within some days and 16.65 percent within a fortnight.

Table 6.3 Frequency of confirmation of orders

Frequency	No. of traders	Percent
Days	8	26.68
1 week	14	46.67
Fortnight	5	16.65
Others	3	10.00
Total	30	100

Source: Primary survey

The traders never allowed credit sales due to heavy risk involved in trade. However, the common procedure was to insist for payment through demand draft before sending fish. In the case of occasional buyers or retailers, even though full payment for the fish was sent through DD, suppliers from neighbouring states never sent fishes for the complete amount paid or according to orders placed; instead, suppliers normally disbursed the varieties already in their stock. The survey showed that majority of traders (53.33 percent) sometimes received the stock as per the orders placed and only 16.67 percent received fishes every time as per order placed (Table 6.4). It was mainly due to the long-term relationship between the supplier and client.

Table 6.4 Reception of fishes based on orders placed

Reception of order	No. of traders	Percent
Every Time	5	16.67
Most Time	6	20.00
Sometime	16	53.33
Never	3	10.00
Total	30	100.00

Source: Primary survey

6.1.3.3 Frequency of arrivals and holding stock

Fish are usually packed in polythene bags, which are filled one fourth with water and the rest with oxygen or compressed air, sealed and packed in cardboard box. The number of fish that a box can contain depends on the size of the fish. The wholesale trader brought four to five parcels per week containing 35-50 boxes. The wholesaler cum retailer on the other hand brought 22- 35 boxes in one parcel, whereas the retailer could arrange only one parcel per week, having eight to 22 boxes per parcel. Table 6.5 presents the number of days, fishes were held in the shop by sample respondents. The wholesale trader and broker cleared out the stock either on the spot or within a few days to make room for next purchase. The storage period of the product in each channel was made to the very minimum so as to avoid loss (Kaicker, 1984). Other than off-seasons, movement of fish stock through the above channel was less than two days. In the case of wholesale cum retail trader or consolidator, fishes were sold on the spot or within two to three days after arrival. In the case of a retail trader, the stock was retained in the shop between three days and two weeks or even up to several months, depending on factors controlling demand. 53.33 percent of the traders sold the stock within 3-7 days.

Table 6.5 Days of holding the stock

Days of holding the stock	No. of traders	Percent
Sold at spot	4	13.32
Less than 3 days	8	26.67
3-7 days	16	53.33
2 weeks	1	3.33
More than 2 weeks	1	3.35
Total	30	100

Source: Primary survey

6.1.3.4 Advertisement

Traders seldom used advertisement until late1990s for promoting business. However, as competition increased with the mushrooming of trading outlets, dealers resorted to advertising through placing boards, displaying products neatly, showing slides in theatres, sponsoring events, participating in exhibitions, distributing visiting cards and direct marketing. Traders were asked to give responses on advertising methods they adopted for promoting business and the results are presented in table 6.6.

Table 6.6 Advertising the product

Modes of advertisement	No. of traders	Percent
Distributing visiting cards alone or combined with placing boards	13	43.33
Participation in exhibitions alone or a combination of distributing visiting cards and placing boards	8	26.67
Advertising in media alone or a combination of distributing visiting cards and placing boards	4	13.33
Display of products alone or with a combination of distributing visiting cards and placing boards	3	10
All the above	2	6.67
Total	30	100

Source: Primary survey

All traders displayed aquarium in a neat and decorative manner. 43.33 percent of them distributed visiting cards and/ or displayed boards for advertising their product. 26.67 percent participated in exhibitions alone or combined distributing visiting cards and placing boards to promote their business and contacts. 13.33 percent adopted advertising in media alone or a combination of distributing visiting cards and placing boards while 10 percent used display of aquarium in other institutions, like hotels/ restaurants or adopted distributing visiting cards and placing boards as advertising method. The remaining 6.67 percent used all the advertising methods together.

6.1.3.5 Transportation

Transportation of fish was one of the important activities in ornamental fish marketing. Major mode of transportation used for the movement of goods from neighbouring state to Kerala was railways, as it gave priority to livestock transportation. For transporting goods from neighbouring states to Kerala, 93.33 percent of traders depended on railways and about seven percent depended on roadways, preferably public transport systems. Once it reached respective stations, auto rickshaws were used for transporting fishes to the market. For transporting fishes from respective stations to various destinations, roadways, were used by retail traders. Number of traders who transported fishes through different methods, within the state and from outside state are computed which are presented in Table 6.7

Table 6.7 Mode of transportation

Mode of transportation		From outside state (Percent)	Within state (Percent)
Train		93.33	0
Roadways	Bus	6.67	6.67
	Auto	0	93.33
Total		100	100

Source: Primary survey

6.1.3.6 Barriers to entry

The barriers to entry refer to any advantages held by market participants, which made it difficult or impossible for prospective competitors to reduce its market share and profit. Experience was an important factor in running ornamental fish trade and those who survived possessed expertise in technical know-how, very good relation with consumers, fellow traders, producers, suppliers and exporters. As already indicated in chapter three, 69.41 percent of consumers bought fish from specific shops, which maintained good relations and services. The strong product-tie between traders and producers based on trust evolved during long years of contact was a crucial factor in the success of the industry. Other than customer awareness and product quality, marketing strategies like good product availability and technical assistance were needed for obtaining market share in a competitive field. Although there were no government restrictions on the entry of new enterprises into this industry, technological and credit constraints prevented entry of new comers. At the same time, many new entrants withered away due to non-adaptability and low profits. Thus, although there were no restrictions on entry, the survival of the units in the long run was low. Of the 35 trading units selected for the study, 5 of them stopped functioning, before the end of the study period. That means 14 percent of the total ornamental fish trading units in Kerala, ceased functioning within 3 years of their entry into the field.

6.1.3.7 Labour and employment pattern

Most of the trading outlets employed family labour and hired workers on full time and part time basis. 67.12 percent of the total labour employed was family labour and 32.88 percent was hired. Table 6.8 shows the number of labourers employed in selected trading outlets.

Male members carried out collection, transportation of fishes and repair and maintenance. Other activities like cleaning tanks, stocking, water exchange, feeding, grading, packing, sales and money keeping were carried out by both male and female workers. 79.59 percent of the total family labour was by male members and the rest by females. In the case of hired labourers, both male and female workers were employed equally, on full time and part time basis (50 percent). 63.01 percent of total labourers were full time and 36.99 percent were part time labourers.

Table 6.8 Employment pattern in the selected trading outlets

Pattern of labour	Family labour			Hired labour		
	Male	Female	Total	Male	Female	Total
Full time	22 (78.57)	6 (21.43)	28 (100)	9 (50)	9 (50)	18 (100)
Part time	17 (80.95)	4 (19.05)	21 (100)	3 (50)	3 (50)	6 (100)
Total	39 (79.59)	10 (20.41)	49 (100)	12 (50)	12 (50)	24 (100)

Source: Primary survey
(Figures in parenthesis indicate the percentage to respective totals)

6.1.3.8 Marketing strategies

Even though seasonal factors, ethical considerations, income, status of consumers, market intermediaries, risks, uncertainties, legislation and governmental pressures affected pricing, the most relevant among them was the competition from fellow traders. Different marketing strategies like price cuts, diversified product mix, introduction of new variety and improved quality were adopted by traders. Marketing strategies adopted by each trader varied according to location, target market, and competition. Product-variety marketing was the strategy followed by experienced traders. In monsoon months, small size fishes were available in all the market, whereas medium size ones were less in quantity. Ordering different sizes and diverse varieties of ornamental fish in a shop was another strategy, which attracted customers.

About 200-250 varieties of ornamental fishes were sold in the market and their availability differed across seasons. Product differentiation was not noticed in individual markets during study period. Almost all shops sold the same varieties of fish and accessories, and there was homogeneity in the product supplied. Uniformity was seen because lion's share of ornamental fishes traded in domestic market arrived from Tamilnadu. However, experienced traders had recently resorted to product differentiation by stocking ornamental fishes with diverse attributes like colour, size, vigour, shapes of rare nature and even indigenous varieties. As a result, imported rare varieties fetched four to five times higher than ordinary ones.

6.1.3.9 Market segments and target groups

Alceste and Jory (2003) stated that product differentiation enhanced value and created new market segments. Traders exhibited different fishes in their shop according to consumer's tastes and preferences that varied across regions. Retailers stocked goods on local basis. Study found out that the location of the shop played a major role in the varieties sold. Table 6.9 shows the marketing strategies adopted by various traders in different locations. In corporation areas, where urban population was high, the number of shops was more, closely located and competed for major market shares. Even though most of the ornamental fish varieties were available, traders targeted high-class affluent society. In municipal regions, the target consumers were medium income people. More over the concentration of shops was less compared to corporation areas and the price structure varied from shop to shop. Small and medium size fishes were available in shop and large ones were available only occasionally or provided on request for high price. As there were only few shops in panchayath areas the competition was minimum. Only small and medium size fishes were available which targeted low and medium income people.

Table 6.9 Marketing strategies adopted by various traders according to the locality

Location of shop	Target market	Size offered	Degree of competition	Concentration of shops
Corporation	All categories, especially high income customers	All size	Highly competitive	More
Municipality	Medium and high income customers	Small and medium size, large size occasionally, or on request	Less competitive	Less
Panchayath	Medium and low income customers, students	Mainly small and medium varieties	Least competitive	Least
Near school/college	School/college students	Mainly small varieties, and less quantities of medium varieties	Based on location	Based on location
Near industrial area/ /heart of city premises	High income customers	High priced varieties, All size	Highly competitive	More
Near government organisations	Middle income customers	Medium priced	Based on location	Less

Source: Primary survey

6.2 Market arrivals of ornamental fishes in Kerala

Arrivals of ornamental fishes in Kerala market were from two sources; local production and from outside states. Composition and market arrivals of ornamental fishes from these two sources are detailed below.

6.2.1 Composition and market arrivals of local varieties of ornamental fishes in Kerala

Local arrivals to various markets comprised of indigenous fishes caught from wild and ornamental fishes produced through breeding and rearing. Chapter 4 revealed that major varieties farmed in Kerala were livebearers, angels, gold fishes and gouramies. Survey noted that, local producers contributed only 16.71 percent to domestic market while the remaining (83.29 percent) arrived from neighbouring states especially from Tamilnadu (Table 6.10). Central zone received bulk of the supply followed by south and north zones. The share of local arrivals was much higher in central zone (21.38 percent), compared to south and north zones (11.44 percent and 10.09 percent respectively). Analysing local market arrivals to various zones it was noted that, livebearers like guppy, molly, swordtail and platy constituted 54.21 percent, angelfish and its varieties constituted 28.86 percent, gourami 6.92 percent, gold fish 6.73 percent and all the remaining fishes together contributed around three percent to various markets in Kerala (Table 6.11).

Table. 6.10 Market arrivals of ornamental fishes from local and outside state by different zones in Kerala: 2000-2001

Quantity: in No. '000
Value : in Rs. '000

Arrival	Quantity				Value			
	South Zone	Central Zone	North Zone	Total	South Zone	Central Zone	North Zone	Total
Local	88.00 (11.44)	354.77 (21.38)	56.44 (10.09)	499.21 (16.71)	591.80 (15.41)	2222.64 (24.80)	347.56 (11.28)	3162.00 (19.91)
Other states	681.54 (88.56)	1304.63 (78.62)	502.65 (89.91)	2488.82 (83.29)	3247.50 (84.59)	6738.29 (75.20)	2732.59 (88.72)	12718.38 (80.09)
Total	769.54 (100)	1659.40 (100)	559.09 (100)	2988.03 (100)	3839.30 (100)	8960.93 (100)	3080.15 (100)	15880.38 (100)

Source: Primary survey

(Figures in parenthesis indicate the percentage to respective totals)

Table 6.11 Composition of local market arrivals in Kerala: 2000-2001

Local ornamental fish varieties		Quantity (Percent)
Livebearers		54.21
Gold fish		6.73
Carp		0.89
Barb		0.60
Shark		0.50
Tetra		0.06
Piranha		0.00
Angel		28.86
Oscar		0.05
Other Cichlids		0.00
Fighter		0.29
Gourami		6.92
Catfish		0.40
Indigenous varieties	Fresh water	0.48
	Marine	0.01
Total		100

Source: Primary survey

The composition of ornamental fishes arrived in the market from local sources through rearing, breeding and wild collection and from other states is summarised in Table 6.12 and the sales value generated under each category is presented in Table 6.13. It may be inferred that 71.93 percent of livebearers were produced locally through breeding and 28.07 percent were reared[3].

Table 6.12 Distribution of market arrivals of ornamental fishes in Kerala: 2000-2001

Quantity: in No. '000

Ornamental fish varieties		Local			Local (Sub total)	Outside state	Total
		Breed ing	Rear ing	Wild caught			
		a	B	c	(a+b+c) d	e	d+ e
Live Bearers		194.65	75.96	0	270.61	809.90	1080.51
Gold fish		3.32	30.27	0	33.59	599.66	633.25
Carp		0.86	3.60	0	4.46	170.67	175.13
Barb		0	3.01	0	3.01	262.03	265.04
Shark		0	2.49	0	2.49	45.29	47.78
Tetra		0.29	0	0	0.29	262.63	262.92
Piranha		0	0	0	0	3.30	3.30
Angel		50.43	93.65	0	144.08	16.07	160.15
Oscar		0.03	0.24	0	0.27	35.06	35.33
Other Cichlids		0	0	0	0	55.28	55.28
Fighter		1.47	0	0	1.47	60.92	62.39
Gourami		13.81	20.71	0	34.52	114.47	148.99
Catfish		1.4	0.61	0	2.01	53.54	55.55
Indig enous	Freshwater	0	0	2.37	2.37	0	2.37
	Marine	0	0	0.04	0.04	0	0.04
Total		266.26	230.54	2.41	499.21	2488.82	2988.03

Source: Primary survey

[3] See appendix 6.1 for detailed composition of livebearers produced locally through breeding and rearing activities

9.88 percent of gold fish produced locally was bred and balance, 90.12 percent was produced by rearing. Similarly, 80.72 percent of the carps were reared and only 19.28 percent was bred. Barbs and sharks were produced solely through rearing. Of the local angel fish supply, 35 percent was produced through breeding and 65 percent through rearing. However, 89.97 percent of the total angel fish traded in domestic market was from local production and only 10.03 percent was from neighbouring states.[4] 25.52 percent of anabantid (fighters and gouramies) supply was from local suppliers. Except angels, all other fishes traded, depended heavily on supply from neighbouring states.

[4] Rearers bought small size angel fish from producers of Thrissur district and sold them after certain period of rearing.

Table 6.13 Distribution of value of ornamental fishes traded in Kerala: 2000- 2001

Value: in Rs. '000

Ornamental fish varieties		Local			Local (Sub total)	Outside state	Total
		Breeding	Rearing	Wild caught			
		(a)	(b)	(c)	d=(a+b+c)	(e)	d+ e
Live Bearers		757.05	299.53	0	1056.58	3193.5	4250.08
Gold Fish		29.44	247.66	0	277.1	3407.91	3685.01
Carps		4.35	24.91	0	29.26	727.96	757.22
Barb		0	11.16	0	11.16	1125.18	1136.34
Shark		0	82.82	0	82.82	782.73	865.55
Tetra		1.67	0	0	1.67	1017.09	1018.76
Piranha		0	0	0	0	70.88	70.88
Angel		498.34	925.49	0	1423.83	203.24	1627.07
Oscar		0.38	5.92	0	6.3	536.09	542.39
Other Cichlids		0	0	0	0	445.99	445.99
Fighter		9.02	0	0	9.02	309.75	318.77
Gourami		90.49	135.74	0	226.23	489.45	715.68
Catfish		12.06	9.39	0	21.45	408.61	430.06
Indigenous	Freshwater	0	0	11.35	11.35	0	11.35
	Marine	0	0	5.23	5.23	0	5.23
Total		1402.8	1742.62	16.58	3162	12718.38	15880.38

Source: Primary survey

Detailed composition of market arrivals of indigenous ornamental fish by zone is presented in table 6.14. This table shows that, being the most common variety, scat was available almost throughout the year and had a steady market (26.97 percent of the total indigenous market). So far the trade flows by local suppliers into domestic market were explained and it was observed that the presence of local producers was weak and bulk of the products arrived from other states. Since this issue has to be examined further, detailed analysis on total arrivals- both from domestic and from other states- to various trade destinations was undertaken and presented below.

Table 6.14 Market arrival of indigenous ornamental fish by zone

Quantity: in Numbers
Value : in Rupees

Indigenous variety	Quantity				Value			
	South	Central	North	Total	South	Central	North	Total
Scat	0.00 (0.00)	501 (26.85)	149 (27.39)	650 (26.97)	0.00 (0.00)	3040.6 (20.56)	759.35 (42.24)	3799.95 (22.92)
Orange chromide	0.00 (0.00)	366 (19.61)	125 (22.98)	491 (20.37)	0.00 (0.00)	1027.75 (6.95)	454.11 (25.26)	1481.86 (8.94)
Danio	0.00 (0.00)	226 (12.11)	84 (15.44)	310 (12.86)	0.00 (0.00)	393.07 (2.66)	105.76 (5.88)	498.83 (3.01)
Gambusia	0.00 (0.00)	75 (4.02)	15 (2.76)	90 (3.73)	0.00 (0.00)	112.25 (0.76)	33.54 (1.87)	145.79 (0.88)
Scavenger	0.00 (0.00)	258 (13.83)	0.00 (0.00)	258 (10.71)	0.00 (0.00)	516.3 (3.49)	0.00 (0.00)	516.3 (3.11)
Tiger Barb	0.00 (0.00)	300 (16.08)	50 (9.19)	350 (14.52)	0.00 (0.00)	600.25 (4.06)	105.28 (5.87)	705.53 (4.25)
Nylon Barb	0.00 (0.00)	0.00 (0.00)	100 (18.38)	100 (4.15)	0.00 (0.00)	0.00 (0.00)	185.9 (10.34)	185.93 (1.12)
Others	0.00 (0.00)	104 (5.57)	21 (3.86)	125 (5.2)	0.00 (0.00)	3864.5 (26.14)	153.56 (8.54)	4018.06 (24.23)
Marine	0.00 (0.00)	36 (1.93)	0.00 (0.00)	36 (1.49)	0.00 (0.00)	5230.75 (35.38)	0.00 (0.00)	5230.75 (31.54)
Total	0.00 (100)	1866 (100)	544 (100)	2410 (100)	0.00 (100)	14785.47 (100)	1797.53 (100)	16583 (100)

Source: Primary survey
(Figures in parenthesis indicate the percentage to respective totals)

6.2.2 Market share of major ornamental fishes in Kerala

Major varieties of ornamental fishes available in various markets across Kerala were livebearers (guppy, black molly, swordtail and platy), cyprinids (gold fish, barb, carp and shark), characins (tetra and piranha), cichlids (angel and oscar), anabantids (fighter and gourami), catfish and loach. A few indigenous varieties also arrived in the market. Table 6.15 presents details of arrivals.

Of the total quantity arrived in domestic market, livebearers, contributed 36.16 percent, while gold fish and carp varieties together contributed 27.05 percent and tetras, barbs, anabantids and angel fish contributed 8.79, 8.87, 7.08 and 5.36 percent respectively. In terms of value, these varieties contributed 26.76, 27.97, 6.42, 7.16, 6.52, and 10.24 percent respectively. Others (shark, piranha, sucker, loach, oscar, other cichlids) contributed 6.6 percent. Thus major varieties having high potential in the domestic market were livebearers, gold fish, and angels[5]. Detailed documentation on the arrivals of these varieties in Kerala market is undertaken below. Figure 6.2 to 6.11 gives zone wise percentage contribution of quantity and sales value of various ornamental fishes and related goods traded in Kerala. Common ornamental fishes traded in the domestic market of Kerala is provided in annexure 1.

[5] Although this appeared to be the general scenario, there were variations across selected zones. For instance, the proportion of carp varieties sold in the central zone was higher (6.36 percent) followed by north zone (5.54 percent) and south zone (5.02 percent). In the case of angels, more quantities were sold in central zone (6.77 percent) followed by south (3.77 percent) and north zones (3.36 percent). Livebearers dominated in all the zones and gold fish varieties were sold around 20 percent in all the zones.

Table 6.15 Distribution of various ornamental fish varieties in selected zones of Kerala: 2000-2001

Quantity : in No.'000
Value : in Rs.'000

Variety	Quantity				Value			
	South Zone	Central Zone	North Zone	Total	South Zone	Central Zone	North Zone	Total
Live bearers	355.57 (46.21)	495.73 (29.871)	229.21 (40.99)	1080.51 (36.16)	1413.61 (36.82)	1886.39 (21.05)	950.08 (30.84)	4250.08 (26.76)
Cyprinids								
Gold	157.94 (20.52)	353.02 (21.27)	122.29 (21.87)	633.25 (21.19)	944.39 (24.6)	1910.25 (21.32)	830.37 (26.96)	3685.01 (23.2)
Carp	38.60 (5.02)	105.55 (6.36)	30.98 (5.54)	175.13 (5.86)	177.81 (4.63)	441.64 (4.93)	137.77 (4.47)	757.22 (4.767)
Barb	64.58 (8.39)	158.42 (9.547)	42.04 (7.52)	265.04 (8.87)	289.82 (7.55)	651.67 (7.27)	194.85 (6.33)	1136.34 (7.16)
Shark	4.57 (0.59)	39.61 (2.39)	3.60 (0.64)	47.78 (1.6)	102.91 (2.68)	676.45 (7.55)	86.19 (2.8)	865.55 (5.45)
Characins								
Tetras	58.35 (7.58)	162.19 (9.77)	42.38 (7.58)	262.92 (8.799)	237.93 (6.2)	590.72 (6.59)	190.11 (6.17)	1018.76 (6.42)
Piranha	0.20 (0.03)	1.77 (0.11)	1.33 (0.24)	3.30 (0.11)	4.90 (0.13)	29.60 (0.33)	36.38 (1.18)	70.88 (0.45)

Cont…

Cichlids								
Angel	29.04 (3.77)	112.34 (6.77)	18.77 (3.36)	160.15 (5.36)	290.22 (7.56)	1151.82 (12.85)	185.03 (6.01)	1627.07 (10.24)
Oscars	5.23 (0.68)	26.35 (1.59)	3.74 (0.67)	35.33 (1.18)	55.78 (1.45)	426.28 (4.76)	60.33 (1.96)	542.39 (3.41)
Other Cichlids	4.18 (0.54)	40.75 (2.46)	10.35 (1.85)	55.28 (1.85)	32.29 (0.84)	308.14 (3.44)	105.56 (3.42)	445.99 (2.81)
Anabantids								
Fighters	21.36 (2.78	24.25 (1.46)	16.78 (3.00)	62.39 (2.09)	107.27 (2.79	123.15 (1.37)	88.35 (2.87)	318.77 (2.01)
Gourami/Others	25.17 (3.27	97.62 (5.88)	26.20 (4.69)	148.99 (4.99)	124.75 (3.25)	462.25 (5.16)	128.68 (4.18)	715.68 (4.51)
Catfish, Sucker, Loach, Others	4.75 (0.62)	39.93 (2.41)	10.88 (1.95)	55.55 (1.86)	57.62 (1.5)	287.79 (3.21)	84.65 (2.75)	430.06 (2.71)
Indigenous								
Freshwater Fishes	0.00 (0.00)	1.83 (0.11)	0.54 (0.1)	2.37 (0.08)	0.00 (0.00)	9.55 (0.11)	1.80 (0.06)	11.35 (0.07)
Marine fishes	0.00 (0.00)	0.04 (0.002)	0.00 (0.00)	0.04 (0.001)	0.00 (0.00)	5.23 (0.060)	0.00 (0.00)	5.23 (0.033)
Total	769.54 (100)	1659.40 (100)	559.09 (100)	2988.03 (100)	3839.30 (100)	8960.93 (100)	3080.15 (100)	15880.38 (100)

Source: Primary survey (Figures in parenthesis indicate the percentage)

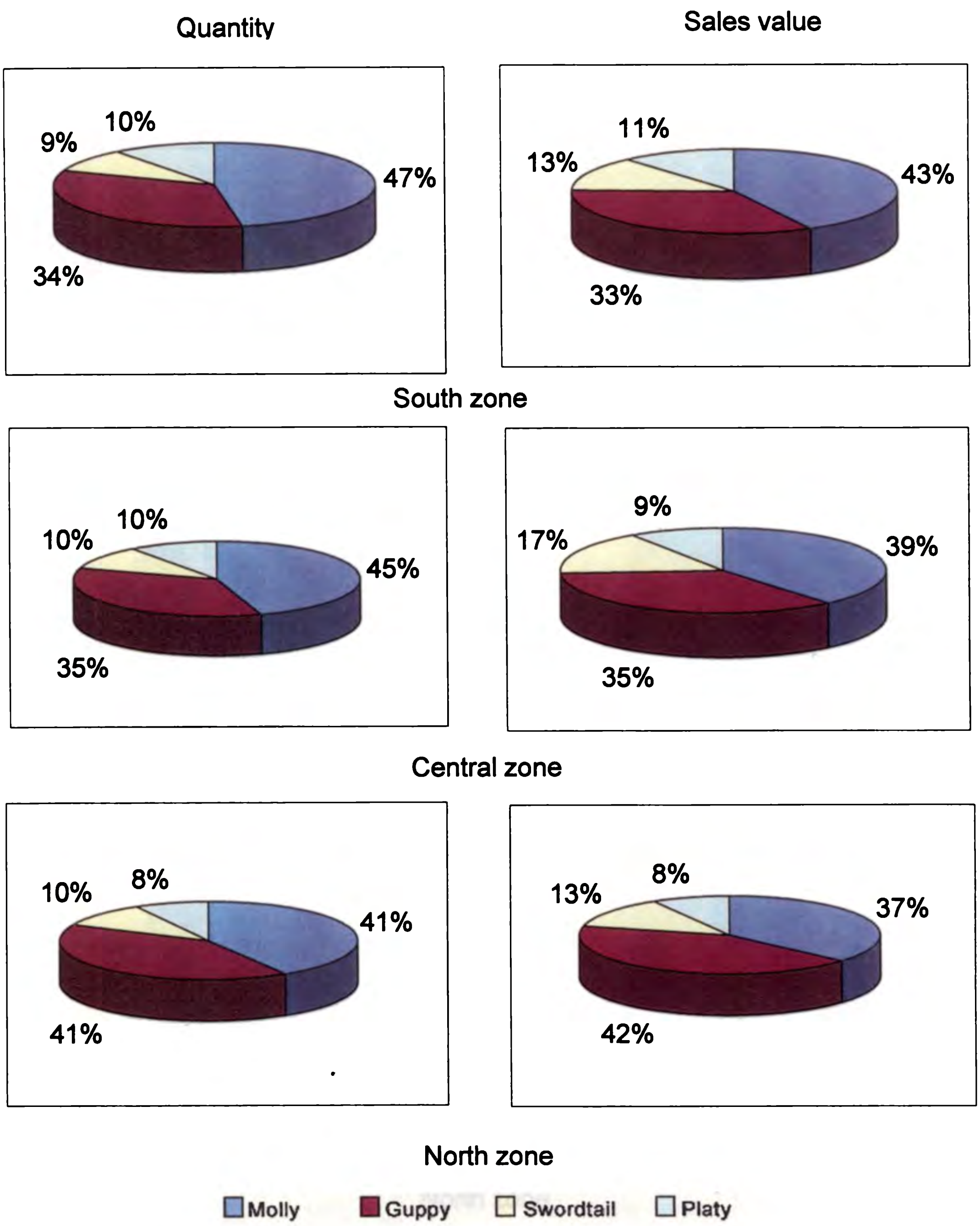


Fig 6. 2 Zone wise percentage contribution of quantity and sales value of livebearers

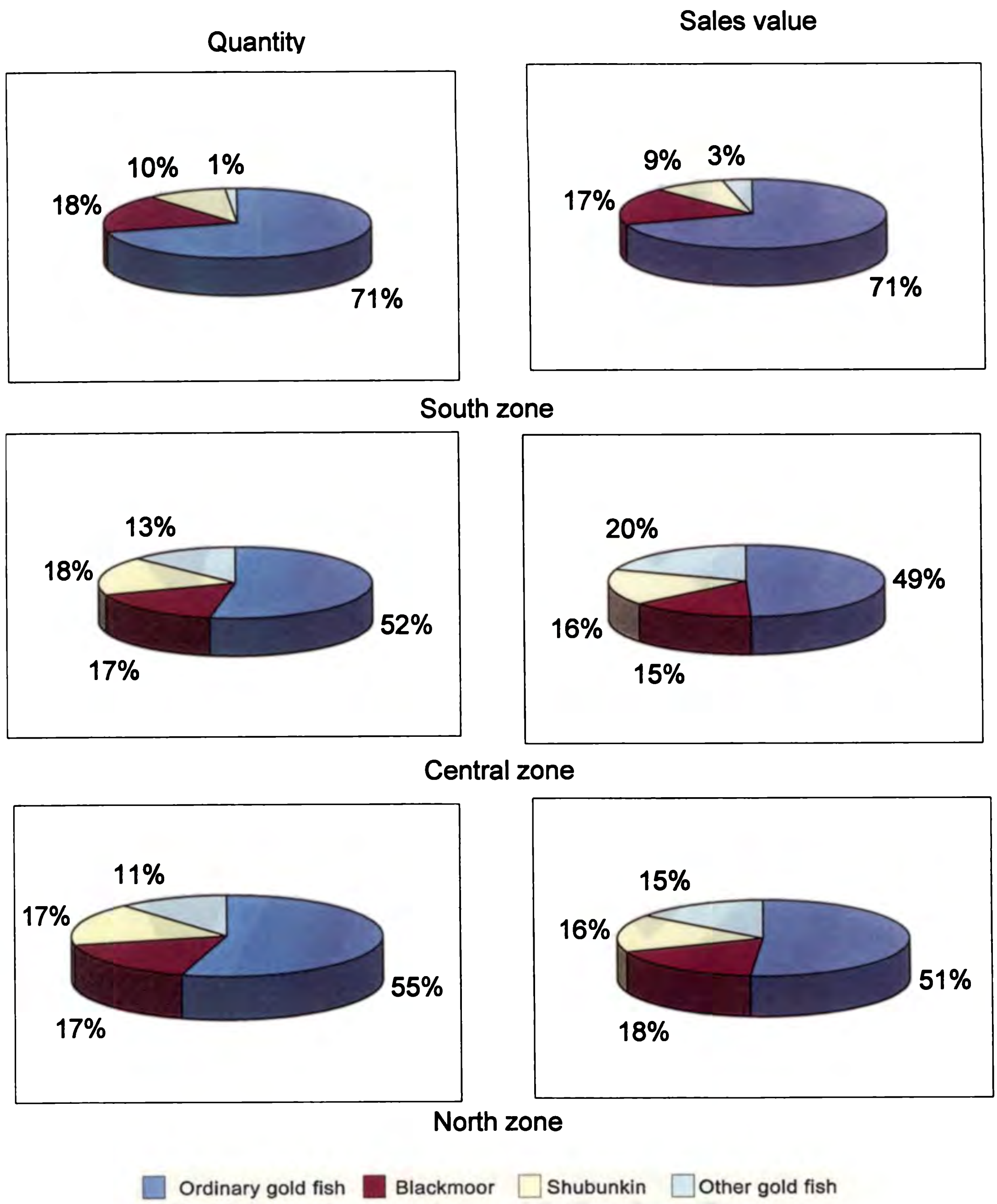


Fig 6.3 Zone wise percentage contribution of quantity and sales value of gold fishes

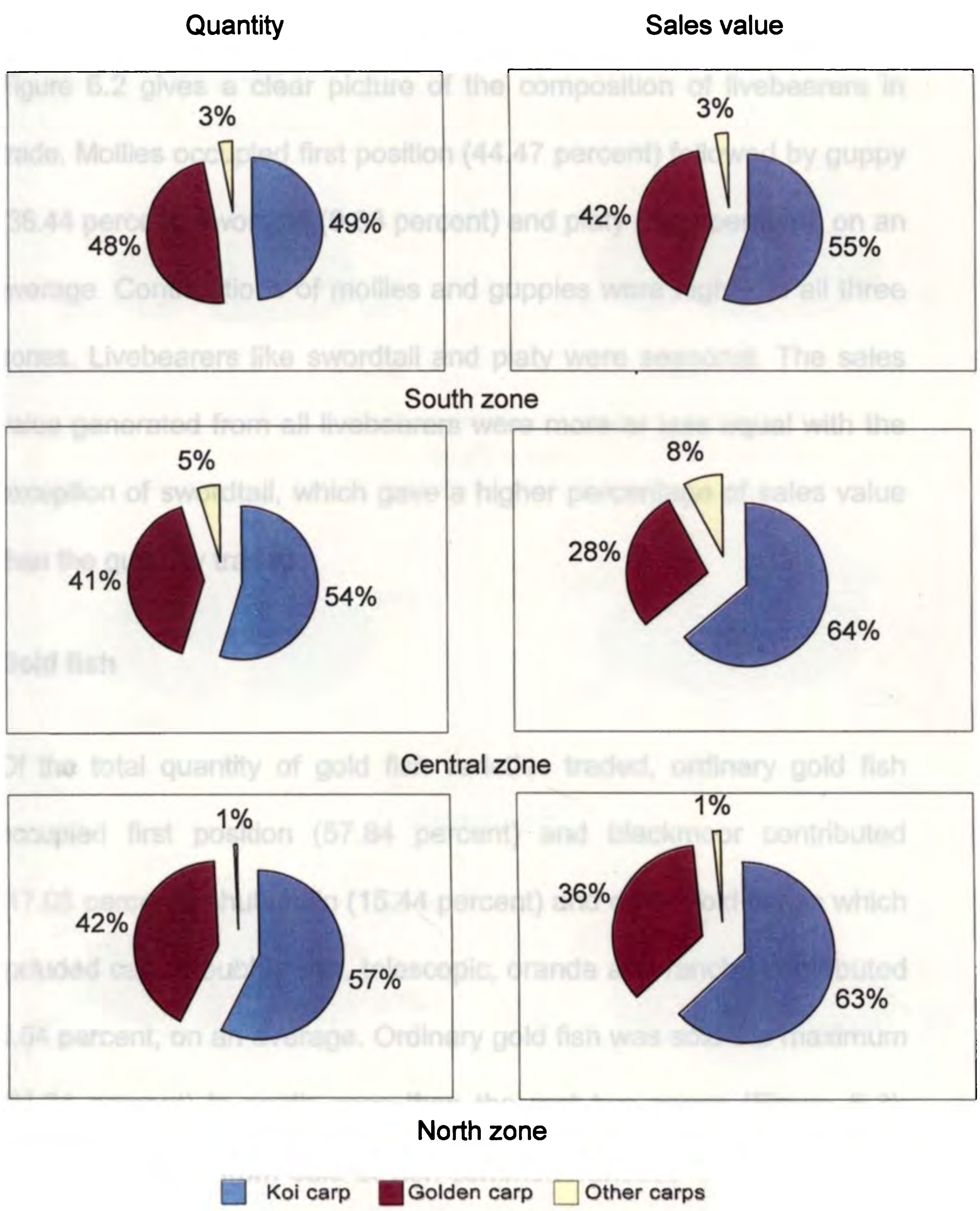


Fig 6.4 Zone wise percentage contribution of quantity and sales value of carps

Livebearers

Figure 6.2 gives a clear picture of the composition of livebearers in trade. Mollies occupied first position (44.47 percent) followed by guppy (36.44 percent) swordtail (9.63 percent) and platy (9.46 percent), on an average. Contributions of mollies and guppies were higher in all three zones. Livebearers like swordtail and platy were seasonal. The sales value generated from all livebearers were more or less equal with the exception of swordtail, which gave a higher percentage of sales value than the quantity traded.

Gold fish

Of the total quantity of gold fish varieties traded, ordinary gold fish occupied first position (57.84 percent) and blackmoor contributed (17.08 percent), shubunkin (15.44 percent) and other gold fishes which included calico, bubble eye, telescopic, oranda and ranchu contributed 9.64 percent, on an average. Ordinary gold fish was sold the maximum (71.21 percent) in south zone than the rest two zones (Figure 6.3). Value generated from sale of non-common varieties was higher than common gold fish varieties. Subramanian (1993) reported that gold fish varieties got high potential in the domestic and international market.

Carps

Figure 6.4 reveals that among the carps, koi carp alone constituted 53.91 percent of the total quantity of carps, contributing 61.86 percent

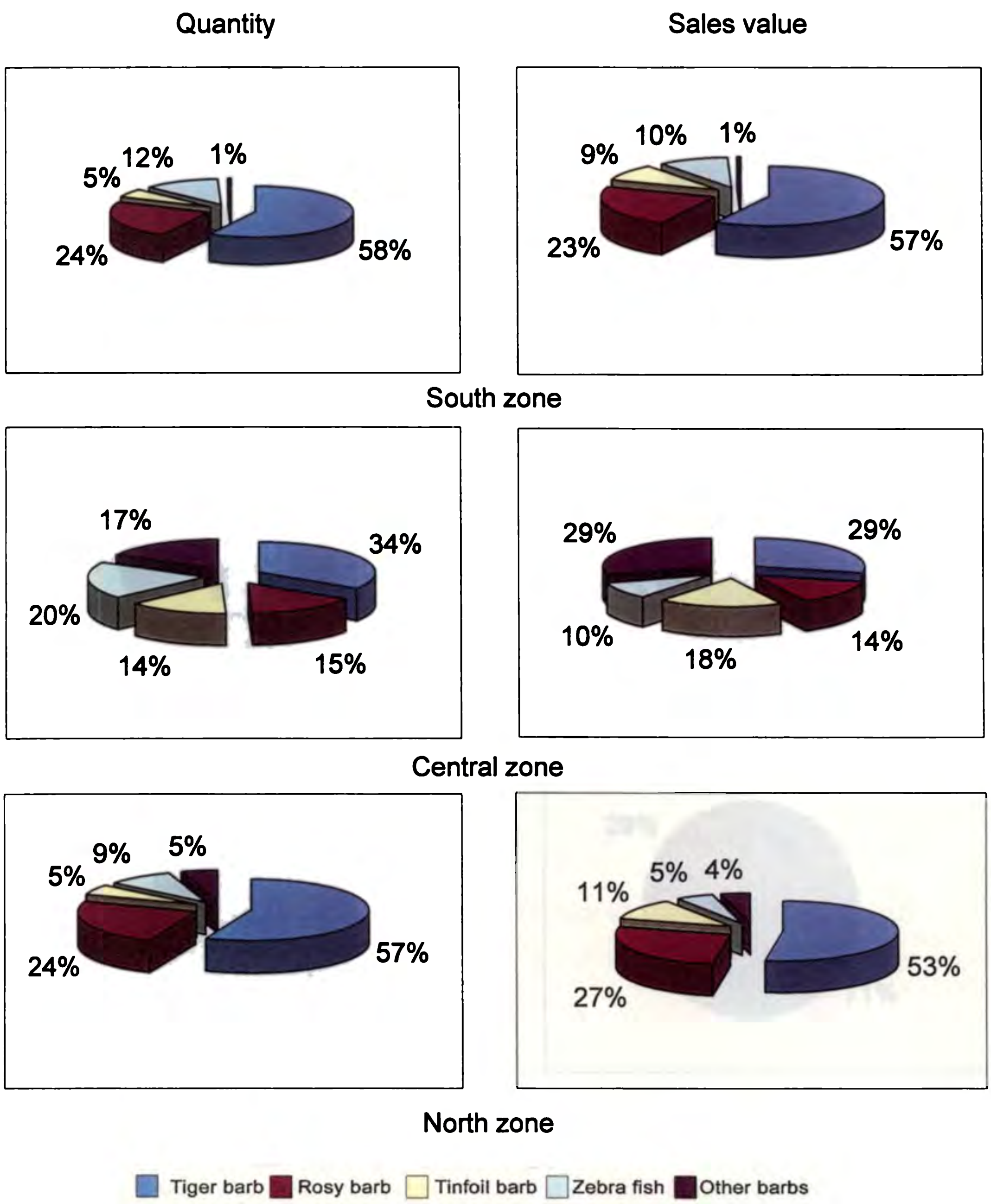


Fig 6.5 Zone wise percentage contribution of quantity and sales value of barbs

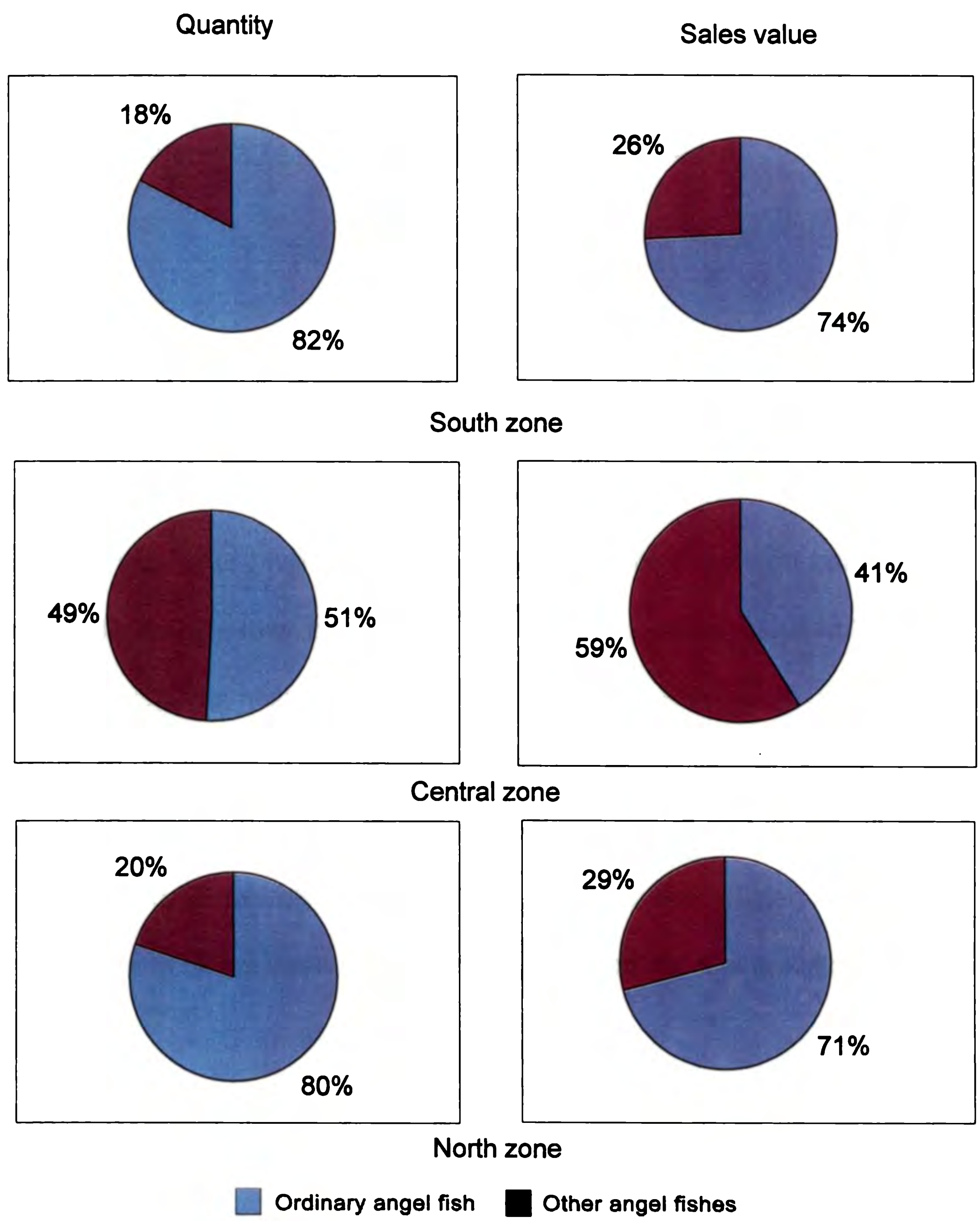


Fig 6.6 Zone wise percentage contribution of quantity and sales value of angels

to the sales value of the respective category, mostly small varieties. Golden carp constituted 42.53 percent, which was a close substitute of ordinary gold fish, generating a value of 32.64 percent. Other varieties of carps contributed 3.56 percent of the total quantity traded.

Barbs

The different types of barbs, noted in the market, were the common tiger barb, rosy barb, tinfoil barb, zebra fish, green tiger barb and other barbs, which included their albino varieties. Figure 6.5 indicated that, on an average, tiger barb constituted 43.48 percent of the total barbs traded, followed by rosy barb (18.74 percent) and zebra fish (16.34 percent) occupying next positions respectively and tinfoil barb (10.4 percent) and others (11.04 percent), which included albino varieties of the above, described barbs. The sales value generated from tinfoil barb was comparatively higher than other barbs. Tiger barb compositions in all the three zones were higher than the rest species of barbs.

Angels

Angel fish was produced in high quantity in our state compared to neighbouring states, and the survey revealed that, water in Kerala was suitable for cichlids and gouramies. Among the total quantity of angels traded, on an average, ordinary angel, contributed 59.89 percent and 40.11 percent were contributed by the other varieties like marble angel, hi-fin angel, diamond, pearl scale, white angel, black angel, yellow

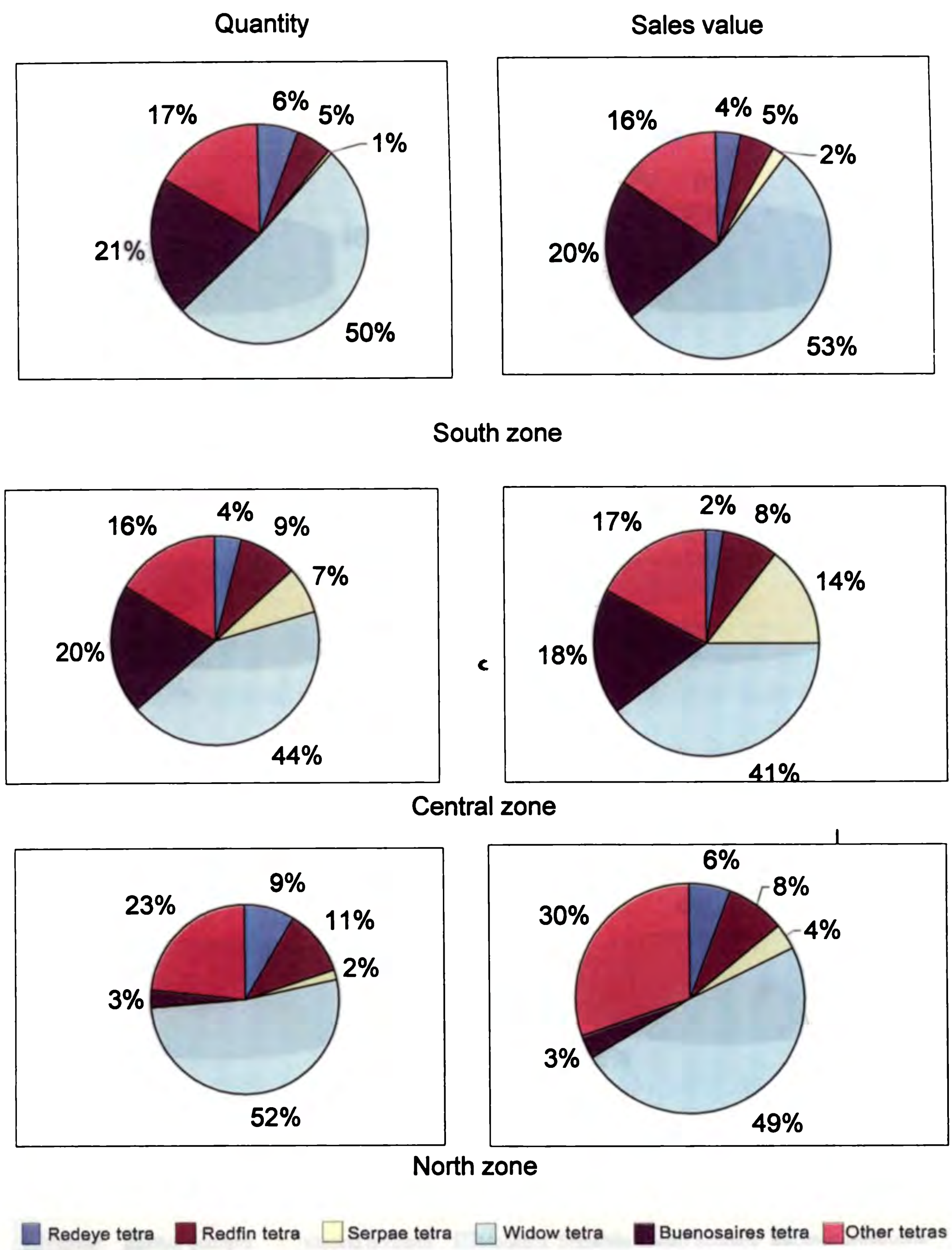


Fig 6.7 Zone wise percentage contribution of quantity and sales value of tetras

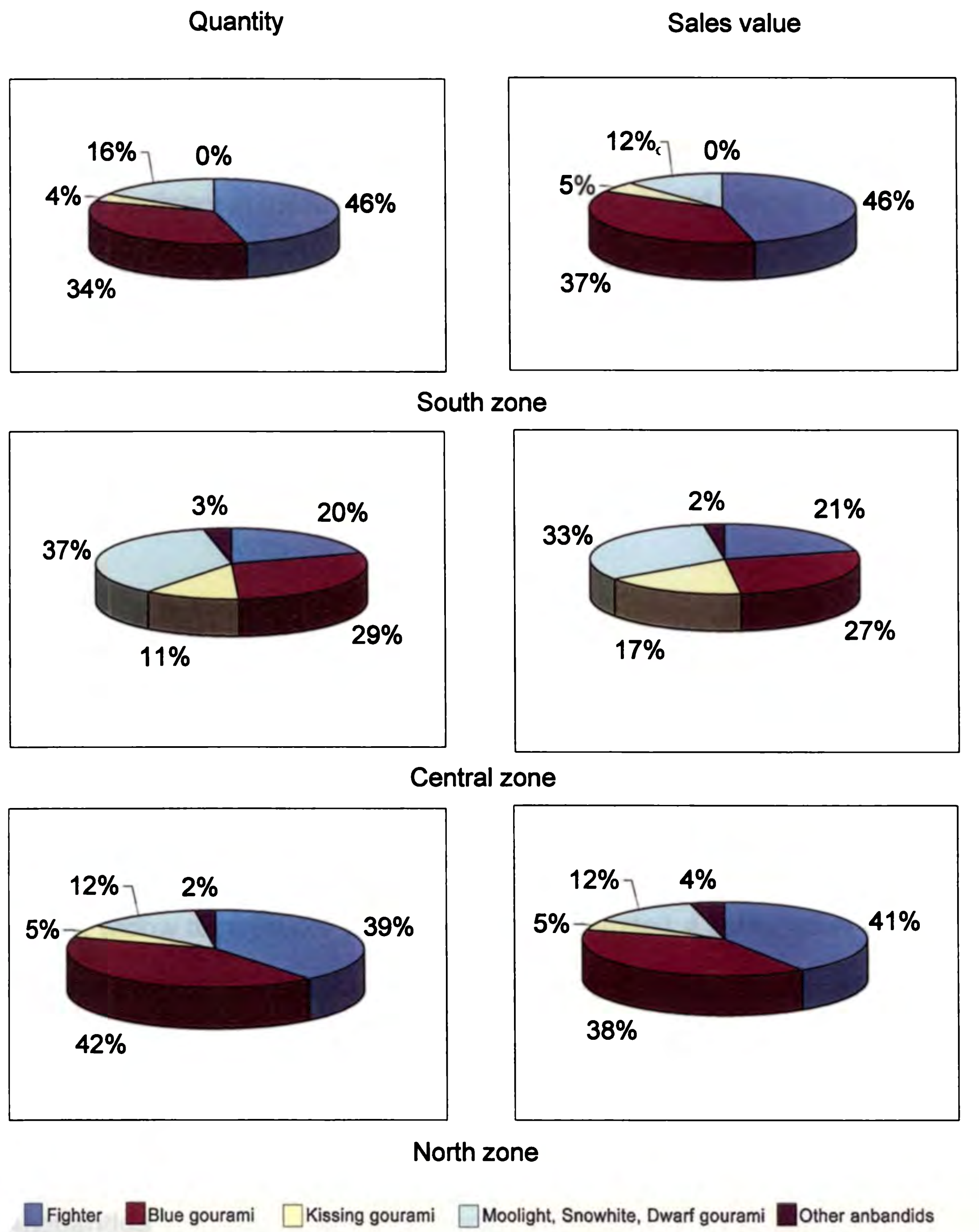


Fig 6.8 Zone wise percentage contribution of quantity and sales value of anabantids

angel, diamond redeye angel, albino red eye angel, ghost angel, and veil tail type of the above and other angel varieties. The sales value generated from ordinary angel was less than other varieties of angels (Figure 6.6).

Both the ordinary angel and other angel varieties shared almost same positions in the central zone, where as in the north and south zones a marked difference was noticed between the two, with ordinary angel occupying more than 80 percent of the total angelfish arrival in the market.

Tetras

Major varieties included widow tetra, Buenosaires tetra and their albino varieties, redfin and redeye tetra, serape tetra, and others, which included, neon tetra, globin and hockey stick. From figure 6.7 it was clear that almost half of the total contribution of tetras was by a single variety, widow tetra (46.21 percent), which generated a sales value of 44.78 percent, on an average. The contribution by Buenosaires tetra was very less in north zone. Similarly, that of serape tetra was highest in central zone.

Anabantids

Blue gourami and fighter, together constituted 62.3 percent of the total contribution of anabantids in the state generating 62.45 percent of total sales value on an average. The other gouramies, which arrived in the market, included kissing gourami (8.54 percent), moonlight, snowhite,

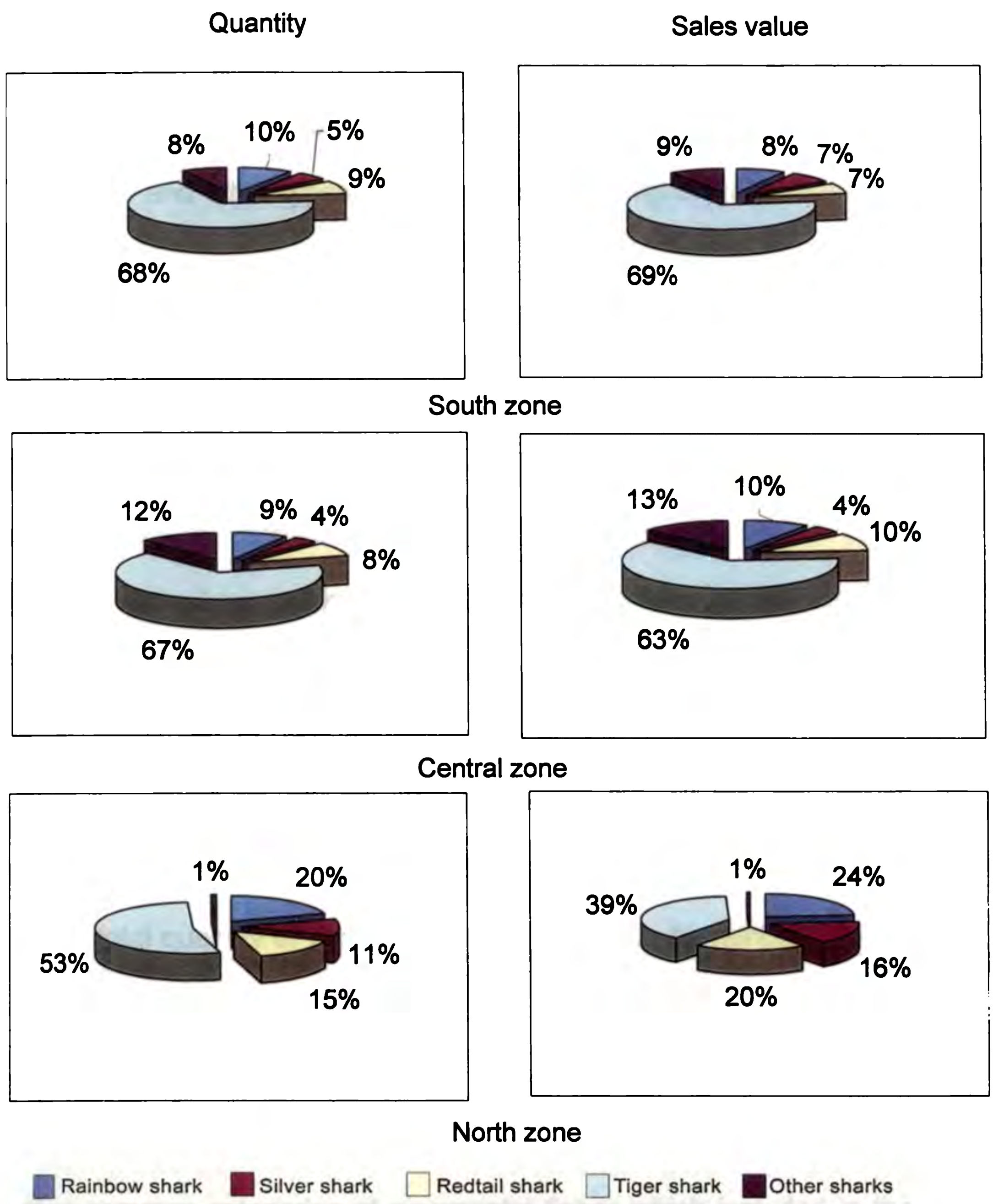


Fig 6.9 Zone wise percentage contribution of quantity and sales value of sharks

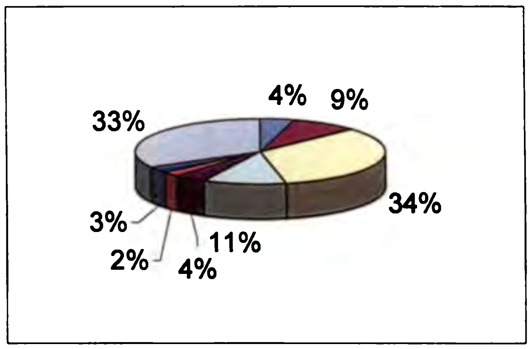
and dwarf gouramies. Other anabantids include chocolate, golden, cosby, pearl gouramies, and Chinese paradise. The composition of fighter and gouramies were higher in the north zone and south zone compared to central zone. The contribution of snowhites, kissing gouramies and other types of anabantids were higher in central zone (Figure 6.8).

Sharks

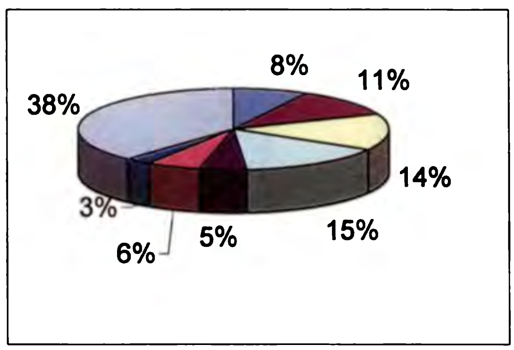
On an average, tiger shark constituted the majority with 65.97 percent of total arrivals, followed by rainbow (9.65 percent), redtail (8.79 percent) and silver sharks (4.54 percent). The other shark varieties included, the albino varieties of the above sharks, black shark etc., which constituted 11.05 percent. The percentage contribution of redtail, rainbow and silver sharks was higher in the north zone when compared to the other two zones. Proportionately higher sales value for the total quantity of sharks arrived were shown by rainbow, redtail and silver sharks (Figure 6.9).

Others

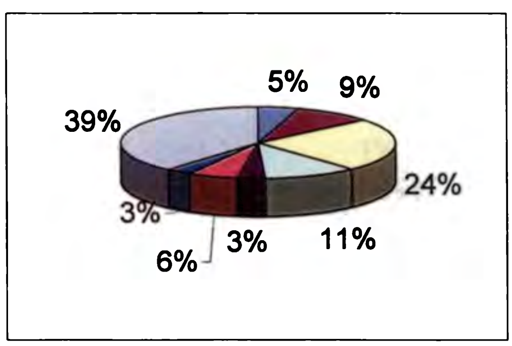
Other common categories of ornamental fishes which included in the trade were other cichlids like blue morph, yellow morph, auratus (1.85 percent), oscar (1.18 percent), piranha (0.11 percent), sucker cat, corydoras, loach, other miscellaneous fishes (1.86 percent), marine (0.001 percent) and indigenous freshwater fishes (0.08 percent). Loach and piranhas had only negligible contribution. Almost all



South zone



Central zone



North zone

Stone, Sand, Driftwood Toys Glass Aerator Medicine Filter, Heater
Other accessories Fish feed

Fig 6.10 Zone wise percentage contribution of sales value of aquarium accessories

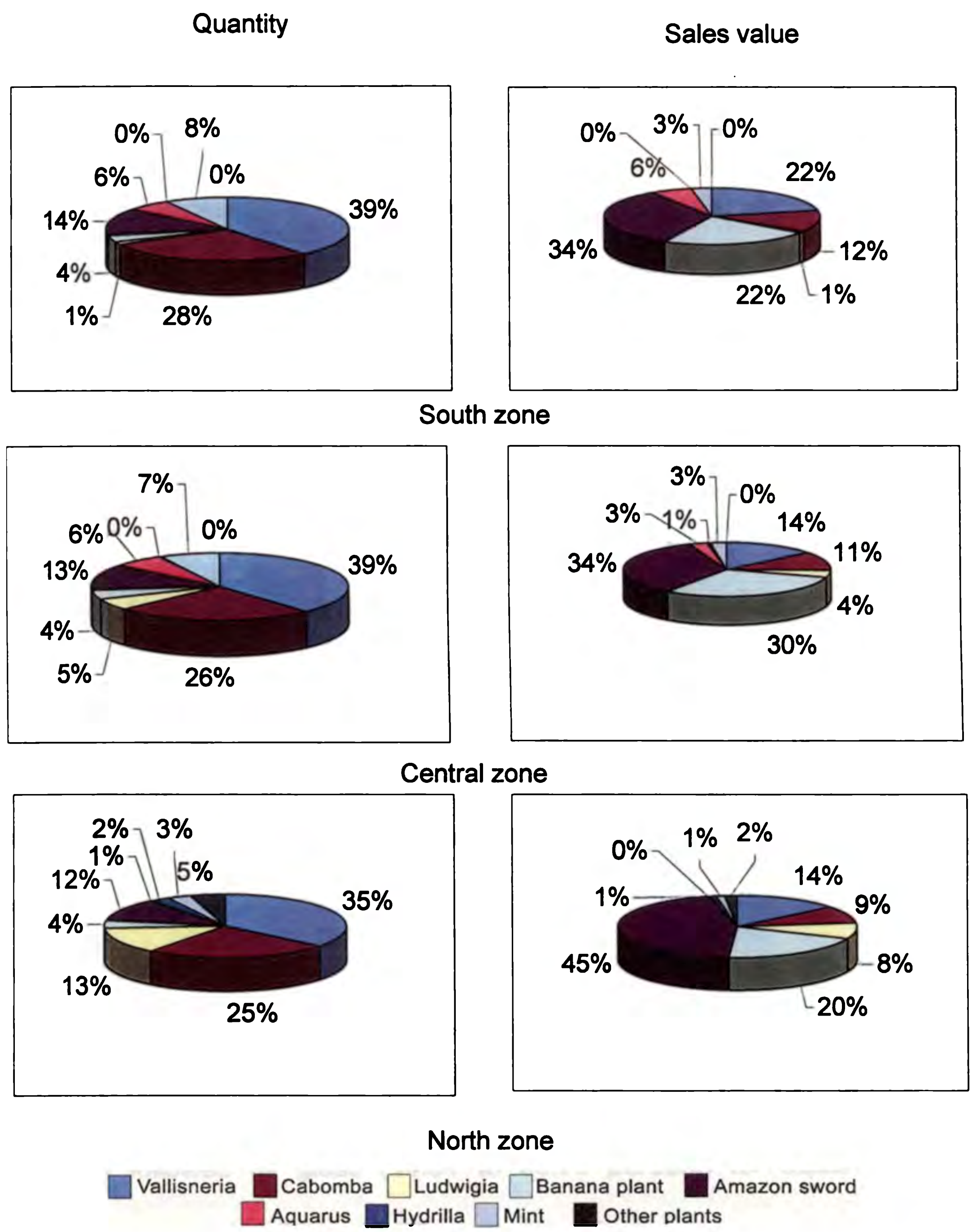


Fig 6.11 Zone wise percentage contribution of quantity and sales value of aquarium plants

varieties showed proportionately higher sales value for the total quantity arrived.

6.2.3 Market for aquarium accessories and plants

Aquarium accessories are broadly classified as items for ornamentation, manufactured merchandise, others and fish feed (Jonklaas, 1982). Items for ornamentation included natural and artificial stones of various shapes, sizes and colours, attractive minerals of desirable shape and colour, driftwood, various mineral sands etc. Manufactured merchandise included items made of plastic or ceramic like toys, plastic plants, aerators, filters, heaters, thermostats, special lighting and similar gadgetry, medicines, glass, other manufactured items. Other than this, fish feed were also included in this category.

Even though feed preparation needed only low investment, units preparing feed for ornamental fishes were not common in Kerala. Most of the aquarium accessories arrived from Tamilnadu, Karnataka and Rajasthan. Value generated by selling accessories by traders of Kerala is shown in figure 6.10[6]. Fish feed were sold the most (33.01 to 38.58 percent) followed by glass (14.34 to 33.75 percent) for aquarium setting, aerators (10.59 to 15.37 percent) and other accessories like toys, medicines, filters and heaters.

Bulk of ornamental aquarium plants (like vallisneria, cabomba, banana plant, ludwigia and Amazon sword) were brought from Tamilnadu in

[6] See Appendix 6.2 for detailed table

the past. Now people culture it locally or collect from natural sources. Culture of aquarium plants, in large scale was practiced in Thrissur and Emakulam districts. Examining the availability and sales value of aquarium plants in different zones the study noted that vallisneria was sold in large quantities (38.1 percent) followed by cabomba (25.65 percent) and Amazon sword (12.74 percent). In terms of value however, Amazon sword contributed 36.99 percent of the total sales value followed by banana plant (24.7 percent). See figure 6.11[7].

6.2.4 Supply of ornamental fishes and aquarium ancillaries: An overview

So far in this chapter an attempt was made to examine the composition of the market for ornamental fish, aquarium accessories and plants. Ornamental fish to Kerala market arrived from local producers as well as from other states. Based on this analysis, total volume and value of ornamental fish traded in Kerala were estimated and presented in table 6.16[8]. Table shows that total number of ornamental fish traded in Kerala state was 1, 04, 712, 10, of which, 43.14, 38.16 and 18.7 percent were sold in central, south and north zones respectively[9]. The value generated from ornamental fish trade was estimated as Rs. 5.54 crores of which 45.63 percent was from

[7] See Appendix 6.3 for detailed table.

[8] To estimate the total volume and value of ornamental fish trade in Kerala, the shares of one wholesaler, 22 wholesaler cum retailers and 171 retailers were estimated using weighted average method. In this process, total value was calculated by generating contributions of wholesaler, wholesaler cum retailers and retailers using sample proportions.

[9] Central zone controlled almost half of total ornamental fish arrivals in the State, due to the presence of two major wholesaler cum retailers and one wholesaler who shared 19.47 percent and 7.44 percent of the total quantity of fish traded respectively.

central zone, 35.31 percent was from south zone, and 19.06 percent was from north zone.

Table 6.17 shows value of sale of aquarium accessories in Kerala during the survey year. The value generated from accessories trade was estimated as Rs. 1.95 crores for the year 2000-2001. Central zone contributed about 39.71 percent of the total sales value, south, 37.06 percent and north zone, 23.23 percent. 59.1 percent of the value of accessories was contributed by retailers, 29.01 percent by wholesaler cum retailers and 11.89 percent by wholesaler. It may be noted that bulk of the value has been generated in the retail channel followed by other marketers.

Table 6.16 Distribution of aggregate quantity and value of ornamental fish traded in Kerala: 2000-2001

Quantity : in No.'000
Value : in Rs.'000

	Quantity				Value			
Traders → / Zone ↓	Retailer	Wholesaler cum retailer	Whole saler	Total	Retailer	Wholesaler cum retailer	Whole saler	Total
South zone	2844.16 (50.42)	1151.94 (28.45)	0.00 (0.00)	3996.10 (38.16)	13634.34 (44.98)	5935.51 (27.68)	0.00 (0.00)	19569.84 (35.31)
Central zone	1699.79 (30.12)	2038.01 (50.32)	779.36 (100)	4517.16 (43.14)	10914.98 (36.01)	10704.94 (49.92)	3670.88 (100)	25290.80 (45.63)
North zone	1098.16 (19.46)	859.79 (21.23)	0.00 (0.00)	1957.95 (18.7)	5761.84 (19.01)	4804.57 (22.40)	0.00 (0.00)	10566.42 (19.06)
Total	5642.11 (100)	4049.74 (100)	779.36 (100)	**10471.21 (100)**	30311.16 (100)	21445.02 **(100)**	3670.88 **(100)**	**55427.06 (100)**

Source: Primary survey
(Figures in parenthesis indicate the percentage to respective totals)

Table 6.17 Value of aquarium accessories traded in Kerala: 2000-2001

Value: in Rs.'000

Channels	Sales value (Rs)	Percent
Retailer	11517.05	59.1
Wholesaler cum retailer	5652.92	29.01
Wholesaler	2316.04	11.89
Total	19486.01	100

Source: Primary survey

Table 6.18 Distribution of aggregate quantity and value of aquarium plants traded in Kerala: 2000-2001

Quantity : in No.'000
Value : in Rs.'000

Trader → / Zone ↓	Quantity				Value			
	Retailer	Whole saler cum retailer	Whole saler	Total	Retailer	Whole saler cum retailer	Whole saler	Total
South	312.24 (23.88)	543.37 (33.01)	0.00 (0.00)	855.61 (26.54)	715.34 (22.05)	1664.89 (43.84)	0.00 (0.00)	2380.23 (32.48)
Central	329.97 (25.24)	879.1 (53.41)	270.9 (100)	1479.97 (45.9)	778.8 (24.01)	1487.5 (39.16)	286.55 (100)	2552.85 (34.84)
North	665.08 (50.88)	223.55 (13.58)	0.00 (0.00)	888.63 (27.56)	1749.51 (53.94)	645.7 (17.00)	0.00 (0.00)	2395.21 (32.68)
Total	1307.29 (100)	1646.02 (100)	270.9 (100)	3224.21 (100)	3243.65 (100)	3798.09 (100)	286.55 (100)	7328.29 (100)

Source: Primary survey

(Figures in parenthesis indicate the percentage to respective totals)

Table 6.18 shows the quantity and value of aquarium plants traded through various marketing channels in Kerala in 2000-2001. The quantity of aquarium plants traded (32.24 lakhs) in the State brought a sales value of 73.28 lakhs rupees. Of the total quantity traded, 45.9, 27.56 and 26.54 percent were sold in central, north and south zones respectively. Similar trends were noted in the generation of values also. Moreover, central zone dominated in sales followed by north and south zones. Common aquarium plants traded in the domestic market of Kerala is provided in annexure 2.

6.2.5 Constraints

Traders in Kerala face a variety of challenges in the marketing of ornamental fish. Non-availability of loans and credit, market uncertainties, tough competition between traders in corporation area, their dominance over other small outlets, barriers to the entry of new traders, lack of information on prices were only a few among such constraints (Nair and Kandoran, 1992; Kumar, 2002; Sathiadas and Kanagam, 2000). Sales outlets that procured bulk quantities were scarce in the state. Too many market channels claimed high marketing margins. The production areas were far away and made timely procurement difficult. Wide spatial and temporal variations in market arrivals and prices, lack of information on fish price and production were other marketing problems (Sathiadas and Kanagam, 2000). Heavy mortality rates during packing and transport along with artificial scarcity created by traders from outside state resulted in high price for some varieties of fish. Wrong reception of orders was another constraint faced by local traders.

6.3 Summary and conclusions

Most of the ornamental pet shops in Kerala were multi-product outlets selling ornamental fish, aquarium accessories, aquatic plants, birds and other pet animals. Ornamental fish traded in various markets in Kerala arrived from local producers and outside the state. Local ornamental fish traders are classified into wholesalers, wholesaler cum retailers and retailers. 67 percent of the total labour employed was family labour and 33 percent was hired. Railways were the major mode of transportation for moving aquarium goods from neighbouring states to various trade destinations in Kerala. Different marketing strategies like price cut, diversified product mix, introduction of new varieties, and improved quality were adopted by traders for attracting customers. Marketing strategies adopted by each trader varied according to location, target market, and degree of competition. Local producers contributed only 16.71 percent to domestic market while the remaining (83.29 percent) fish arrived from neighbouring states especially, Tamilnadu. Major varieties having high potential in the domestic market were livebearers (36.16 percent), gold fish (27.05 percent), and angels. Regarding aquarium accessories, fish feed were sold the most (35 percent) followed by glass for aquarium setting (24 percent). The value generated from ornamental fish trade in Kerala during the year 2000-2001 was estimated as Rs. 5.54 crores, aquarium accessories trade, Rs. 1.94 crores, and aquarium plants trade as Rs. 73.28 lakhs. Moreover, central zone dominated in sales followed by north and south zones. Non-availability of loans and credit, market uncertainties, lack of information on prices and artificial scarcity created by outside suppliers were some of the constraints in development.

Appendix 6.1

Detailed composition of livebearers produced locally through breeding and rearing

Quantity: in No.'000
Value: in Rs.'000

Live bearers	Quantity (No)			Value (Rs)		
	Breeding	Rearing	Total	Breeding	Rearing	Total
Molly	77.65 (39.89)	25.88 (34.08)	103.54 (38.26)	277.41 (36.64)	92.47 (30.87)	369.88 (35.01)
Guppy	80.52 (41.37)	26.84 (35.33)	107.36 (39.67)	315.64 (41.69)	105.21 (35.13)	420.85 (39.83)
Sword tail	23.63 (12.14)	12.73 (16.75)	36.36 (13.44)	115.66 (15.28)	62.27 (20.79)	177.93 (16.84)
Platy	12.85 (6.6)	10.51 (13.84)	23.36 (8.63)	48.34 (6.39)	39.55 (13.21)	87.90 (8.32)
Total	194.65 (100)	75.96 (100)	270.61 (100)	757.05 (100)	299.51 (100)	1056.56 (100)

Source: Primary survey

(Figures in parenthesis indicate the percentage to respective totals)

Appendix 6.2

Contribution of sales value of aquarium accessories in Kerala, by zone: 2000-2001

Value: in Rs.'000

Items	South zone	Central zone	North zone	Total
Stones, Sand, Driftwood	318.23 (4.41)	595.53 (7.7)	214.44 (4.74)	1128.2 (5.79)
Toys	623.49 (8.63)	870.32 (11.25)	411.77 (9.1)	1905.58 (9.78)
Glass	2437.36 (33.75)	1109.75 (14.34)	1100.39 (24.31)	4647.5 (23.85)
Aerator	764.79 (10.59)	1189.48 (15.37)	496.48 (10.97)	2450.75 (12.58)
Medicine	318.33 (4.41)	379.83 (4.91)	148.6 (3.28)	846.76 (4.35)
Filters, Heaters	159.15 (2.2)	426.87 (5.51)	266.27 (5.89)	852.29 (4.36)
Others	216.74 (3)	229.49 (2.97)	141.66 (3.13)	587.89 (3.02)
Fish Feed	2384.15 (33.01)	2936.74 (37.95)	1746.15 (38.58)	7067.04 (36.27)
Total	7222.24 (100)	7738.01 (100)	4525.76 (100)	19486.01 (100)

Source: Primary survey

(Figures in parenthesis indicate the percentage to respective totals)

Appendix 6.3

Contribution of quantity and sales value of aquarium plants in Kerala, by zone: 2000-2001

Quantity: in No.'000
Value: in Rs.'000

Variety	Quantity				Value			
	South	Central	North	Total	South	Central	North	Total
Vallisneria	92.3 (39.1)	219.23 (38.42)	68.2 (35.89)	379.73 (38.1)	150.55 (21.71)	121.02 (14.11)	75.5 (14.28)	347.07 (16.69)
Cabomba	66.15 (28.02)	142.7 (25.01)	46.8 (24.63)	255.65 (25.65)	83.95 (12.1)	98.16 (11.44)	46.93 (8.88)	229.04 (11.01)
Ludwigia	3.28 (1.39)	30.65 (5.37)	25.62 (13.48)	59.55 (5.97)	8.19 (1.18)	35.85 (4.18)	44.1 (8.34)	88.14 (4.24)
Banana	8.37 (3.55)	25.5 (4.47)	7.07 (3.72)	40.94 (4.11)	153.74 (22.17)	256.73 (29.93)	103.4 (19.56)	513.87 (24.7)
Amazon Sword	32.82 (13.9)	72.19 (12.65)	21.98 (11.57)	126.99 (12.74)	234.41 (33.8)	296.67 (34.58)	238.4 (45.09)	769.48 (36.99)
Aquarus	13.7 (5.8)	35.7 (6.26)	1.07 (0.56)	50.47 (5.05)	41.1 (5.93)	22.5 (2.62)	1.08 (0.2)	64.68 (3.11)
Hydrilla	0 (0)	2.36 (0.41)	4.68 (2.46)	7.04 (0.71)	0 (0)	4.72 (0.55)	4.67 (0.89)	9.39 (0.45)
Mint	19.46 (8.24)	42.32 (7.41)	5.75 (3.03)	67.53 (6.78)	21.67 (3.11)	22.15 (2.59)	5.74 (1.09)	49.56 (2.38)
Others	0 (0)	0 (0)	8.85 (4.66)	8.85 (0.89)	0 (0)	0 (0)	8.85 (1.67)	8.85 (0.43)
Total	236.08 (100)	570.65 (100)	190.02 (100)	996.75 (100)	693.61 (100)	857.8 (100)	528.67 (100)	2080.08 (100)

Source: Primary survey

(Figures in parenthesis indicate the percentage to respective totals)

CHAPTER 7

Seasonal variation and economic viability of ornamental fish trade

In the previous chapters an attempt was made to explore the demand for ornamental fishes and the responses of various producers to organise various goods and services. The analysis firmly called for exploring seasonal variations of ornamental fish trade and economic viability in different regions of the state for a meaningful understanding and forward planning. This chapter undertakes a detailed examination of this task. Seasonal variations in ornamental fish availability and sales value are examined in section one. In the second section, economic evaluation of different trading units was carried out to understand its viability. Section three summarises the major conclusions of this chapter.

7.1 Seasonal variation in ornamental fish market

Market arrivals of ornamental fishes were seasonal and availability of different varieties varied significantly as environment changed. Correspondingly sales value also changed. Seasonal variation in the availability and sales value of ornamental fish from local sources, as well as from other states, by size was calculated for various zones by simple average method (Gupta, 1981; Hooda, 1994).

$$\text{Seasonal index} = \frac{\frac{P}{R} * 100}{\frac{\Sigma (P/R)}{N}}$$

Where,

P represents quantity of ornamental fish arrival in a month

R represents number of units surveyed

N represents number of months

Same formula was applied for calculating seasonal variation in sales value also where P represented the sales value of fish generated in a month

7.1.1 Seasonal variation in the availability and sales value of ornamental fish from local sources in south zone

In the south zone, the availability of small-size fish from local sources began in June, peaked in July (273.79) and declined continuously since then. The medium-size fish on the other hand began in August and peaked in September (202.57) and decreased during subsequent months and again increased in January. The decline during November-December was due to the artificial scarcity created by producers who withheld their stock for size augmentation and to be sold later for getting better prices. A positive skewness with fluctuations was noted in medium-size local fish. In the case of large-size local fish, peak availability was noted in November (204.39), which became irregular later. Figure 7.1 shows these seasonal variations in south zone.

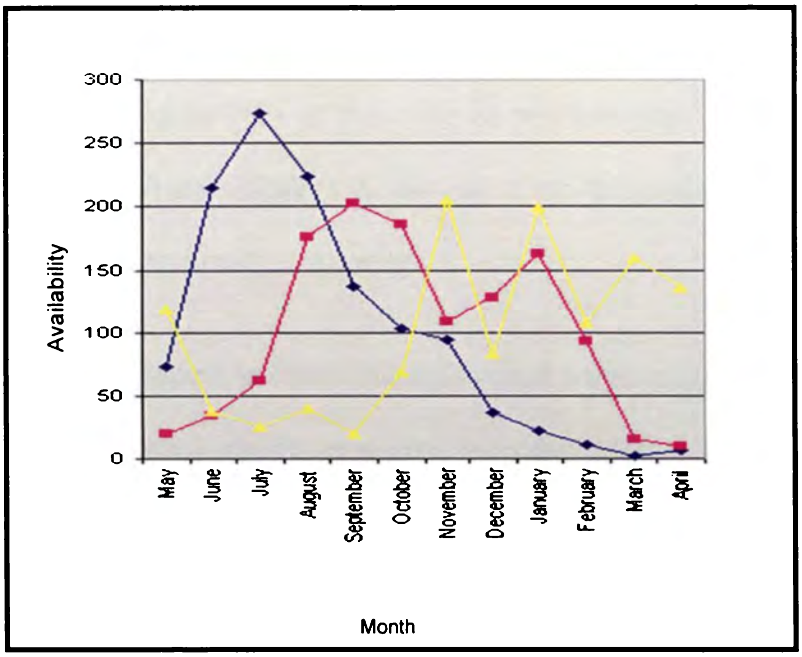


Fig 7.1 Seasonal variation in the availability of ornamental fish from local sources in south zone

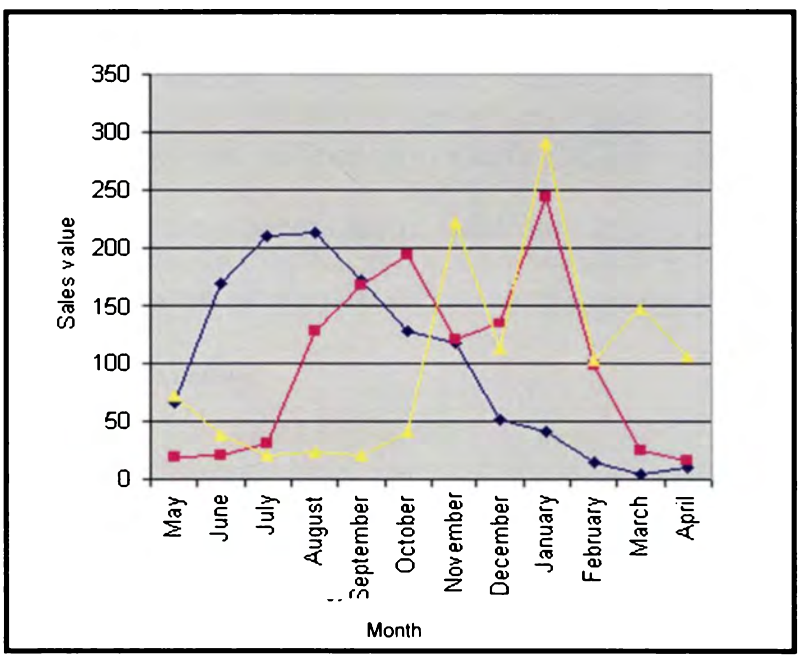
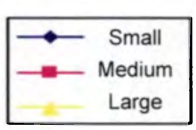


Fig 7.2 Seasonal variation in the sales value of ornamental fish from local sources in south zone

Source: Primary survey



Sales value of small-size ornamental fish from local sources was the highest in August (213.61) and the value declined steadily through the remaining months (Figure 7.2). In the case of medium-size and large-size fishes peak value was highest in January. Both the series showed higher fluctuations than small-size group.

7.1.2 Seasonal variation in the availability and sales value of ornamental fish from other states in south zone

Arrivals from other states on the other hand, showed different patterns in almost all the zones (Figure 7.3). For instance, seasonal availability of small-size ornamental fish started in May, peaked in July (211.01) and declined henceforth. Availability of medium-size fish began in July continuously increased in subsequent months, peaked during December- January (181.88). In the case of large-size fish, sudden increase in availability was noticed in January (282.35) due to the influence of aquarium show conducted at south zone during the survey year. Analysing the trends of outside arrivals, a much stable trend for all the size groups was noted.

Seasonal variations in sales value of small-size fish supplied from other states were highest during July (161.08), and it decreased gradually and sharp variation was noticed from November onwards. (Figure 7.4) The sales value of medium (262.75) and large-size (423.63) fish both supplied from outside states and locally were at its peak during January, which was associated with the aquarium show.

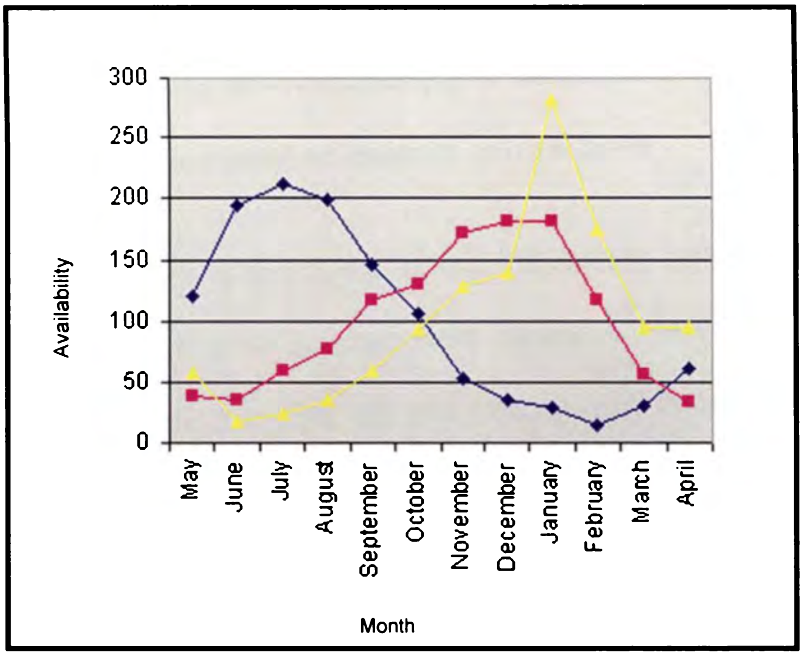


Fig 7.3 Seasonal variation in the availability of ornamental fish from other states in south zone

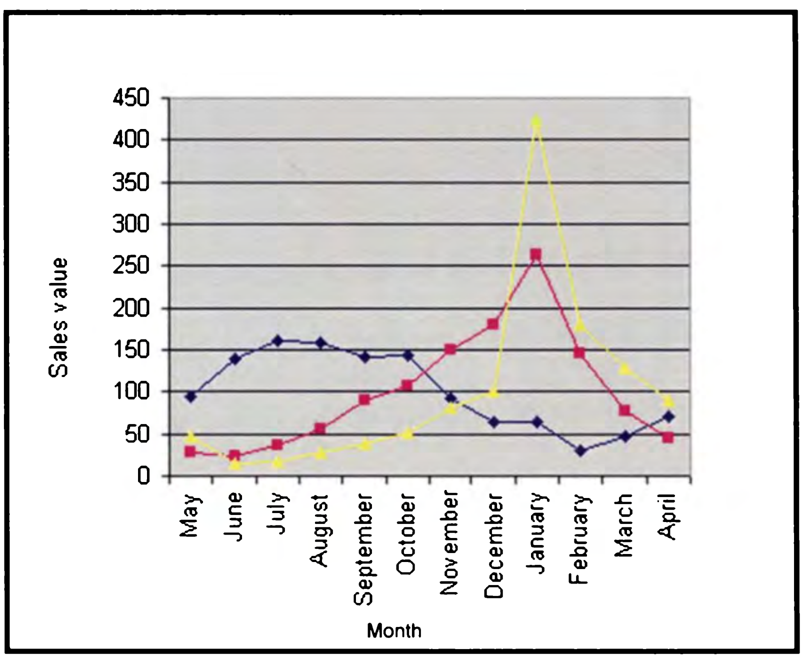
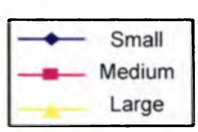


Fig 7.4 Seasonal variation in the sales value of ornamental fish from other states in south zone

Source: Primary survey



7.1.3 Seasonal variation in the availability and sales value of ornamental fish from local sources in central zone

Central zone witnessed early monsoon during the survey year and hence small-size fish from local sources were available more since May. The supply peaked in July (287.42) and continuously decreased towards other months (Figure 7.5). Availability of medium-size fish was high during August-December with peak availability in September (183.82). Lowest availability of medium-size fish was noted in May (4.78). Peak availability of large-size fish occurred in December (253.18), declined during adjacent two months and increased slightly in March due to the incoming of large quantities of fishes from quarries. The availability of large-size fish was lower during June (12.46) and July months.

Seasonal variation in sales value for local small-size fish was highest during July (263.87), and it decreased gradually and sharp variation was noticed from November onwards, where its availability was very scarce. Sales value generated from medium-size fish was highest in November (213.48). The value generated showed more variations in April and May, where the availability of medium-size fish was scarce (Figure 7.6).

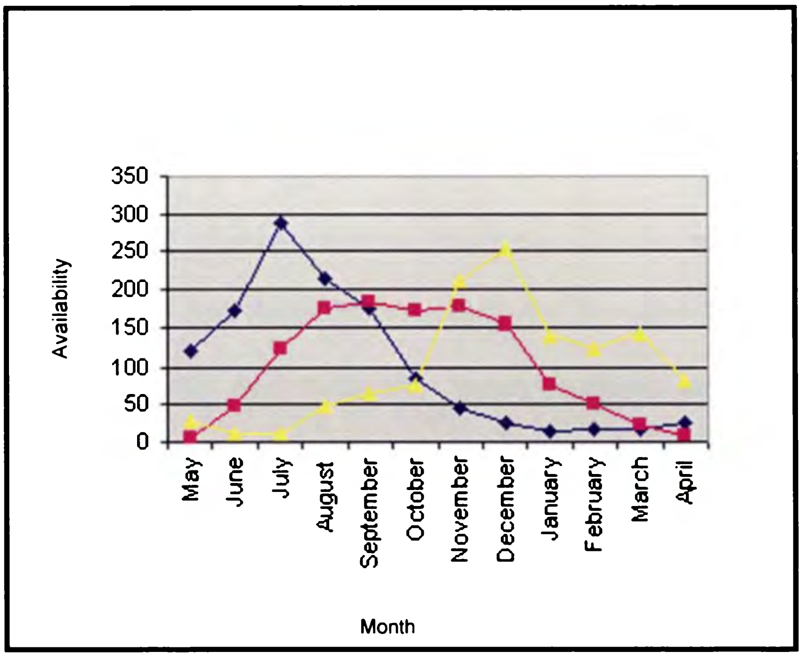


Fig 7.5 Seasonal variation in the availability of ornamental fish from local sources in central zone

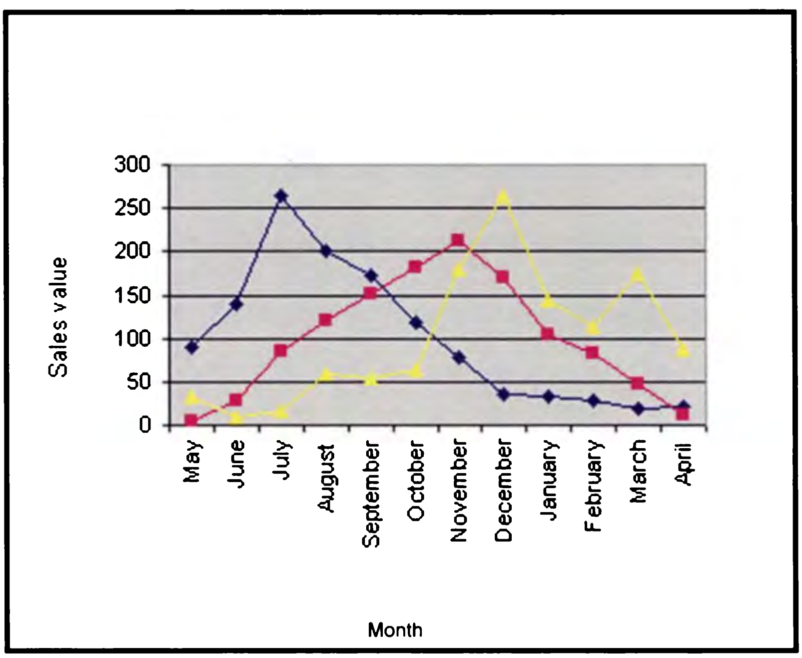
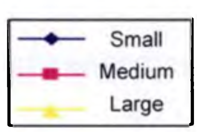


Fig 7.6 Seasonal variation in the sales value of ornamental fish from local sources in central zone

Source: Primary survey



7.1.4 Seasonal variation in the availability and sales value of ornamental fish from other states in central zone

Availability of ornamental fish from other states to the central zone is presented in figure 7.7. It may be inferred that small-size ornamental fish peaked during June-July (225.27) months, medium-size during October-December (175.43) and large-size ones during December (178.42) to March. The availability of small-size fish declined from August onwards while the medium varieties decreased from January onwards. Availability of large-size fish decreased from the month of June onwards.

In the case of small-size ornamental fish, the sales value peaked in July (171.81) and declined thereafter. The sales value of medium-size fish was highest during December-January (197.7). Christmas and New Year seasons showed an increased sales value for medium-size fish. Large-size fish on the other hand increased steadily since July and peaked in December (211.29). Figure 7.8 summarise these patterns.

7.1.5 Seasonal variation in the availability and sales value of ornamental fish from local sources in north zone

Monsoon started early in north zone and hence, small-size fish from local sources were available from May onwards. Supply peaked in July (301.55) and declined during subsequent months. Medium-size fishes were available from July to December and peaked in August (201.91).

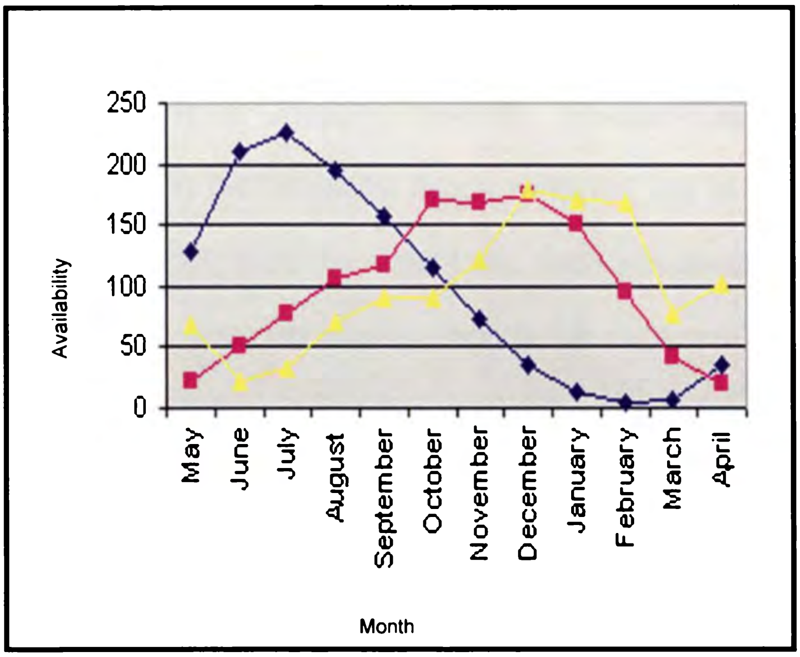


Fig 7.7 Seasonal variation in the availability of ornamental fish from other states in central zone

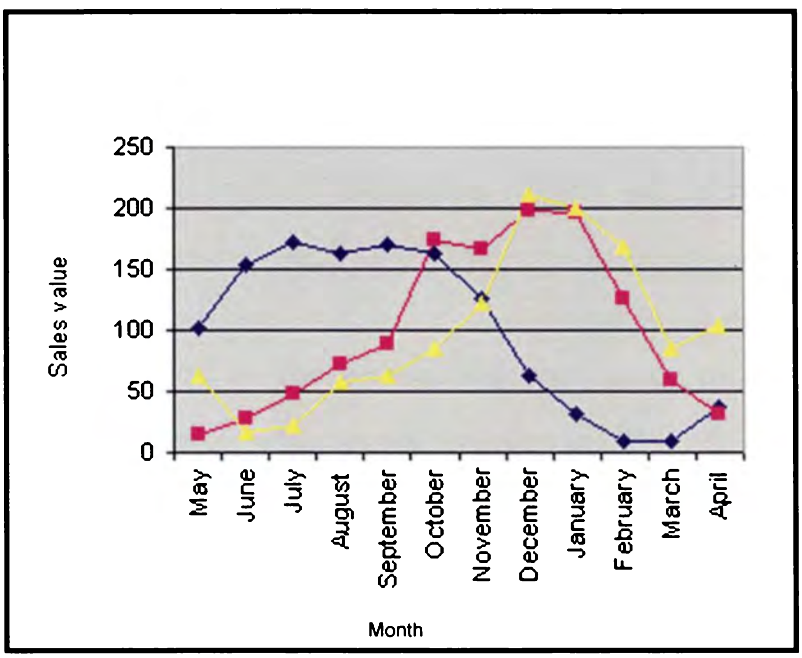
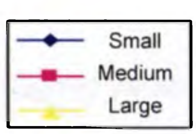


Fig 7.8 Seasonal variation in the sales value of ornamental fish from other states in central zone

Source: Primary survey



Large-size fish was plenty during December (231.17) and April. It was further observed that the supply of small-size fish from local sources dried up completely from January onwards. Medium-size fish disappeared in May while the large-size fishes vanished fully in June. This shows that local supply was intermittent and traders depended on neighbouring states for ensuring supply. Figure 7.9 captures these variations.

Figure 7.10 shows the seasonal variation in sales value of ornamental fish from local sources in north zone. Availability of small-size fish peaked during July and the sales value (262.48) also showed a similar trend. From November onwards, sales value showed a sudden downward slope with almost negligible values in January. Medium-size fish registered high sales value in October (253.83) and in May, sales of medium-size fish were not noticed. Large-size fish showed highest variation in sales value in December (276.2) with minimum variation in June (2.84).

7.1.6 Seasonal variation in the availability and sales value of ornamental fish from other states in north zone

The availability of small-size fish from other states peaked in July (228.11) and decreased gradually towards subsequent months. Medium-size fish became available in April, increased steadily thereafter, peaked during October to December and then declined gradually (Figure 7.11). Large-size fishes were available from November to April with peak availability during January (202).

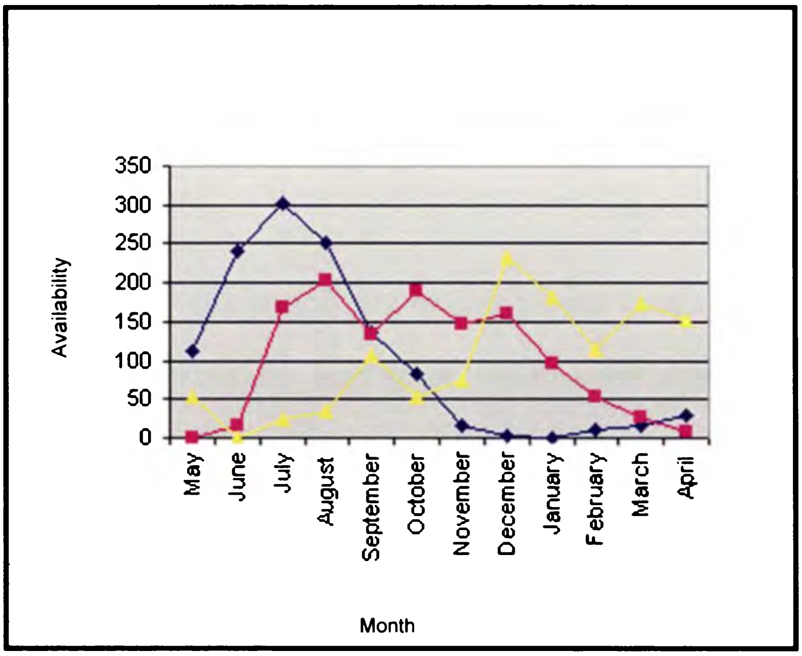


Fig 7.9 Seasonal variation in the availability of ornamental fish from local sources in north zone

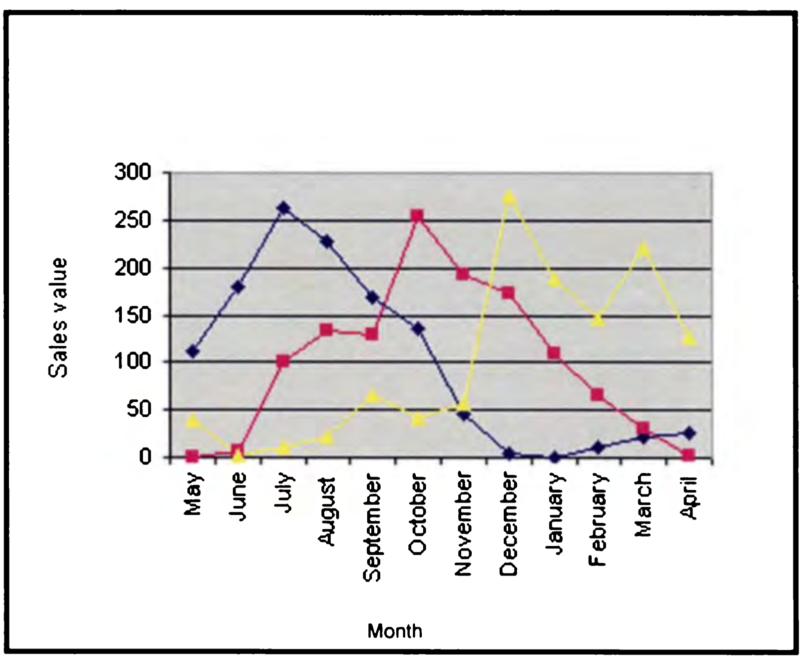
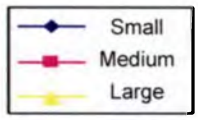


Fig 7.10 Seasonal variation in the sales value of ornamental fish from local sources in north zone

Source: Primary survey



Regarding the sales value, the graph for small fish reached the highest point during July (194.54) and decreased gradually. Sales values generated from both medium-size and large-size fishes were highest in January (Figure 7.12).

Thus it was concluded that the availability of ornamental fishes of all size classes, viz., small, medium and large, from other states to different zones in Kerala showed stable and normal pattern, whereas the supply from local sources within Kerala was highly irregular. According to availability of ornamental fish, sales value also changed.

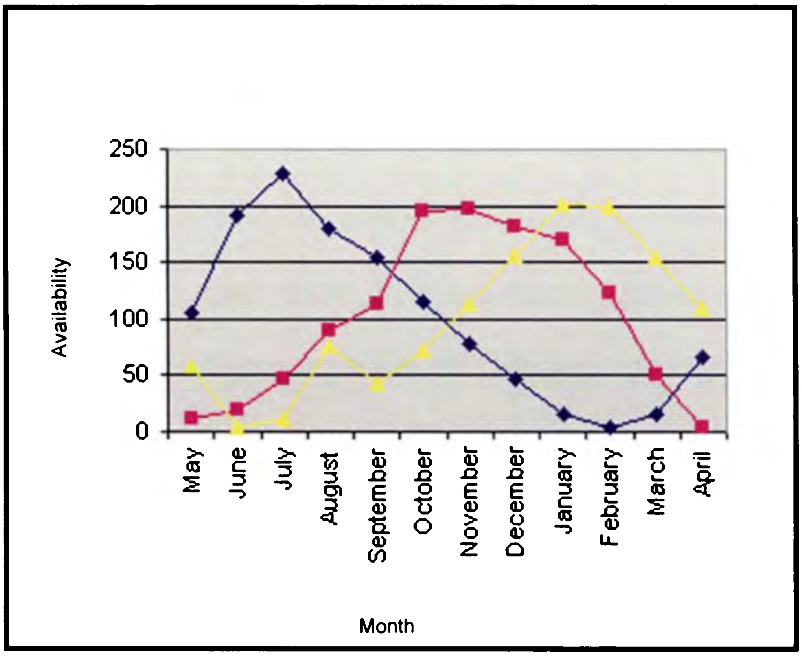


Fig 7.11 Seasonal variation in the availability of ornamental fish from other states in north zone

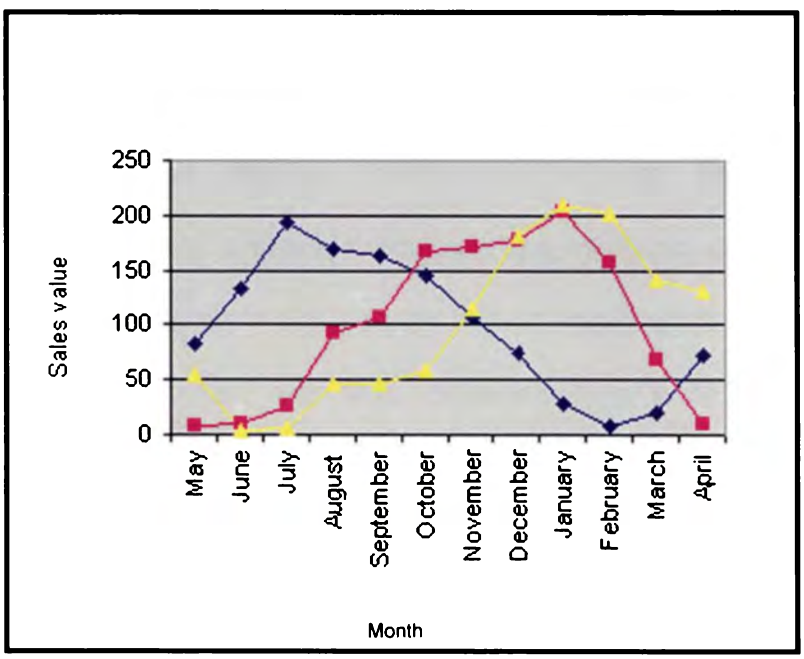
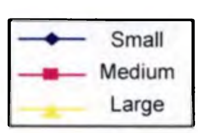


Fig 7.12 Seasonal variation in the sales value of ornamental fish from other states in north zone

Source: Primary survey



7.1.7 Level of significance: ANOVA

In order to find out whether there is significant difference between months in quantity of arrival of fish and its sales value generated, analysis of variance (two way ANOVA without replication) for different size classes of fishes and their totals in the selected zones was employed. Least significant difference had been calculated to find out the month in which there was significance.

7.1.7.1 ANOVA of difference between months in quantity of arrivals of different sizes of fishes and sales value over the months in south zone

ANOVA of difference between months in quantity of arrivals of different sizes of fishes and sales value over the months in south zone are shown in tables 7.1 to 7.4. Table 7.1 revealed that for small-size fish in the south zone, there was significant difference between month ($p<0.01$) and also significant difference between quantity and sales value ($p<0.001$). July values were significantly higher than December, January, February, March, April and May. Between June and July there was no significant difference. The Sales values generated were significantly higher than the total quantity of fish.

For medium-size fish of south zone, there was no significant difference between months, but between quantity and sales value there was significant difference ($p< 0.001$). The Sales values generated were significantly higher than the total quantity of fish (Table 7.2).

For large size fish of south zone, there was no significant difference between months but between quantity and sales value there was significant difference ($p < 0.01$). The Sales values generated were significantly higher than the total quantity of fish (Table 7.3).

For various size (small, medium and large size together) fishes of south zone there was no significant difference between months but between quantity and sales value there was significant difference ($p<0.001$). The Sales values generated were significantly higher than the total quantity of fish (Table 7.4).

Table 7.1 ANOVA of quantity of arrival of small-size fish and its sales value generated in south zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	48751201358	11	4431927396	6.78	0.0018	2.82
Bet. quantity and sales value	41092572083	1	41092572083	62.90	7.09E-06	4.84
Error	7186626399	11	653329672.6			
Total	97030399840	23				

Source: Primary survey

Table 7.2 ANOVA of quantity of arrival of medium-size fish and its sales value generated in south zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	63209965611	11	5746360510	1.47	0.2664	2.82
Bet. quantity and sales value	84027780901	1	84027780901	21.51	0.0007	4.84
Error	42968267400	11	3906206127			
Total	1.90206E+11	23				

Source: Primary survey

Table 7.3 ANOVA of quantity of arrival of large-size fish and its sales value generated in south zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	22329615837	11	2029965076	1.17	0.4012	2.82
Bet. quantity and sales value	17963085520	1	17963085520	10.33	0.0083	4.84
Error	19133152217	11	1739377474			
Total	59425853574	23				

Source: Primary survey

Table 7.4 ANOVA of quantity of arrival of various size fishes and its sales value generated in south zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	97409899428	11	8855445403	1.01	0.4930	2.82
Bet. quantity and sales value	3.92646E+11	1	3.92646E+11	44.82	3.4E-05	4.84
Error	96364786672	11	8760435152			
Total	5.86421E+11	23				

Source: Primary survey

7.1.7.2 ANOVA of difference between months in quantity of arrivals of different sizes of fishes and sales value generated over the months in central zone

ANOVA of difference between months in quantity of arrivals of different sizes of fishes and sales value over the months in central zone are shown in tables 7.5 to 7.8. For small-size fish of central zone, there was significant difference between month ($p<0.01$) and also significant difference between quantity and sales value ($p<0.001$). The month July gave significantly higher value compared to May, August, September, October, November, December, January, February, March and April. Between June and July the difference was not significant. The average sales value was significantly higher than the total quantity of fish sold (Table 7.5).

For medium-size fish of central zone, there was no significant difference between months but between quantity and sales value there was significant difference ($p<0.001$). Sales values generated were significantly higher than the total quantity of fish (Table 7.6). For large-size fish of central zone, there was no significant difference between months but between quantity and sales value there was significant difference ($p<0.001$). Sales values generated were significantly higher than the total quantity of fish (Table 7.7).

For various size ornamental fishes of central zone, there was no significant difference between months but between quantity and sales value there was significant difference ($p<0.001$). Sales values generated were significantly higher than the total quantity of ornamental fish (Table 7.8).

Table 7.5 ANOVA of quantity of arrival of small-size fish and its sales value generated in central zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	2.23555E+11	11	20323201508	5.88	0.0033	2.82
Bet. quantity and sales value	1.02736E+11	1	1.02736E+11	29.70	0.0002	4.84
Error	38046382753	11	3458762068			
Total	3.64338E+11	23				

Table 7.6 ANOVA of quantity of arrival of medium-size fish and its sales value generated in central zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	3.32903E+11	11	30263915950	1.56	0.2373	2.82
Bet. quantity and sales value	5.01575E+11	1	5.01575E+11	25.81	0.0004	4.84
Error	2.13804E+11	11	19436763377			
Total	1.04828E+12	23				

Source: Primary survey

Table 7.7 ANOVA of quantity of arrival of large size fish and its sales value generated in central zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	1.11381E+11	11	10125543392	1.31	0.3326	2.82
Bet. quantity and sales value	2.13145E+11	1	2.13145E+11	27.50	0.0003	4.84
Error	85256619601	11	7750601782			
Total	4.09783E+11	23				

Source: Primary survey

Table 7.8 ANOVA of quantity of arrival of various size fishes and its sales value generated in central zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	6.1368E+11	11	55789116641	1.26	0.3545	2.82
Bet. quantity and sales value	2.22135E+12	1	2.22135E+12	50.14	2.04E-05	4.84
Error	4.87367E+11	11	44306127533			
Total	3.3224E+12	23				

Source: Primary survey

7.1.7.3 ANOVA of difference between months in quantity of arrivals of different sizes of fishes and sales value over the months in north zone

ANOVA of difference between months in quantity of arrivals of different sizes of fishes and sales value over the months in north zone are shown in tables 7.9 to 7.12. For small-size fish of north zone, there was significant difference between months ($p<0.05$) and also significant difference between quantity and sales value ($p<0.001$). July figures were significantly higher than November, December, January, February, March, April and May. Between June, July, August, September and October, the difference was not significant. The sales values generated were significantly higher than the total quantity of fish (Table 7.9).

For medium-size fish of north zone, there was no significant difference between months but between quantity and sales value there was significant difference (p<0.001). The Sales values generated were significantly higher than the total quantity of fish (Table 7.10). For large-size fish of north zone there was no significant difference between months but between quantity and sales value there was significant difference (p<0.001). The sales values generated were significantly higher than the total quantity of fish (Table 7.11).

For various size fishes of north zone there was no significant difference between months but between quantity and sales value there was significant difference (p<0.001). The sales values generated were significantly higher than the total quantity of fish (Table 7.12).

Table 7.9 ANOVA of quantity of arrival of small size fish and its sales value in generated north zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	36045020186	11	3276820017	4.43	0.0103	2.82
Bet. quantity and sales value	22929050380	1	22929050380	31.00	0.0001	4.84
Error	8135937229	11	739630657.2			
Total	67110007796	23				

Source: Primary survey

Table 7.10 ANOVA of quantity of arrival of medium-size fish and its sales value generated in north zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	42369949944	11	3851813631	1.62	0.2174	2.82
Bet. quantity and sales value	51878302787	1	51878302787	21.86	0.0007	4.84
Error	26110581654	11	2373689241			
Total	1.20359E+11	23				

Source: Primary survey

Table 7.11 ANOVA of quantity of arrival of large-size fish and its sales value generated in north zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	11851182135	11	1077380194	1.27	0.3508	2.82
Bet. quantity and sales value	18337690638	1	18337690638	21.56	0.0007	4.84
Error	9354277255	11	850388841.3			
Total	39543150028	23				

Source: Primary survey

Table 7.12 ANOVA of quantity of arrival of various size fishes and its sales value generated in north zone

Source of variation	SS	df	MS	F	P-value	F crit
Month	53593180551	11	4872107323	1.25	0.3615	2.82
Bet. quantity and sales value	2.64822E+11	1	2.64822E+11	67.65	5.01E-06	4.84
Error	43057252892	11	3914295717			
Total	3.61472E+11	23				

Source: Primary survey

Thus it is inferred that in the case of small size ornamental fishes there was significant difference between months in central, south zone ($p<0.01$) and north zone ($p<0.05$) and also significant difference between quantity and sales value in all the three zones ($p<0.001$). The sales values generated were significantly higher than the total quantity of fish in all the three zones. The month July gave significantly higher value over other months in all the three cases.

Whereas in the case of medium-size ornamental fishes there was no significant difference between months, but between quantity and sales value there was significant difference in all the zones ($p<0.001$). In the case of large size ornamental fishes, there was no significant difference between months but between quantity and sales value there was significant difference in south zone ($p<0.01$) and in central and north zones ($p<0.001$).

The reason for the significant difference between months and also significant difference between quantity and sales value in all the three zones for small size fish may be attributed to its availability in certain months which was associated with monsoon. The sales values generated were significantly higher than the total quantity of fish in all the three zones for all sizes of fish.

7.2 Economics of ornamental fish marketing

Well organised marketing system is important for the growth of enterprises engaged in trading ornamental fish and no serious studies which examine the economic viability of ornamental fish trading units in Kerala exist as on date. This section presents the results of a detailed economic analysis of profitability of different category of trading units in the three zones in Kerala. Economic viability of different types of trading units in south, central and north zones is presented in tables 7.13, 7.14 and 7.15 respectively.

7.2.1 Economic viability of different trading units in south zone

The study did not identify any wholesale trader at the time of survey in south zone. Wholesaler cum retailers of this zone had not invested on land and building and they either hired shops or converted a portion of their own house as ornamental fish shop. Infrastructure like cement tanks, well, (39.28 percent) and aquarium tank, (33.28 percent) constituted the major investment cost for the wholesaler cum retailer. The total initial investment cost for them on an average was Rs. 21.36 thousands. Retailers, on an average, had invested 35.68 percent on building and 33.04 percent on other infrastructure. The average initial investment of a retailer was double than that of the wholesale cum retail trader. The ratio of fixed cost to total cost of wholesaler cum retailer and retailer was 4.9 percent and 10.61 percent respectively. The ratio of variable cost to total cost of wholesaler cum retailer and retailer was 95.1 percent and 89.39 percent respectively. Selling ornamental fishes, aquarium plants and accessories generated revenue and for wholesaler cum retailer and retailer it was Rs. 8.62 lakhs and Rs. 2.69 lakhs respectively (Table 7.13)

Table 7.13 Economic viability of different trading units in south zone

Value: in Rs. '000

Category	Wholesaler cum retailer	Retailer
A. INITIAL INVESTMENT		
Land	0.00	0.00
Building	0.00	16.66
Other infrastructure	8.39	15.43
Aquarium tank	7.11	6.73
Equipments	5.60	7.67
Miscellaneous	0.26	0.20
Total investment costs	**21.36**	**46.69**
B. FIXED COST		
Depreciation	3.18	4.14
Interest on initial investment	0.00	1.90
Rent	18.53	7.80
Opportunity cost	10.92	10.36
Total fixed costs (a)	**32.63 (4.89)**	**24.20 (10.61)**
C. VARIABLE COST		
Fish	330.24	97.95
Plants	65.02	5.51
Accessories	132.87	38.52
Family Labour	37.75	22.79
Hired Labour	0	5.65
Transportation	49.54	19.27
Packing	5.70	2.07
Electricity	2.61	5.13
Feed	4.27	2.96
Telephone	2.94	3.24
Others	3.04	0.87
Total variable costs (b)	**633.98 (95.11)**	**203.96 (89.39)**
TOTAL COST (a+b)	**666.61**	**228.16**
D. REVENUE		
Fish	539.59	186.77
Plants	151.35	9.80
Accessories	171.22	73.14
Total revenue	**862.16**	**269.71**

Source: Primary survey
(Figures in parenthesis indicates the percentage of respective costs to total cost)

7.2.2 Economic viability of different trading units in central zone

The study identified only one wholesale trader in central zone at the time of survey and he had purchased both land and shop for doing business. Wholesaler cum retailers and retailers of this zone were doing trade in rented shops or in their own houses. The average investment made by the wholesaler, wholesaler cum retailer and retailer in this business was Rs. 16.21 lakhs, Rs. 1.23 lakhs and Rs. 0.21 lakhs respectively. It was noted that lions share of investment of the wholesaler was for purchasing land (46.28 percent) and building (43.19 percent). For wholesaler cum retailer, both the aquarium tanks and related equipments demanded major investment costs. Among retailers, highest investment was needed for the purchase of aquarium tanks (30.42 percent), followed by building (29.08 percent). The total fixed cost of wholesale unit (Rs 2.32 lakhs) was higher than wholesale cum retail unit (Rs 1.74 lakhs). The variable cost, on an average for wholesaler, wholesaler cum retailer and retailer was 95.83, 92.96 and 87.69 percent of the total costs respectively. Total costs for wholesaler, wholesaler cum retailer and retailer on an average was Rs. 55.60 lakhs, Rs. 24.65 lakhs, and Rs. 1.96 lakhs respectively. Revenue of wholesaler, wholesaler cum retailer and retailer was Rs. 61.91 lakhs, Rs. 26.18 lakhs and Rs. 2.34 lakhs respectively (Table 7.14).

Table 7.14 Economic viability of different trading units in central zone

Value: in Rs. '000

Category	Wholesaler	Wholesaler cum retailer	Retailer
A. INITIAL INVESTMENT			
Land	750.00	0.00	0.00
Building	700.00	0.00	6.25
Other infrastructure	62.00	32.72	3.33
Aquarium tank	52.50	35.02	6.54
Equipments	55.25	47.72	4.66
Miscellaneous	0.86	7.70	0.71
Total investment costs	**1620.61**	**123.16**	**21.49**
B. FIXED COST			
Depreciation	41.53	17.79	2.92
Interest on initial investment	174.00	1.50	0.64
Rent	0.00	52.20	16.65
Opportunity costs	15.35	99.96	3.80
Others	0.70	2.05	0.12
Total fixed costs (a)	**231.58 (4.17)**	**173.50 (7.04)**	**24.13 (12.31)**
C. VARIABLE COST			
Fish	2820.25	1394.90	93.37
Plants	173.95	109.40	4.53
Accessories	1663.50	318.95	27.37
Family Labour	48.00	36.00	22.58
Hired Labour	48.00	63.80	4.2
Transportation	395.80	258.46	12.04
Packing	73.00	33.68	1.52
Electricity	19.40	30.00	2.4
Feed	16.65	10.52	1.46
Telephone	60.00	30.00	1.85
Others	9.81	6.16	0.5
Total variable costs (b)	**5328.36 (95.83)**	**2291.87 (92.96)**	**171.82 (87.69)**
TOTAL COST (a+b)	**5559.94**	**2465.37**	**195.95**
D. REVENUE			
Fish	3670.88	1962.84	170.55
Plants	286.55	236.95	12.17
Accessories	2233.31	417.72	50.84
Total revenue	**6190.74**	**2617.51**	**233.56**

Source: Primary survey

(Figures in parenthesis indicates the percentage of respective costs to total cost)

7.2.3 Economic viability of different trading units in north zone

In the north zone too, the study did not identify any wholesale trader at the time of survey. Wholesaler cum retailers in north zone had not invested on land and building. The total initial investment on an average for wholesaler cum retailers was Rs. 61.45 thousands and retailers, Rs. 36.01 thousands. Contradictory to the south zone, the average initial investment of a wholesale cum retail trader was double than that of the retailer. The fixed cost as a proportion to total costs was 4.79 percent for wholesaler cum retailer and 11.83 percent for retailer. The ratio of variable cost to total cost of wholesaler cum retailer and retailer was 95.21 percent and 88.17 percent respectively. Revenue for wholesaler cum retailer and retailer on an average was Rs. 17.63 lakhs and Rs. 3.07 lakhs respectively.

Table 7.15 Economic viability of different trading units in north zone

Value: in Rs. '000

Category	Wholesaler cum retailer	Retailer
A. INITIAL INVESTMENT		
Land	0.00	0.00
Building	0.00	12.50
Other infrastructure	4.25	7.07
Aquarium tank	33.47	7.61
Equipments	22.35	8.63
Miscellaneous	1.38	0.20
Total investment costs	**61.45**	**36.01**
B. FIXED COST		
Depreciation	8.30	3.57
Interest on initial investment	0.00	0.00
Rent	52.20	23.96
Opportunity costs	5.53	3.24
Others	0.00	0.00
Total fixed costs (a)	**66.03 (4.79)**	**30.77 (11.83)**
C. VARIABLE COST		
Fish	801.41	96.75
Plants	58.95	19.29
Accessories	238.35	47.10
Family labour	21.00	18.25
Hired labour	42.00	14.50
Transportation	72.54	18.38
Packing	13.88	2.18
Electricity	53.25	5.58
Feed	3.46	3.23
Telephone	6.70	3.39
Others	2.11	0.63
Total variable costs (b)	**1313.65 (95.21)**	**229.28 (88.17)**
TOTAL COST (a+b)	**1379.69**	**260.05**
D. REVENUE		
Fish	1201.14	169.47
Plants	161.43	51.45
Accessories	400.43	86.00
Total revenue	**1763.00**	**306.92**

Source: Primary survey

(Figures in parenthesis indicates the percentage of respective costs to total cost)

7.2.4 Comparison of profitability of different trading units

In table 7.16, profits and efficiency indices of different categories of traders are compared. On the whole, ornamental fish trade in Kerala had been a profitable activity. It may be noted that the wholesale trader had a net profit of Rs. 6.31 lakhs. Wholesale cum retail traders of south, central and north zones had made a net profit of Rs. 1.96 lakhs, Rs. 1.52 lakhs and Rs. 3.83 lakhs respectively. It could be observed that, the total cost of the wholesale cum retail traders of south zone was comparatively lesser than that of the rest two zones. Even though the volume of trade was higher in central zone, the total cost increased and reduced net returns. Retail traders of south, central and north zones had a net profit of Rs. 41.55 thousands, Rs. 37.61 thousands and Rs. 46.87 thousands respectively. Pay back period and rate of return are also provided in the table.

Table 7.16 Zone wise profitability of different traders

*Units: in Rs. '000

Zones	South zone		Central zone			North zone	
Category	Whole saler cum retailer	Retailer	Whole saler	Whole saler cum retailer	Retailer	Whole saler cum retailer	Retailer
TC*	666.61	228.16	5559.94	2465.37	195.95	1379.69	260.05
Revenue*	862.16	269.71	6190.74	2617.51	233.56	1763.00	306.92
Net profit*	195.55	41.55	630.80	152.14	37.61	383.31	46.87
Pay back period**	0.11	1.02	2.41	0.72	0.53	0.16	0.71
RATE OF RETURN (%)							
On investment	915.50	88.99	38.92	123.53	175.01	623.78	130.16
On fixed cost	599.30	171.69	272.39	87.69	155.86	580.51	152.32
On variable cost	30.84	20.37	11.84	6.64	21.89	29.18	20.44
On total cost	29.33	18.21	11.35	6.17	19.19	27.78	18.02

Source: Primary survey ** in years

To sustain economic profits, traders minimised input costs by substituting family labour for hired labour, reduced transportation and packing costs or even recycled packing materials. Moreover, the sole wholesaler purchased land exclusively for this business while a large proportion of traders had been using a portion of their own house for trading activity. These cost reducing methods were highly useful to reduce costs and increase profits.

7.2.5 Profitability range of different traders

Thus in order to examine the leverage effect of opportunity costs on profitability, an attempt was undertaken to calculate the range of profitability of traders in different zones, with the following formula,

95 percent confidence interval for p= p+ $1.96\sqrt{^{pq}/n}$.

Where, p represents percentage net profit per month to total costs

q represents p-1

n represents number of months, ie.12.

7.2.5.1 Profitability range of traders with and without opportunity cost in south zone

Table 7.17 represents the profitability range of traders in the south zone including and excluding various opportunity costs. For wholesaler cum retailers of south zone, the lower profitability range was above zero, and upper profitability range varied from 48.67 percent to 66.16 percent when opportunity costs were considered. Barring opportunity costs, the minimum profitability range was 8.05 percent and varied up to 18.59 percent while the maximum ranges for all of them were above 60 percent. For retailers of south zone, lower profitability range was zero, except one firm and upper profitability range varied from 3.59 percent to 55.22 percent when opportunity costs were considered. Barring opportunity costs, the minimum profitability range was 0.54 percent and varied up to 17.38 percent and the maximum range varied from 49.57 percent to 73.73 percent.

Table 7.17 Profitability range of traders in south zone

	Wholesaler cum retailer		Retailer	
	With opportunity costs	Without opportunity costs	With opportunity costs	Without opportunity costs
1	2.61 to 53.44	16.01 to 72.20	0.00 to 22.34	14.68 to 70.65
2	11.06 to 66.16	18.59 to 75.06	0.00 to 34.80	7.33 to 61.00
3	0.08 to 48.67	9.48 to 64.04	0.00 to 3.59	5.52 to 58.25
4	1.02 to 50.51	8.05 to 62.04	0.00 to 46.12	17.07 to 73.39
5			0.00 to 33.15	2.80 to 53.77
6			3.65 to 55.22	13.48 to 69.21
7			0.00	11.24 to 66.38
8			0.00 to 41.54	0.54 to 49.57
9			0.00 to 22.41	17.38 to 73.73

Source: Primary survey

7.2.5.2 Profitability range of traders with and without opportunity cost in central zone

Table 7.18 gives the profitability range of traders with and without opportunity costs in central zone. For wholesaler, profitability range varied from zero to 30.18 percent, when opportunity costs are considered. Without opportunity costs, the profitability range varied from zero to 32.97 percent. Similarly, in the case of wholesaler cum retailer in the central zone, lower range of profitability was zero, when calculated with and without opportunity costs. Upper profitability range varied from 7.01 percent to 18.89 percent when opportunity costs were considered and 12.95 to 34.04 percent when opportunity costs were not considered. For retailers in the central zone, lower range of profitability was zero for all, except two traders, where it was above eight percent, and upper profitability range varied from 5.47 percent to 63 percent when opportunity costs were considered. Lower range of profitability fell between zero to 21.06 percent except a single trader, which registered a higher value of 40.51 percent, and upper range varied from 21.81 percent to 93.68 percent when opportunity costs were not considered.

Table 7.18 Profitability range of traders in central zone

	Wholesaler		Wholesaler cum retailer		Retailer	
	With opportunity costs	Without opportunity costs	With opportunity costs	Without opportunity costs	With opportunity costs	Without opportunity costs
1	0.00 to 30.18	0.00 to 32.97	0.00 to 7.01	0.00 to 12.95	0.00 to 29.17	0.00 to 38.22
2			0.00 to 18.89	0.00 to 34.04	0.00 to 32.63	14.31 to 70.21
3					8.73 to 63.00	40.51 to 93.68
4					0.00 to 30.87	11.56 to 66.80
5					0.00 to 20.28	18.24 to 74.68
6					8.68 to 62.94	17.07 to 73.39
7					0.00 to 27.94	21.06 to 77.64
8					0.00 to 5.47	0.00 to 21.81

Source: Primary survey

7.2.5.3 Profitability range of traders with and without opportunity cost in north zone

Table 7.19 represents the profitability range of traders with and without opportunity costs in north zone. In the case of wholesaler cum retailer, lower profitability range varied from zero to 9.74 percent and upper profitability range varied from 43.80 to 64.40 percent, when opportunity costs were considered. Without opportunity costs, the lower profitability range varied from zero to 11.97 percent, and upper profitability range varied from 48.11 to 67.33 percent. For retailers on the north zone, the lower profitability range varied from zero to 3.4 percent and upper profitability range varied from 18.78 to 54.80 percent when opportunity costs were considered. Without opportunity costs, the lower profitability range varied from zero to 14.88 percent, and upper profitability range varied from 37.85 to 70.88 percent. The analysis showed that the firms could earn more profits mainly because of the opportunity costs.

Table 7.19 Profitability range of traders in north zone

	Wholesaler cum retailer		**Retailer**	
	With opportunity costs	Without opportunity costs	With opportunity costs	Without opportunity costs
1	0.00 to 43.80	0.00 to 48.11	0.00 to 18.78	5.82 to 58.72
2	9.74 to 64.40	11.97 to 67.33	0.00 to 28.27	0.00 to 37.85
3			3.40 to 54.80	14.88 to 70.88
4			2.55 to 53.33	9.06 to 63.47

Source: Primary survey

To test whether there is any significant difference between zones in the percentage profit taken by the retailers, one-way ANOVA with unequal number of observation was carried out separately for, with opportunity costs and without opportunity costs for retailers. The ANOVA table of value for P with and without opportunity costs is presented in Table 7.20 and Table 7.21 respectively.

Table 7.20 Table showing significance of difference between zones in the percentage profit taken by retailers (with opportunity costs)

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.0113	2	0.0057	0.41	0.6704	3.55
Within Groups	0.2498	18	0.0139			
Total	0.2611	20				

Source: Primary survey

Table 7.21 Table showing significance of difference between zones in the percentage profit taken by retailers (without opportunity costs)

Source of variation	SS	df	MS	F	P-value	F crit
Between Groups	0.0131	2	0.0066	0.36	0.7046	3.55
Within Groups	0.3308	18	0.0184			
Total	0.3439	20				

Source: Primary survey

In both the tables, there was no significant difference between zones at 5 percent level of significance indicating that the profit margin was more or less equal for 3 regions. The table value of F (2,18) is 3.55. Since the calculated value was less than table value, there was no significant difference between zones in the percentage profit.

7.2.6 Constraints

Seasonality of ornamental fishes prevented availability of all sizes of ornamental fish in all seasons. As on date, no technology is available to ensure smooth and regular supply of all varieties round the year. As our traders had to rely on supply from other states during seasons of high demand, artificial scarcity for certain varieties of fish was created by traders of neighbouring states. Tie-ups between outside suppliers and local wholesaler had also taken place to create an unbalanced price structure in the market. Markets were vested with private individuals who look at the markets as source of revenue/earnings. Private traders and middlemen dominated in marketing and trading. Moreover, professional manpower was not available for running of this industry (Ghosh *et.al;* 2003a).

7.3 Summary and conclusions

The study found that ornamental fish markets were seasonal and availability of different varieties varied significantly according to natural

/climatic conditions. Correspondingly sales values also changed. It was noted that, small size fishes were available plenty in July- August months and during subsequent months the supply continuously declined and from December onwards they faded out till next breeding season. Correspondingly the sales value of the fish was higher during the lean seasons. Medium size fishes were available during August till November and from then onwards they also declined, whereas large size fishes were available more from December onwards till next March, as it was the harvesting time of natural production systems. Fish bought from outside states showed a stable trend whereas the availability and supply of local varieties were intermittent and showed an irregular pattern.

In general, seasonal variation in sales value of small-size ornamental fish from outside and local sources was the highest in July- August and the value declined steadily through the remaining months. In the case of medium-size and large-size fishes both supplied from local and outside states, peak sales value was highest in December- January. The sales values were also noted to be higher during period of social visibility, vacation and exhibitions.

The availability and sales value of ornamental fishes in south zone, showed noted variations during November, December and January months due to the aquarium show conducted on the zone, during the survey period.

Economic viability of different trading units in different zones revealed that, only a single trader had purchased land and building and others rented shops or used a portion of their house for doing business. Initial investment was low, fixed costs and variable costs were kept considerably low through self-employed input that brought in high profits. Even though the volume of trade was higher in central zone, the total cost increased at much higher rate and reduced net returns. Retail traders in north zone made high profits compared to traders in other zones.

The effect of opportunity costs on profitability of different firms was examined and it was found that firms could earn more profits mainly because of self employed inputs and their opportunity costs. Contrary to the popular belief that exhibitions and trade events generated more profits, the study indicated that even though the sales were higher during those periods, the cost in different forms also escalated simultaneously and hence the profit margin was more or less equal in various locations.

CHAPTER 8

Summary and Conclusions

Ornamental fisheries in Kerala demonstrate great potential for development. The industry generates employment and foreign exchange, offers livelihoods and therefore its economic and social significance is indubitable. The industry has been traditionally organised by local communities, in extremely diversified ecological and economic conditions. However, local initiatives and state-sponsored development interventions did not progress enough due to poor understanding of consumer's demand, low level of technology, limited markets, and lack of institutional support to local producers. The policy of the state has been to offer limited incentives to build up a production base for ornamental fish sector. Exhibitions and seminars were also organised to achieve targets. Such efforts, although released internal synergies to enhance domestic production marginally, resulted the industry more dependant on supplies from neighbouring states. In fact, such consumerism is not unique to Kerala's ornamental fish sector alone. This has been the general pattern of Kerala's primary producing industry for quite some time and serious efforts are needed to reverse this tendency. The real question that we face in the context of ornamental fisheries development in the state of Kerala is whether such reversals are possible and if so, how?

This thesis started exploring the internal dynamics of ornamental fisheries of Kerala with this broad concern in mind and adopted an integrated approach to examine inter-relationships among various consumers, producers and ornamental fish traders.

Review of literature on ornamental fisheries revealed that studies were mainly confined to biological aspects and trade. Studies highlighting socio-economic factors on production, marketing, consumer behaviour, economic viability studies were scanty.

Detailed examination of factors determining consumer's demand for ornamental fishes in selected regions of Kerala was undertaken with special reference to the socio economic status of both urban and semi-urban population. Demand function for ornamental fishes in Kerala was estimated. The structure, organising practices and economic viability of major ornamental fish production and marketing activities were also ascertained. Effort has also been made to enlist the nature of constraints. Recommendations for the development of ornamental fisheries were made based on these analyses.

The study revealed that 99 percent of demand for ornamental fishes originated from households. An examination of the socio-economic status of target consumers revealed that this hobby was popular among the urban middle classes falling in the category of age 16-30 years. 62.35 percent of households started keeping ornamental fishes very recently. Examination of factors determining the demand for ornamental fishes revealed that the colour of fish played a major role for the purchase of ornamental fishes, followed by price, variety and size. Surprisingly, income of the consumer had only little influence on demand for ornamental fish and it was also non significant. All age groups, irrespective of their income cherished ornamental fish keeping and purchased different varieties. Experienced consumers purchased ornamental fishes less frequently than the non-experienced customers. The purchase of ornamental fishes depended on the attraction and affection of individuals towards these items. The demand for different size classes of gold fish was estimated using multiple linear regression analysis. The total variability explained by regression analysis for small size fish was 81 percent, which was significant at $p < 0.01$. It also revealed that for purchase of small size gold fish, price of substitute, was a major influencing factor. The total variability explained by regression analysis for medium size fish was 78 percent, which was highly significant at $p < 0.001$. The total variability explained by regression analysis for large size fish was 99 percent, which was significant at $p < 0.05$. For medium and large size gold fish, price of substitute did not influence consumer's demand.

In Kerala, ornamental fish farming has always been a livelihood activity undertaken by communities utilising locally available resources. One of the major characteristics of domestic ornamental fish production systems had been its diversity. The systems were scattered and organised under diverse ecological settings. Case studies revealed that each system had its own techno-economic characteristics and system specific variations. Production centres were concentrated in the central zone where local inputs were relatively abundant. Study found out that most of the producers relied heavily on rearing of ornamental fish rather than breeding due to the lack of a cost effective technology package, credit deficiencies and low extension activities. Most of the systems cultured two or three varieties, mainly livebearers. Even though capacities existed in the selected production systems, local producers under-utilised capacities and produced below optimum levels. Surprisingly, these systems together could not meet domestic demand and traders procured excess quantities needed to Kerala markets from other states.

Cost-return analysis on production systems revealed that the cost of seeds varied from 40-60 percent for grow out systems, where as it accounted to only less than 15 percent for professional breeders. Cost of feed ranged from six to twenty five percent depending on the system and most farmers adopted their own formula for feeding. Fertilizer costs amounted to seven percent. Lined clay pools (34.7 percent) and cement tanks (16.88 percent) needed high electricity costs for pumping water from pond/well. Marketing costs were higher for rings (30.75 percent), and cement tanks (13.96 percent). Incidental costs associated with risks, unnatural death of organisms and other miscellaneous expenses were observed as high as 33.97 percent for earthern pond. Labour costs ranged between 15-43 percent, with maximum working time of six hours per day for hired labour. Family labour accounted for more than 75 percent in all systems. Total labour cost was highest in lined clay pools, where it came to 42.47 percent. While considering the net profit, all of them showed positive returns, even though the net profit from rings were very low. Ratio of net profit to total cost has worked out to be highest for earthern pond (4.82) followed by paddy ponds (4.78). Hence the study indicated a bright economic future for strengthening domestic production systems along commercial lines.

The State however has been undertaking only limited promotional activities, for the development of ornamental fisheries as a professional and profitable business. For instance realising the potential for ornamental fisheries, Kerala Government has been organising exhibitions in various metropolitan cities. Major expansion in ornamental fish sector of Kerala was planned by the Government in late 1990s. A noteworthy influence of these promotional activities has been an expansion of domestic market for ornamental fishes. Traders and intermediaries have responded to the growing demand by networking with trading firms outside the state. Today, large proportion of ornamental fishes arrives from Tamilnadu. It is sad to note that no reliable data exists on the arrival of ornamental fishes from other states to Kerala markets.

Market studies revealed that producers of Kerala were able to supply only 16.71 percent of its domestic ornamental fish demand while other states together supplied 83.29 percent of our demand.

Local producers faced intense competition from neighbouring states. Most commonly used method for fish transportation from neighbouring states to our state was railways. More than half of the total traders in the State (53.33 percent) ordered ornamental fish from other states by sending cash advances. Experienced traders transacted business through telephone.

Marketing studies revealed that most of the aquarium shops in Kerala employed (67.12 percent) family labour followed by hired labour (32.88 percent) Apart from ornamental fishes and related accessories, birds, aquatic and terrestrial plants and other pet animals were also sold in these shops. Majority of traders (43.33) agreed that distributing visiting cards or placing boards in the shop are the best tools for advertising products.

The value of ornamental fish traded in entire Kerala state during 2000-2001 was 5.54 crores. Of the total ornamental fish arrivals in Kerala, 36.16 percent was contributed by the livebearers, which included molly, guppy, swordtail and platy, contributing 26.76 percent of the total sales value. Second position was occupied by goldfish and carp varieties together, which took 27.05 percent of the total arrival contributing 27.97 percent of the total sales value. Third, fourth, fifth and sixth positions were occupied by tetras (8.79 percent), barbs (8.87 percent), fighter and gourami (7.08 percent) and angel (5.36 percent) respectively. Indigenous freshwater fishes and marine fishes constituted negligible proportions.

Seasonal variation studies conducted on fish arrivals from outside states showed a normal distribution pattern, whereas for local varieties the supply was intermittent and showed irregular pattern. Analysis of variance revealed that in the case of small size ornamental fish there was significant difference between months in central, south zone ($p < 0.01$) and north zone ($p < 0.05$) and also significant difference between quantity and sales value in all the three zones ($p < 0.001$). The month of July gave significantly higher value over other months in all the three cases. In the case of medium and large size ornamental fishes there was no significant difference between months in all the three zones. In the case of medium-size fishes between quantity and sales value there was significant difference in all the three zones ($p < 0.001$). In the case of large-size fishes between quantity and sales value there was significant difference in south zone ($p < 0.01$) and central and north zones ($p < 0.001$). The reason for the significant difference between months and also significant difference between quantity and sales value in all the three zones for small-size fish may be attributed to its restricted availability associated with monsoon months.

Regarding accessories trade, ornamental fish feed was the most selling dry item in a pet shop. Glass tank setting was a major revenue earning activity for traders. Regarding sales of plants, in all the three zones, vallisneria was the single plant, which was sold in large quantities (38.1 percent), but the sales value generated was only 16.69 percent of the total.

Economics of trading operations were performed zone wise and results showed that, all the units were getting positive returns. The study did not identify any wholesale trader at the time of survey in south zone and north zone. Wholesaler cum retailers of three zones had not invested on land and building and they either hired shops or converted a portion of their own house as ornamental fish shop.

Infrastructure like cement tanks, well, (39.28 percent) and aquarium tank, (33.28 percent) constituted the major investment cost for the wholesaler cum retailer in the south zone. Retailers, on the other hand, invested 35.68 percent on building and 33.04 percent on other infrastructure. The average initial investment of a retailer was double than that of the wholesale cum retail trader. For all the traders, among the major variable costs incurred, comparatively higher expense was incurred for purchasing ornamental fishes followed by aquarium accessories.

In the central zone, the average investment made by the wholesaler, wholesaler cum retailer and retailer in this business was Rs. 16.21 lakhs, Rs. 1.23 lakhs and Rs. 0.21 lakhs respectively. The variable cost, on an average for wholesaler, wholesaler cum retailer and retailer was 95.83, 92.96 and 87.69 percent of the total costs respectively. Total costs for wholesaler, wholesaler cum retailer and retailer on an average was Rs. 55.60 lakhs, Rs. 24.65 lakhs, and Rs. 1.96 lakhs respectively. Revenue of wholesaler, wholesaler cum retailer and retailer was Rs. 61.91 lakhs, Rs. 26.18 lakhs and Rs. 2.34 lakhs respectively. In the north zone, the total initial investment on an average for wholesaler cum retailers was Rs. 61.45 thousands and retailers, Rs. 36.01 thousands. Pay back period was higher for wholesale trader (2.41 years) compared to other two channels.

The analysis on "profitability range" confirmed that trading firms were making profits mainly because of the opportunity costs. One-way ANOVA with unequal number of observations was carried out separately with opportunity costs and without opportunity costs for retailers to test whether there was any significant difference between zones in the percentage profit taken by retailers. The result showed that the profit margin was more or less equal in all the three regions.

Ornamental fish industry is primarily a household industry and extreme diligence and devotion are needed for developing the industry. Compared to food fish aquaculture, ornamental fish farming needed low investment and farmers in the State could undertake these activities to earn good returns, as there were growing markets both inside and outside the country. The study confirmed that despite positive profits, the domestic production base of ornamental fisheries in Kerala has not grown to meet the growing demands in internal and external markets due to a variety of bottlenecks related to demand and supply, which needed urgent attention and corrections. Among the various constraints faced by the ornamental fishery, lack of technology, market information, finance and credit remained as obstacles for development. Climatic variations, unorganised breeding activities, remoteness of breeding farms, lack of transparency in farm operations, low extension activities inhibited domestic production.

Despite constraints prevailing, the Government's initiatives for the promotion of this industry were commendable. Ornamental fisheries development has been one of the subjects in decentralized planning with good results. However, steps taken were not fully appreciated because of over politicisation, vested interests and non-attention (Arrignon, 1999). Even though Government has promoted activities through exhibitions, training programmes and subsidies, follow up actions were few. As the study indicated, the exhibitions and other promotional activities, although boosted internal markets, the benefits have not percolated to local producers. Careful planning and interventions are needed to stabilise and sustain the process of benefit transfers to local producers. That remains as the major challenge of ornamental fisheries development in the state of Kerala. Ornamental fisheries development through public–private partnerships, networking and clustering of self-help groups, local bodies, co-operatives and collective marketing are strategies worth experimenting for forward planning. An integrated approach is therefore essential to rejuvenate ornamental fisheries development in Kerala.

The study hence recommends the following actions for developing ornamental fisheries in Kerala.

- Considering the prevailing socio-economic conditions of ornamental fish farmers, credits at low cost have to be provided.
- Financial institutions may be persuaded to grant credits to ornamental fish farmers along patterns adopted for financing agriculture.
- Additional varieties of ornamental fishes should be incorporated in culture operations along with the ones already practiced.
- Sub contracting, clustering, collective actions and group farming have to be encouraged after making comparisons and viability studies.
- While adopting technologies from other regions, modifications of methods according to local environment might be necessary to achieve results.
- The impacts of climatic conditions over ornamental fisheries on a regional scale have to be assessed.
- Based on the feed back from farm level studies, appropriate technology transfer and strategies for up-gradation have to be developed with the participation of beneficiaries. Traditional wisdom of the local people has to be incorporated for adaptation.

- Extension programmes have to be planned for producers/ traders/ bankers and officials.
- Partial harvesting, lagged multiple stocking, and grading of fishes before selling to traders might be practised by farmers.
- Technology-based scientific studies should be developed to the mass rearing of angelfish, which are best suited for culture in quarries.
- In places where promotion of the fishery is difficult, strong tie-ups have to be evolved with local governments, non-governmental organizations, farmers and traders.
- Since products from other states dominate local markets, measures are needed to regulate outside arrivals and to support local producers.
- Techniques should be evolved to reduce cost of production by increasing the scale of operations in various domestic systems so as to equip them to compete with neighbouring states.
- The possibility to introduce support price to local products should be explored.
- Better market information service, which improves links among various producers and also with traders is essential to minimise information asymmetries and trade secrecies in the marketing of ornamental fishes.

- Strategies to ensure continuous supply have to be formulated to maintain perfect price balance in the market during lean seasons.
- Strengthening post-marketing services to maintain aquariums particularly in urban areas is essential to generate employment opportunities.
- Necessary institutional arrangements have to be introduced for quarantining.

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Annexure

Annexure 1

Common ornamental fishes traded in the domestic market of Kerala

Livebearers

Cobra guppy

Delta guppy

Female guppy

Female sword tail

Male sword tail

Platy

Platy

Black molly

Silver lyretail molly

Spotted molly

Cyprinids

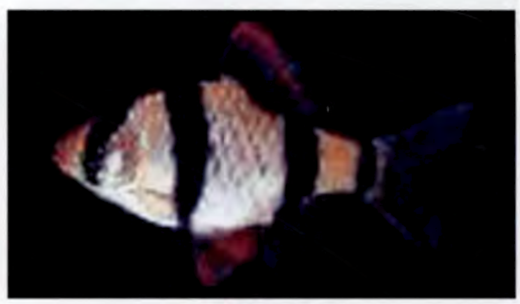
Ordinary gold fish

Fantail gold fish

Shubunkin

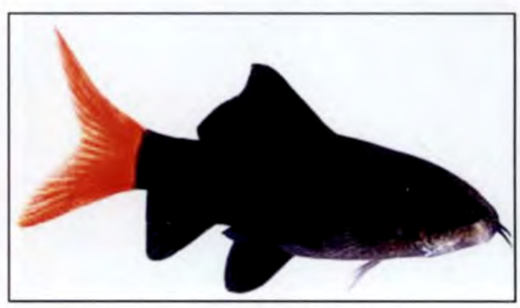
Blackmoor

Carp



Tiger barb

Rosy barb



Redtail shark

Redfin shark

Zebra fish

Characins

Black widow tetra

Albino widow tetra

Beunos aires tetra

Red eye tetra

Serpae tetra

Neon tetra

Glowlight tetra

Silvertip tetra

Pacu

Silverdollar

Cichlids


Ordinary angel


Marble angel


Golden angel


Koi angel


Black angel


Leopard angel


Tiger oscar


Red albino tiger oscar

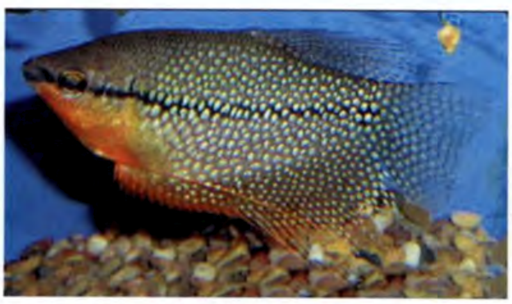

Yellow morph


Yellow severum

Anabantids

Blue gourami

Yellow gourami



Pearl gourami

Moonlight gourami

Dwarf gourami

Kissing gourami

Male fighter

Female fighter

Annexure 2

Common aquarium plants

Vallisneria

Amazon sword

Green cabomba

Red cabomba

Banana plant

Aquarus

Ludwigia

Milfoil

Annexure 3

COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF INDUSTRIAL FISHEREIS

ECONOMICS OF ORNAMENTAL FISHERIES IN KERALA

Questionnaire for consumer survey

Date of survey
ID code

Name and address of respondent
Name of shop
Location of shop (corporation, municipality, panchayath)

1 Family particulars

Sex	Age (Yrs)	Education	Main job	Total monthly Income (in Rs)
1. Male	1. 0-15	1. Upto SSLC	1. Student	1. Upto 3000
2. Female	2. 16-30	2. Plus one	2. Pvt. Employee	3. 3001-6000
	3. 31-45	3. Degree	3. Govt. servant	4. 6001-9000
	4. 46-60	4. PG	4. Unemployed	5. 9001-12000
	5. 61 and above		5. Own business	6. 12001-15000
			6. Retired persons	7. 15001 above

2 When did you first start ornamental fish keeping as a hobby?

☐ <5 yrs ☐ 5-10 yrs ☐ 10-20 yrs ☐ >20 yrs

3 What are your other hobbies?

☐ Other pets ☐ Sports ☐ Gardening
☐ Coin &stamp collection ☐ Reading ☐ Music

4 Reasons for starting ornamental fish keeping

☐ To reduce tension ☐ To overcome loneliness
☐ To reveal economic status ☐ For spending time
☐ Easy to maintain ☐ Like watching fishes/interest

5 Factors influencing purchase of ornamental fish

(Rank ...1,2,3, according to order of preference)

No	Factors	Rank
1	Income	
2	Price	
3	Substitute's price	
4	Fish size (a) small (b) medium (c) large	
5	Health	
6	Feeding habit	
7	Colour	
8	Shape	
9	Fin attributes	
10	Variety	
11	Movement	
12	Compatibility	
13	Others, specify	

6 How many tanks did u maintain when u started ornamental fish keeping?

☐ 1 ☐ 2 ☐ 3 ☐ >3

7 How many tanks did u maintain now?

☐ 1 ☐ 2 ☐ 3 ☐ >3

8 How many tanks did you purchase during the last one-year?

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ >3

9 How frequent do u buy fish for filling tanks?

☐ Fortnightly ☐ Once in a month ☐ Once in 2/4 months
☐ Once in 4/6 months ☐ Others

10 What is the average monthly expenditure incurred for this hobby (in Rs)?

☐ Upto Rs.50 ☐ Rs.51-100 ☐ Rs.101-150
☐ Rs.151-200 ☐ Rs.201 and above

11 Under what circumstances do you normally substitute a variety with other one?

☐ Price variations ☐ Death/disease
☐ Monotonous nature ☐ Compatibility

12 In case you could not buy fish you want, what options do you pursue?

☐ Substitute with other varieties of
a) Same price b) low price c) high price
☐ Do not substitute
☐ Substitute ornamental fish system with other pet keeping
☐ Substitute with native varieties
☐ Substitute with ornamental plants

13 How do you make your choices to introduce an expensive/new variety of fish into your tank?

☐ Consult family and friends ☐ Read books
☐ Consult shopkeeper ☐ Others

14 Do you prefer to buy fish from same seller always?

☐ Yes ☐ No

15 If yes, state reasons

☐ Diverse varieties of fish ☐ Low price ☐ Availability of fish
☐ Good quality ☐ Known persons ☐ Proximity

16 If no, state reasons

☐ High price ☐ Less varieties ☐ Negative approach of trader

17 What are the major issues in keeping aquariums at home?

☐ No problems ☐ Cleaning tank ☐ Disease
☐ Feeding ☐ Others

18 What are the major varieties of fishes you bought now?

No.	Variety	Number	Price/unit
1 2 3 4			

19 What are the major varieties of fishes you substituted?

No.	Variety intend to buy	Substituted variety	Number	Size	Price/unit
1 2 3 4					

Annexure 4

COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF INDUSTRIAL FISHEREIS

ECONOMICS OF ORNAMENTAL FISHERIES IN KERALA

Questionnaire for ornamental fish traders

Date of survey
ID number

Name and address of trader
Name of shop
Address
Location (corporation, municipality, panchayath)

1.1 FAMILY PARTICULARS

Sl.no 1	Name 2	Sex 3	Age 4	Educational qualification 5	Main occupation 6	Sub occupation 7	Remarks 8

1.2 Experience

1.2.1 When did you start the shop?

1.2.2 Reason for entering business

2 Details about shop

Total area (in cents) 1	Area used for ornamental fish business 2	Other business in the plot 3	Area for other business 4

3 Details about unit

Nature of the unit 1	Nature of ownership 2	Type of ownership 3	Source of water 4	Distance from source of water 5
Wholesaler Retailer Wholesaler cum retailer Brokers Others	Own Rented Leased	Domestic Individual Partnership Society Co-operative NGO Others	Tube well Ponds Bore well	

3.1 Finance

3.1.1 Do you have enough working capital for starting this industry?
☐ Yes ☐ No

3.1.2 If no, mention

Source of finance 1	Amount borrowed 2	Rate of interest 3	Purpose shown 4	Total amount 5
Family share Relatives Friends Government institutions Pvt. bank Others				

3.1.3 If you have taken loans form bank, what are the available banking facilities?

☐ Co-op bank ☐ Land mortgage bank ☐ Rural bank
☐ NABARD ☐ Others

3.1.4 Are you satisfied with their functioning?
☐ Yes ☐ No

3.1.5 Did you take government loans? State reasons.
☐ Yes ☐ No

3.1.6 What Problems do you encounter in borrowing?

☐ Too much paper work ☐ Delay in release of loans
☐ High interest rates ☐ Others

3.1.7 What factors accounted for the choice of the particular source?

☐ Accessibility ☐ Simple procedures ☐ Fast credit
☐ Extension services offered

4 Inventory of assets and calculation of depreciation

Sl. no	Items* 1	Acquisition		Quantity/ (no) 4	Unit cost (rs) 5	Prevailing market value 6	Estimated economic life 7	Salvage value 8	Depreciation 9
		Date 2	Cost 3						
	Land Buildings Aquarium tank Concrete tanks Oxygen cylinder Generator Well								

	Vehicle								
	Motor								
	Others								
	Miscellaneous								
	Aerator								
	Tube, stones								
	Hose								
	Feed tray								
	Filters								
	Test kit								
	Literature & library								
	Scoop net								
	Others								
	Total								

*Specify R for rented and O for owned

5 RECORD OF FIXED INPUTS

Date 1	Item 2	Monthly expenditure 3	Annual cost 4
	Rent		
	Tax		
	On accessories		
	Building		
	Vehicle		
	Other taxes		
	Insurance premiums		
	Security charges		
	Interest on initial investment		
	Depreciation		

6 MONTHLY RECORD OF VARIABLE COSTS

6.1 Procurement of fish

6.1.1 When the shop was first started, how many varieties of ornamental fishes did you sell?

6.1.2 How many varieties do you sell now? State reasons for the changes introduced?

6.1.3 How do you procure fish for marketing?

☐ Own Collection ☐ Own production ☐ Local wholesaler
☐ Local producer ☐ Outside state ☐ Broker/ Middlemen

(If locally procured, fill 6.1.4 and 6.1.5 and if procured form the other states go to 6.1.6)

6.1.4 Own source

☐ Own Collection ☐ Own production

Place of procurement	Size	Variety	Quantity	Price
Total				

6.1.5 Locally procured within the state from

☐ Wholesaler ☐ Local producer ☐ Wholesaler cum retailer

Nature of marketing channel				
Place of procurement	Size	Variety	Quantity	Price
Total				

6.1.6 Procured from other states

☐ Primary wholesaler ☐ Secondary wholesaler ☐ Others, specify.

Nature of marketing channel				
Place of procurement	Size	Variety	Quantity	Price
Total				

6.1.7 How many days do you keep the lot before selling?

☐ Sold at the spot ☐ Less than 3 days ☐ 3-7 days
☐ Two weeks ☐ More than 2 weeks

6.1.8 If the fishes are not sold with in a limited time what will you do?

☐ Sell at reduced rates ☐ No problem encountered so far

6.1.9 What are the requirements for unforeseen expenses?
Explain the costs incurred for

Items	Costs incurred (Rs)
Holdings Fish mortality Feed Others	
Total	

6.1.10 Costs of wastage through mortality

6.1.10.1 Do you encounter mortality problems ☐ Yes ☐ No

6.1.10.2 If yes, please specify

Source of procurement	Month	Variety	Quantity	Total cost
Within state				
Outside state				
Total				

6.1.10.3 What are the reasons for mortality in your unit and explain the measures taken to prevent this

6.1.10.4 Do you undertake any of the following to condition the procured fish?

☐ Acclimatise ☐ Sell before conditioning
☐ Apply chemicals and antibiotics ☐ Others

6.2 Procuring accessories

6.2.1 From where do you procure the accessories?

☐ Own manufacture ☐ Brought locally
☐ Brought from other states ☐ Imported

Source of procurement				
Place	Items	Quantity	Price	Total
	Ornamentation Stones/sand/driftwood **Manufactured merchandise** Toys Glass Aerator Medicine Filters/heaters Others **Fish feed** Total			

6.3 Procuring plants

6.3.1 From where do you procure the plants?

☐ Own collection ☐ Brought locally
☐ Brought from other states ☐ Imported

Variety	Source of procurement	Quantity	Price per piece	Total
Vallisneria Cabomba Ludwigia Banana Amazon sword Aquarus Hydrilla Mint Others				
Total				

6.4 Labour costs

Sl.no	Type of activity	Kind of labour 2		Total Persons	Payment 4		Working hours/ Day	Total labour cost
		Family	Hired					
	1	Male/ Female	Male/ Female	3	Rate/ Person /day	Food (others)	5	6
1	Collection							
2	Cleaning tanks							
3	Water exchange							
4	Stocking							
5	Feeding							
6	Harvesting							
7	Grading /packing							
8	Transportation							
9	Repair and maintenance							
10	Money keeping							
11	Others							

6.5 Variable costs for feed/medicines/chemicals

Items	Quantity used	Cost/unit	Total costs
Feed Medicines Chemicals Salt			

6.6 Transportation

6.6.1 Do you face any serious problem in transporting your consignments? Explain

Place of procurement	Mode of transport	Place of arrival	Distance covered	Handling charges	Other charges	Total

6.7 Other input costs record

Sl. No	Items	Quantity/month	Value	Total
	Water Electricity Packing Advertising Others			

7.0 SALES

7.1 Sale of fishes

Variety	Size			Brought from within state		Brought from other states		Imported		Total	
	Small	Medium	Large	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value

7.2 Sale of plants

Variety	Brought from within state		Brought from other states		Total	
	Quantity	Value	Quantity	Value	Quantity	Value

7.3 Sale of accessories

Items	Brought from within state		Brought from other states		Total	
	Quantity	Value	Quantity	Value	Quantity	Value

8.0 STRUCTURE OF ORNAMENTAL FISH MARKET

8.1 As a trader, how do you ensure the timely supply of different varieties of ornamental fishes in your shop? Explain

8.2 Have you given any advance to any broker or direct supplier to ensure the timely supply of the product?

☐ Yes ☐ No

8.3 If yes, to whom

Amount given	Broker	Direct supplier		Others
		Local	Outside	

8.4 State reasons for giving advance

8.5 How do you place orders?
☐ Telephone ☐ Fax ☐ Telegram ☐ Letter ☐ DD advance

8.6 How early do you confirm orders?
☐ Days ☐ One Week ☐ Fortnight ☐ Others

9.0 PRICING

9.1 As size of fish is an important factor in pricing, what measures did you adopt for getting a better price?
☐ Buy back mechanism ☐ Grow fish in your own unit
☐ Both the above ☐ Others

9.2 What all factors did you consider relevant in pricing fishes

☐ Seasonal Factors ☐ Competition from other traders
☐ Ethical Considerations ☐ Income status of consumers
☐ Legislation and Governmental Pressures ☐ Risks
☐ Market Intermediaries

9.3 How did the introduction of other pet shops affect your business?

9.4 What all strategies do you adopt to overcome competition?
☐ Improved quality ☐ Offer more quantity for same price
☐ Price cut ☐ Diversified product mix

10.0 ADVERTISING ,PUBLICITY AND SALES PROMOTION

10.1 Do you get the fishes according to the order you have placed?
☐ Yes ☐ No

10.2 If yes, ☐ Most time ☐ Every time ☐ Some time ☐ Never

10.3 If no, state reasons

10.4 Do you advertise your products to attract more customers
☐ Yes ☐ No

10.4 If yes what are the major forms of advertisement

☐ Distribution of visiting cards ☐ Advertising in media ☐ placing boards
☐ Participation in exhibitions and trade fair
☐ Display of products ☐ Direct customer approach ☐ All the above

10.6 If you have participated in exhibition, in what way did it help you?

☐ To introduce a new product ☐ To identify the channels of distribution
☐ To sell product ☐ Cerate product awareness among customers

11.0 ROLE OF INSTITUTIONS

11.1 From where did you get the technical advice for the functioning of your shop?

☐ Own experience ☐ Fellow Traders ☐ Books ☐ Government Institutions

11.2 Are you aware that the government is offering subsidy for the promotion of ornamental fishery? Explain your experiences

11.3 Have you got training in this field?
☐ Yes ☐ No

11.4 If yes specify
1. Name of course 2. Organizers 3. Date 4. Place
5. Duration 6. Fee details if any

11.5 Explain how did it help you run your farm

11.6 Are you a member of any ornamental fish association?
☐Yes ☐ No

11.7 If yes, explain how association helps you

☐ Provide information ☐ Give training and advice by experts
☐Join discussions ☐ Give Credit

12 Do you think this industry has a bright future? Explain the major functional problems facing the industry now

Annexure 5

COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF INDUSTRIAL FISHEREIS

ECONOMICS OF ORNAMENTAL FISHERIES IN KERALA

Questionnaire for ornamental fish farmers

Date of survey
ID number

Name and address of respondent
Village
Taluk
District
Name of farm

1.0 FAMILY PARTICULARS

Sl.no	Name 1	Sex 2	Age 3	Educational qualification 4	Main occupation 5	Sub occupation 6	Experience 7	Reason for entering business 8	Total income from occupation 9

1.1 General features of culture system

Type of system 1	No of units/ tanks in farm 2	Area of each 3	Depth 4	Age (yrs) 5	Seasonal/ perennial 6

Source of water 7	Distance from source of water 8	Any inlet outlet structures 9	Shape of pond/tank 10	Environmental parameters 11

1.12. What are the other uses of pond

☐ Agriculture ☐ Drinking ☐ Washing
☐ Bathing ☐ Others

1.13. Do you think that these alternate uses of water seriously affect ornamental fish culture? Explain

1.14. Do you feel that the quality of water around this area is good for omamental fishery? What are the possible sources of pollution?

☐ Hypemeutrification ☐ Eutrophication

☐ Pesticides pollution ☐ Others

1.15 How do you detect the water pollutants of your farm?

1.16 How can you prevent pollutants entering your farm? Give your suggestions.

1.17 What remedial measures have you adopted in the past for saving the fishery in case of loss due to pollution/disease?

1.18. Have you received any technical assistance for detection of pollution? Name the source and cost?

1.19. Have you ever applied the following in your farm/pond?

☐ Weedicides /Pesticides ☐ Medicines/Antibiotics ☐ Chemicals

☐ Yes ☐ No ☐ Yes ☐ No ☐ Yes ☐ No

1.20 From where did you get the above knowledge

1.21 Do you apply antibiotics/chemicals /medicines while transporting fish?

1.22 Has the farm ever subject to floods?

1.23 Mention the loses incurred during flooding

Extent of damage (Rs)	Damage to bund (Rs)	Escaped fish (Rs)	Mortality (Rs)	Others (Rs)

1.24 Explain the remedial measures to overcome this problem?

1.25 What all ornamental fish varieties do you culture? List them.

1.26 What are the major problems evolved in the introduction of these varieties? Explain

1.27 In case your farm is affected by any predators/pests explain how you eradicate them?

☐ Traps ☐ Chemicals ☐ Manual ☐ Biological ☐ Others

1.28 In case the farm is susceptible to poaching/attacks by birds/snakes/tortoise etc, how do you eliminate these?

1.2 DETAILS ABOUT HOLDING

1.2.1 Type of soil

1.2.2. Average sale price of land/cent in the area

1.2.3. Major crops, area cultivated and monthly income

Crops	1	2	3	Total
Area				
Income				

1.2.4 Area under ornamental fish culture

Own (cents)		Leased in	Leased out	Total
Inherited	Purchased during last 5 years			

1.2.5 If rented/leased

Sl.no	Private/ public	Distance from owners farm (km)	Rent/Lease period	Monthly rent /lease (Rs)	Mode of payment	Other payments
					Weekly Monthly Others	

1.2.6 Nature of ownership

- ☐ Own
- ☐ Lease
- ☐ Family enterprise
- ☐ Partnership
- ☐ Co-Operatives
- ☐ Others

2. INITIAL INVESTMENT FOR A FARM

Sl.no	Costs incurred for (Rs)						
	Land	Site preparation	Tank construction	Pump	Fence/shade preparation	Nets	Miscellaneous items

3 PROCUREMENT OF SEEDS

3.1 From where do you procure seeds?

1) Own production 2) Buy locally

(If the answer is 1, then execute 3.1.1. to 3.1.6; otherwise go to 4)

3.1.1 Brood stock management

Sl. No	Variety	Number of breeding stock	Size of brood stock	Stocking density	Type of feed given	Time and amount of feeding

3.1.2 Do you culture plants along with brood stock farm?

3.1.3 How do you maintain water quality? Give details.

3.1.4 What are the parameters for selecting quality brooders?

3.1.5 How many times a brooder are allowed to spawn?

3.1.6 Details of breeding

Sl. No	Variety bred	Method of breeding		Fecundity	Survival rate	Growth rate	Freq. of breeding	Total fish production
		Natural	Artificial					

4. INVENTORY OF ASSETS AND CALCULATION OF DEPRECIATION

Sl. No	Items*	Acquisition		Quantity (No)	Unit cost (Rs)	Prevailing market value	Estimated economic life	Salvage value	Depreciation
		Date	Cost						
	1	2	3	4	5	6	7	8	9
	Pond/farm								
	Water canal								
	Pond excavation								
	Fence								
	Aquarium tank								
	Concrete tanks								
	Well								
	Others								
	Buildings								
	Caretakers house								
	Office								
	Others								
	Equipment								
	Aerator								
	Tube, stones								
	Hose								
	Pumps								
	Breeding materials								
	Oxygen cylinder								
	Generator								
	Feeding equipment								
	Refrigerator								
	Others								
	Transportation								
	Two wheeler								
	Three wheeler								
	Four wheeler								
	Others								
	Nets								
	Cast net								
	Seine net								
	Scoop net								
	Others								
	Total								

Specify R for rented and O for owned

5. RECORD OF FIXED INPUTS

Date 1	Item 2	Monthly expenditure 3	Annual cost 4
	Rent Tax Lease Insurance premiums Security charges Interest on initial investment Depreciation Others		

6. MONTHLY RECORD OF VARIABLE COSTS

6.1 Labour costs

Sl.no	Type of activity 1	Kind of labour 2		Total Persons 3	Payment 4		Working hours/ day 5	Total labour cost 6
		Family Male/ female	Hired Male/female		Rate/ person /day	Food (others)		
1	Pond preparation							
2	Fertilization							
3	Cleaning tanks							
4	Fencing/netting							
5	Stocking							
6	Feeding							
7	Harvesting							
8	Grading/packing							
9	Transporting							
10	Repair and maintenance							
11	Others							

6.2 Monthly record of costs of feed, fertilizers and medicine

Items	Frequency of application	Mode of application	Quantity	Costs (Rs)	Prepared/collected/ cultured /bought
Feed 1.Live 2.Dry Fertilizer Manure Lime Weedicide Pesticide Medicine					

6.2.1 Any persons employed for collecting live feeds? Give details

6.2.2 Specify the type of feed given to different varieties of fish

6.2.3 If live feeds are prepared in the farm, what are they and mention the costs for that

6.2.4 Any feed store?

☐ Yes ☐ No

6.2.4.1. If no, where do you store feed ?

6.2.5 In case any quality degradation in feed will you feed that to fish

☐ Yes ☐ No ☐ Yes, but after cleaning

6.2.6 How did you acquire the knowledge of feeding/fertilization technique?

☐ Own experience ☐ Fellow farmers advice

☐ Extension agents ☐ Reading

6.3 Monthly record for Seeds (brooders/fingerlings)

6.3.1 If seeds are procured locally, specify from whom
1) Local producers 2) Traders

Variety	Size	Quantity	Total costs

6.4 How do you transport fish?
☐ By parcel ☐ Direct at farm site

6.4.1 If by parcel, what are the marketing costs/consignment

Sl.no	Mode of transport	Transport charge	Parcel charge	Porter fee	Other labour	Total
	Air					
	Train					
	Bus					
	Auto rickshaw					

6.4.2 How distant is your farm from respective stations?

6.5 Monthly record of other variable costs

Items	Quantity	Costs for (Rs)	Total costs
Water Fuel & electricity Packing material Reagents Others			

7. HARVESTING

Factors influencing ornamental fish production

7.1. Mortality

Sl.no	Items	Quantity lost (no)	Loss of value (Rs)
	Weather problem Feed problem Disease Water pollution Overstocking Flood Others (specify)		

7.2 Which of the following prompted you to harvest the varieties

☐ According to order ☐ To optimize production ☐ Need for money
☐ To get higher price ☐ Availability of fry for stocking ☐ Others, specify?

7.3 How do you harvest the ornamental fish?

☐ Total drainage of pond ☐ Pumping ☐ Using net ☐ Others

7.4 How many harvests do you make in one year

8. MONTHLY RECORD OF FARM OUTPUT

Pond no.
Date

Sl.no	Varieties harvested	Quantity (no)	Price (Rs)	Total (Rs)
	Gold fish Gourami Angel Guppy Molly Broods sold			
	Total			
	Less No. of fish kept for brood stock In kind payment Balance retained			
	Total			

9. MARKETING OF ORNAMENTAL FISHES

Outlet	Variety	Variety grade wise						Total Qnty (No)	Total Value (Rs)
		Small		Medium		Large			
		Qnty (No)	Value (Rs)	Qnty (No)	Value (Rs)	Qnty (No)	Value (Rs)		
Local sales									
Out side state									
Export									
Total									

9.2 Nature of marketing channels

Nature of sale	Variety	Variety grade wise						Total	
		Small		Medium		Large			
		Qnty (No)	Value (Rs)	Qnty (No)	Value (Rs)	Qnty (No)	Value (Rs)	Qnty (No)	Value (Rs)
Wholesaler									
Retailer									
Broker									
Consumer									
Direct farm sales									
Others									

9.3 How many traders did you change during the last one-year? Explain why?

9.4 Have you received any advance from trader?

☐ Yes ☐ no

9.5 If yes, whom?

Amount received (Rs)	Broker	Wholesaler	Retailer	Others	Total

9.6 State reasons for drawing advance

9.7 Mode of payment

☐ Ready cash ☐ Cheque ☐ Demand draft ☐ Credit ☐ Direct collections

9.8 If credit,

☐ No of days ☐ No of installment

9.9 If brokers are involved, explain how transactions are carried out?

9.10 Have you borrowed any money from the trader/broker?

☐ Yes ☐ No. If yes, amount

9.11 If the trader helps you to find out a market, do you offer any concession to him? Explain

9.12 How do you obtain orders

☐ Telephone ☐ Fax ☐ Telegram ☐ Letter ☐ Others

9.13 How early do you receive confirmed orders?

☐ Before One Month ☐ Fortnight ☐ One Week

☐ Sent according to agreement

10. ROLE OF INSTITUTIONS

10.1 Record of loan

Source of loan	Amount borrowed (Rs)	Date of borrowing	Rate of interest (Rs)	Purpose shown	Problems encountered
Family share Relatives Friends Government Private bank Public bank Others					

10.2 What factors accounted for the choice of the particular source?

☐ Accessibility ☐ Simple procedures ☐ Fast credit
☐ Extension services offered

10.3 Do you know that the government is offering incentives for the promotion of ornamental fishery? Explain your experiences?

10.4 Did you receive any subsidy from the following sources ever?

Amount	State Fisheries	MPEDA	Co-operatives	Others

10.5 From where did you get the technical advice for the functioning of your farm?

☐ Own experience ☐ Fellow Farmers ☐ Books ☐ Government Institutions

10.6. Have you got training in this field?
☐ Yes ☐ No

If yes, specify
☐ Name of course ☐ Organizers ☐ Date ☐ Place ☐ Duration ☐ Fee details if any

10.7 Explain how did it help you run your farm

10.8 Are you a member of any association?

☐ Yes ☐ No

10.9 If yes, explain how association helps you

☐ Provide Information ☐ Give training and advice by experts

☐ Join Discussions ☐ Give Credit ☐ Others

10.10 What are the major constraints in the development of this industry?