MANAGEMENT OF ORNAMENTAL FISH MARKETING IN KAMRUP (METRO) DISTRICT OF ASSAM

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In partial fulfillment of the requirements for the degree of

MASTER OF BUSINESS ADMINISTRATION
(Agri Business Management)
In
AGRICULTURAL ECONOMICS AND FARM MANAGEMENT

By

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July, 2017

ASSAM AGRICULTURAL UNIVERSITY

Faculty of Agriculture

CERTIFICATE – I

This is to certify that the thesis entitled **"Management of ornamental fish marketing in Kamrup (Metro) district of Assam"** submitted to the Faculty of Agriculture, Assam Agricultural University in partial fulfilment for the degree of **Master of Business Administration (Agri Business Management)** in **Agricultural Economics and Farm Management** is a record of research work carried out by **Miss Sujata Kaushik** under my personal supervision and guidance.

All helps received by her have been duly acknowledged.

No part of this thesis has been reproduced elsewhere for any degree.

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CERTIFICATE II

This is to certify that the thesis entitled **"Management of ornamental fish marketing in Kamrup (Metro) district of Assam"** submitted by **Miss Sujata Kaushik, Roll No. 15-ABM-06** to the Assam Agricultural University in partial fulfilment of the requirement for the degree of **Master of Business Administration (Agri Business Management)** in the discipline of **Agricultural Economics and Farm Management** has been examined and approved by the Student's Advisory Committee after viva-voce.

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ABSTRACT

Ornamental fish keeping and its propagation has been an interesting activity for many, which provide not only aesthetic pleasure but also financial openings. The present study was conducted in Kamrup (Metro) district of Assam to see the present status, management aspect of rearing, production and breeding, and problems associated with marketing of ornamental fish. For the study a sample of 30 ornamental shop owners was selected using simple proportionate random sampling technique. Selected shop owners were further categorized into three groups based on their shop rearing size *viz*., Group I (<250 sq.ft.), Group II (250-500 sq.ft.) and Group III (>500 sq.ft.).

Regarding present status of ornamental fish business in Assam, it was found that about 80% of ornamental fishes from India to international market are exported via Kolkata airport, of which the lion's share (more than 80%) is contributed from North Eastern Region. Out of 250 potential ornamental fish species in North East, Assam recorded the highest number of species (187), followed by Arunachal Pradesh (165), Meghalaya (159), Manipur (139), Tripura (103), Nagaland (71), Mizoram (46), and Sikkim (29). There were only 20 aquarium shops in Guwahati up to 2004 (Bhattacharyya and Choudhury, 2004) which increased to 88 aquarium shops in 2016 (Department of Fisheries, GoA). Presently only 11 persons are associated with breeding of ornamental fishes in Guwahati.

With respect to management aspects of rearing and breeding, it was found that most of the recommended equipments and accessories were used by the shop owners except cement tank, quarantine tanks and heating apparatus, which were not used by them due to involvement of higher costs. Similarly, majority of the shop owners used recommended management practices. Marketing costs was found highest for crocodile fish (Rs. 1267.00), followed by parrot fish (Rs. 1175.00). Similarly, marketing margin was highest for discus (Rs. 35,913.00), followed by arawana (Rs. 28,364.00) and parrot fish (Rs. 14,288.00) respectively.

Manpower problem was emerged as the most severe problem in breeding of ornamental fishes. Breeding problem, high cost, electricity problem, non availability of good quality brood fish, mortality of new born babies etc. were some other problems identified during the present study. Mortality of reared fishes and higher transportation costs were identified as the major two problems faced by the firms in rearing of ornamental fishes. Fluctuations in demand was the major problem faced in marketing of ornamental fishes. Change of customer choice and manpower problem were the next two important marketing problems faced by the respondent firms.

Among the problem related to breeding the most encountered problems were manpower problem followed by complicacy of breeding process and high cost. Similarly mortality, higher transportation cost and financial problems were the major rearing problems. The major marketing problems were high cost of accessories, electricity problem and manpower problem.

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CHAPTER I

INTRODUCTION

Ornamental fish keeping and its propagation has been an interesting activity for many, which provide not only aesthetic pleasure but also financial openings. About 600 ornamental fish species have been reported worldwide from various aquatic environments. Indian waters possess a rich diversity of ornamental fish, with over 100 indigenous varieties, in addition to a similar number of exotic species that are bred in captivity. The Western Ghats of India is one of the 34 biodiversity 'hotspot' areas of the World (Anna Mercy, 2007). Among the 300 species of freshwater fishes available in the Western Ghats, 155 are considered as ornamental fishes of which 117 are endemic to the Western Ghats. North Eastern region is the home-ground of 250 ornamental fish species out of which 187 species are found in different parts of Assam (Mahapatra, 2004). Nearly 90 per cent of the ornamental fishes marketed in India are exotic. Even though there are quite a lot of indigenous fishes having high potential as ornamental fishes, they have not been properly exploited.

Ornamental fishes usually mean attractive colorful fishes which have various characteristics, which are kept as pets in confined space of an aquarium or a garden pool for fun and fancy. Ornamental fishes are usually kept in glass aquarium and hence popularly known as 'Aquarium fishes'. These living jewels need not always have bright colours; as sometimes their peculiar characteristics such as body colour, morphology, mode of taking food etc. may also add to their attractiveness.

Keeping of aquarium has emerged as the second most popular hobby in recent years, next to photography. Perhaps, China is the pioneer in adopting aquarium fish as a hobby. The world's first public aquarium was established in England in 1853, and now nearly 1000 public aquariums exist throughout the world.

Almost 90 per cent of ornamental fish trade is dependent on fresh water fishes of which 98 per cent are cultured and 2 per cent are captured from wild. The rest 10 per cent of total ornamental fish trade are with marine fishes of which 98 per centare captured and 2 per cent from cultured. About 80 per cent of ornamental fishes from India to international market are exported via Kolkata airport, of which the lion's share

(more than 80%) is contributed from North Eastern Region. Already 217 fish species belonging to 136 genera has been identified in Assam, of which about 187 species have been reported to be of ornamental value and in case of more than 50 species, overseas demand has been established.

There were only 20 aquarium shops in Guwahati up to 2004 (Bhattacharyya and Choudhury, 2004). A total of 88 aquarium shops were available only at Guwahati up to August, 2016 (Department of Fisheries, GoA). The sustainable management of the ornamental fisheries is possible through appropriate strategic planning. In addition, this will ensure and generate employment for a substantial section of labour force in the North-Eastern states. Enormous agri-business opportunities can be explored in systematic collection and marketing of native ornamental fishes (wild catch) as well as rearing of exotic ornamental fish species (captive breeding) suitable in the region. Perhaps the opportunity of gainful employment underlines at all the levels of activities in the ornamental fish industry, *viz.* production, marketing and exports. Presence of diverse natural water bodies is also an added advantage. Many young and enthusiastic entrepreneurs are very much interested to take up such ventures on commercial basis.

Researchers of various organizations like Central Inland Fisheries Research Institute (CIFRI), Guwahati University, Dibrugarh University, Assam University, College of Fisheries under Assam Agricultural University etc. has done some pioneering works. The North Eastern Regional Centre of CIFRI has been conducting research on various aspects on indigenous ornamental fishes of this region including cataloguing of potential species, methods of collection from the wild, conditioning of wild fishes and laboratory rearing etc.

Agencies like Marine Products Export Development Authority (MPEDA), National Bank for Agriculture and Rural Development (NABARD), North Eastern Development Finance Corporation Ltd. (NEDFi) are taking keen interest for promoting the development of culture of ornamental fishes with a view to develop the ornamental fish sector in North Eastern region.

In spite of all these diverse efforts, progress in ornamental sector needs considerable improvement. Presently, the trade of indigenous ornamental fishes in the state is unorganized and mainly based on natural collection. The fishes are collected from the wild habitat by local fishermen and these are marketed by traders, who actually

control all the activities. It has been observed that, enthusiastic collectors collect ornamental fishes in large number during the peak season, but as market is neither ensured nor channelized properly. This has an adverse effect at the budding stage of the entrepreneurship itself. Presently ornamental fish business is showing a tremendous growth throughout the country in general and in Guwahati in particular. In this connection the present study is undertaken to examine the various management aspects in relation to production, rearing and distribution of ornamental fishes and identify the problems and challenges associated with the sector in Kamrup (Metro) district of Assam with the following objectives:

1. Study the present status and progress of ornamental fish industry in the district
2. Examine the managerial aspects of rearing, production and distribution of ornamental fishes
3. Identify the problems encountered and suggest suitable measures

CHAPTER II

METHODOLOGY

The sampling technique adopted, the nature and sources of data used, and analytical tools and techniques employed in fulfilling the objectives of the study are discussed in this chapter. The details of the methodology are discussed under the following sub heads:

2.1 Study area

2.2 Period of study

2.3 Sampling design

2.4 Sample selection

2.5 Collection of data

2.6 Method of analysis of data

2.7 Scope of the study

2.8 Limitation of the study

2.1 Study area

The study was conducted in Kamrup (Metro) district of Assam to examine the various management aspects in relation to rearing, production and distribution of ornamental fish and analyze the problems and challenges associated with the sector in Kamrup (Metro) district of Assam.

2.2 Period of study

The study refers to financial year 2016-2017 and the data were collected from the sample ornamental fish firms during March-May, 2017.

2.3 Sampling design

A simple random sampling technique was adopted to select the sample firms from the study area. Altogether 30 firms were selected randomly out of 88 firms to collect relevant information through personal interview. The 30 selected firms were

grouped into three groups according to their rearing size of the shop, i.e. Group I (< 250 sq.ft.), Group II (250 - 500 sq.ft.) and Group III (> 500 sq.ft.), respectively**.**

2.4 Sample selection

The distribution of sample respondents in three groups is mentioned below:

Table 2.4.1. Classification of firms based on the rearing area

Shop size groups	Sq.ft.	Total no. of firms	No. of sample firms (34%)
Group I	<250	11	4
Group II	250-500	35	12
Group III	>500	42	14
All Group	-	88	30

2.5 Collection of data

Primary sources

The primary data required for the study were collected from the sample firms by personal interview method with the help of a pre-structured questionnaire. The questionnaire was designed keeping in mind the objectives of the study. The respondents were interviewed at the firms itself during the market hours. The questionnaire used for interviewing the shopkeepers consists of:

Part I: General information like name, age, education, gender, occupation and experience were taken.

Part II: Specific information including production related management, number of firms using facilities and materials required for breeding and rearing of ornamental fishes, reasons for not using the recommended facilities and materials by the firms involved in breeding and rearing of ornamental fishes, opinion of firms about breeding and rearing process of different fish species, marketing channels for both exotic and

local ornamental fish species, attributes influencing customer purchasing behaviour of fish species, problems faced in breeding, rearing , and marketing of ornamental fishes.

Secondary data

Secondary data were collected from the agriculture related website, books, journals, National Fisheries Development Board (NFDB) and ICAR-Central Inland Fisheries Research Institute (CIFRI), Regional Centre, Guwahati.

2.6 Method of analysis of data

Tabular analysis: The data collected for the study was processed and analyzed by using simple tabular analysis, percentage and mean/average.

Garret's ranking technique: It was used to examine the problems faced by the firms in breeding, rearing and marketing of ornamental fish marketing in Kamrup (Metro) district of Assam. The rank given by each firm on the problems were converted to percentage by using the following formula:

$$\text{Per cent position} = \frac{R_{ij} - 0.5}{N_j} \times 100$$

Where, Rij stands for rank given for the i^{th} factor by the j^{th} individual and

Nj stands for numbers of factors ranked by j^{th} individual.

The percentage so obtained was converted to scores using Garret table. From these mean scores for each constraint the ranking is done in the descending order of the mean score.

Marketing margin

Marketing margin refers to the profit earned by a particular firm for a period of time from sale of fish after meeting purchase cost and associated marketing costs. Marketing margins per month for ornamental fish firms were calculated using the following formula:

Marketing margin = Sale price × Quantity of fish sold – (Purchase price x Quantity of fish purchased marketing + Marketing costs per month)

2.7 Scope of the study

The ornamental fish industry is an upcoming industry in the fields of business particularly in Kamrup (Metro) district of Assam. The present study would provide useful information regarding the management of rearing, production and distribution aspects of ornamental fish industry and the attributes influencing the customer purchasing behaviour of fish species. Moreover, the study would help in identifying the problems faced in breeding, rearing and marketing of the fish species. This would help the firms to develop marketing strategies for increasing their volume of business as well as to earn more profit.

2.8 Limitation of the study

The study was undertaken with certain limitations. Firstly the study was based on primary data collected from a small sample firms as the population size was less. There were only 88 ornamental fish firms in Guwahati. As many of the firms furnished the required information from their memory and experience, the collected data would be subjected to recall bias. The study area was limited to Kamrup (Metro) ornamental fish firms only and the findings may not be applicable to other ornamental fish firms of other areas. There were not enough breeding firms found in the district which was another limitation of the study. It would have been better if the study could cover more areas to get a comprehensive picture. But due to lack of time, the study was confined to Kamrup (Metro) district of Assam.

CHAPTER III

RESULTS AND DISCUSSION

The results of the present investigation are presented and discussed under the following broad heads:

3.1 General information of the selected respondents

3.2 Present status and progress of ornamental fish industry in the district

3.3 Managerial aspects of production, rearing and distribution of ornamental fishes

3.4 Problems encountered in production, rearing and marketing of ornamental fishes and suggest suitable measures.

3.1 General information about the selected respondents

The general information of the sample respondents who were involved in ornamental fish business in Kamrup (Metro) district of Assam are thoroughly discussed below.

3.1.1 Distribution of sample respondents based on age

It could be observed from the Table 3.1.1 that out of the total thirty respondents there were equal number of respondents (33.33% each) in the age groups 30-40 and 40-50 years. In size groups I and II, maximum respondents were fell under the age group 40-50 years (75.00 and 41.67 per cent respectively), while in group III highest percentage of respondents were observed to fall under the category having age group 30-40 years.

Table 3.1.1. Distribution of sample respondents based on age

Size groups	No. of firms	Age groups (years)			
		< 30	30-40	40-50	> 50
Group I	4 (13.33)	-	1 (25.00)	3 (75.00)	-
Group II	12 (40.00)	3 (25.00)	4 (33.33)	5 (41.67)	-
Group III	14 (46.67)	4 (28.57)	5 (35.7)	2 (14.28)	3 (21.42)
All groups	30 (100.00)	7 (23.33)	10 (33.33)	10 (33.33)	3 (10.00)

(Figures in parentheses indicate percentage to total)

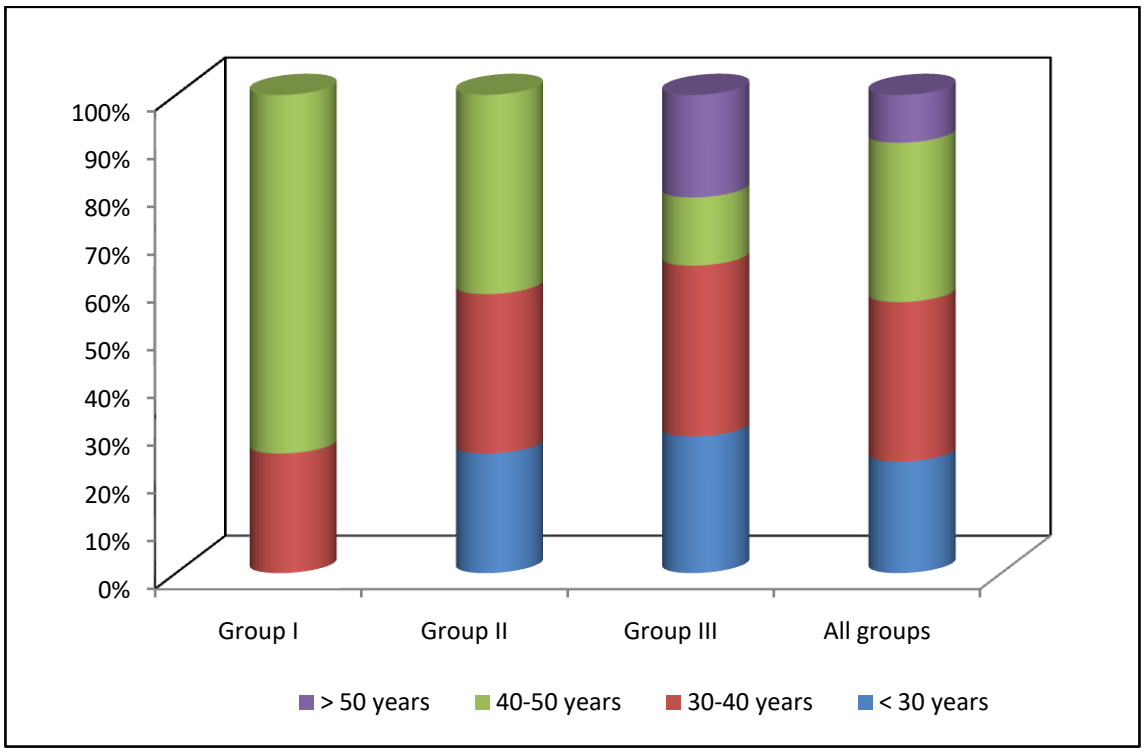

FIG. 3.1.1. GRAPHICAL REPRESENTATION OF DISTRIBUTION OF SAMPLE RESPONDENTS BASED ON AGE

3.1.2 Distribution of sample respondents based on gender

Distribution of the sample respondents based on gender were analyzed and depicted in the Table 3.1.2 and Fig 3.1.2. It can be seen from the table that among the total respondents 93.33 per cent were male and remaining 6.67 per cent were female. Across the size groups, it was found that all respondents were male in both the groups I and III, whereas 83.33 per cent male respondents were found in the group II.

Table 3.1.2. Distribution of sample respondents based on gender

Size groups	No. of firms	Gender	
		Male	Female
Group I	4 (13.33)	4 (100.00)	0 (0.00)
Group II	12 (40.00)	10 (83.33)	2 (16.67)
Group III	14 (46.67)	14 (100.00)	0 (0.00)
All groups	30 (100.00)	28 (93.33)	2 (6.67)

(Figures in parentheses indicate percentage of total)

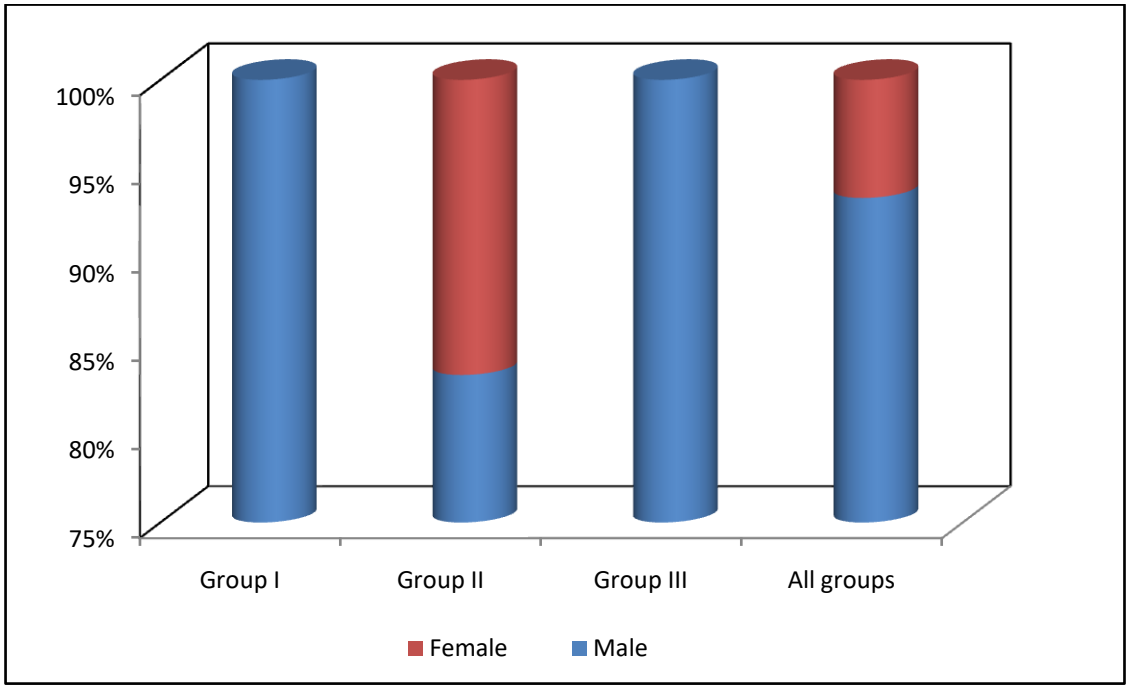

FIG. 3.1.2. GRAPHICAL REPRESENTATION OF DISTRIBUTION OF SAMPLE RESPONDENTS BASED ON GENDER

3.1.3 Distribution of sample respondents based on education

It was observed from Table 3.1.3 that 73.33 per cent of the total respondents were graduates, while the remaining 26.67 per cent had completed their class XI examinations. In group I all the four (4) respondents were found to be degree holders. In group II and III, 58.33 and 78.57 per cent of the respondents were found to be graduate holders, respectively. Interestingly, none of the respondents had their educational qualification below the class XII level. Therefore, it can be stated that well educated youths are attracted towards ornamental fish business, may be because of the reason that they can get higher return for per rupee invested in this business. Moreover, their knowledge may help them in maintaining ornamental business related scientific guidelines more easily in compared to the less educated people.

Table 3.1.3. Distribution of sample respondents based on education

Size groups	No. of firms	Educational qualification			
		Up to class X	Up to class XII	Graduate	Post graduate
Group I	4	-	-	4	-
	(13.33)			(100.00)	
Group II	12	-	5	7	-
	(40.00)		(46.6)	(58.33)	
Group III	14	-	3	11	-
	(46.67)		(21.42)	(78.57)	
All groups	30	-	8	22	-
	(100.00)		(26.67)	(73.33)	

(Figures in parentheses indicate percentage to total)

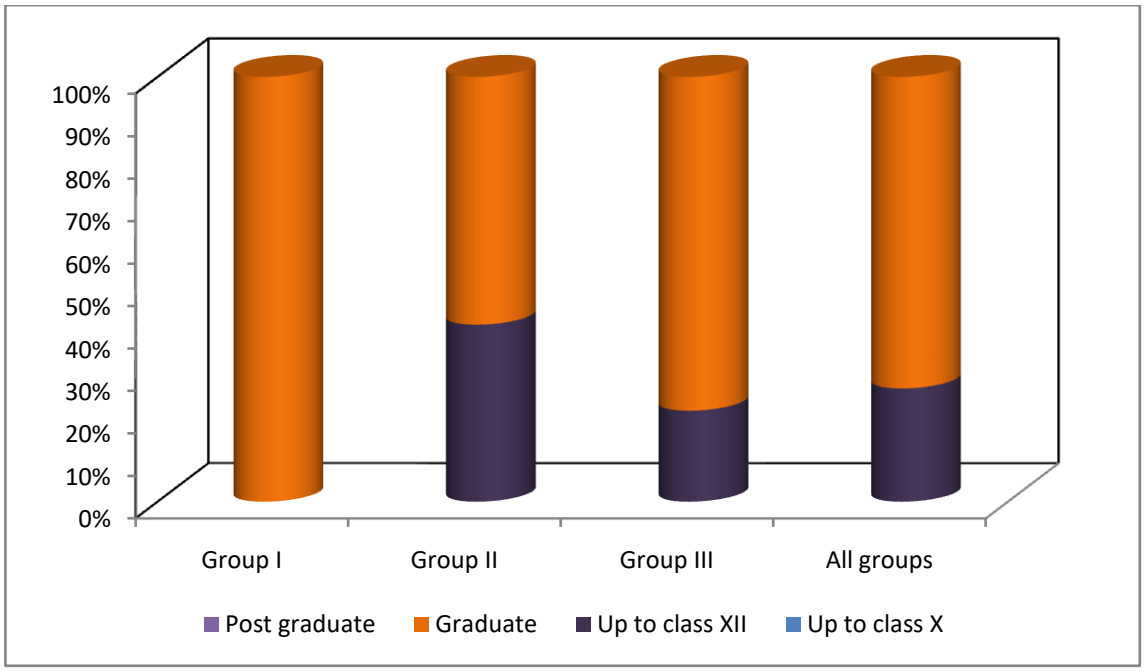

FIG. 3.1.3. GRAPHICAL REPRESENTATION OF DISTRIBUTION OF SAMPLE RESPONDENTS BASED ON EDUCATION

3.1.4 Distribution of sample respondents based on occupation

Table 3.1.4 shows that 73.33 per cent of the total respondents considered ornamental fish business as their primary occupation. In group I, ornamental fish business is the main source of income for 50 per cent of the respondents, while more than 75 per cent respondents considered it as the primary occupation in case of both group II and III (75% and 78.57% respectively). The respondents who considered ornamental fish business as the secondary occupation, either involved in service or other businesses and normally open the shop in the afternoon hours.

Table 3.1.4. Distribution of sample respondents based on occupation

Size groups	No. of firms	Occupation	
		Primary	Secondary
Group I	4 (13.33)	2 (50.00)	2 (50.00)
Group II	12 (40.00)	9 (75.00)	3 (25.00)
Group III	14 (46.67)	11 (78.57)	3 (21.43)
All groups	30 (100.00)	22 (73.33)	8 (26.67)

(Figures in parentheses indicate percentage to total)

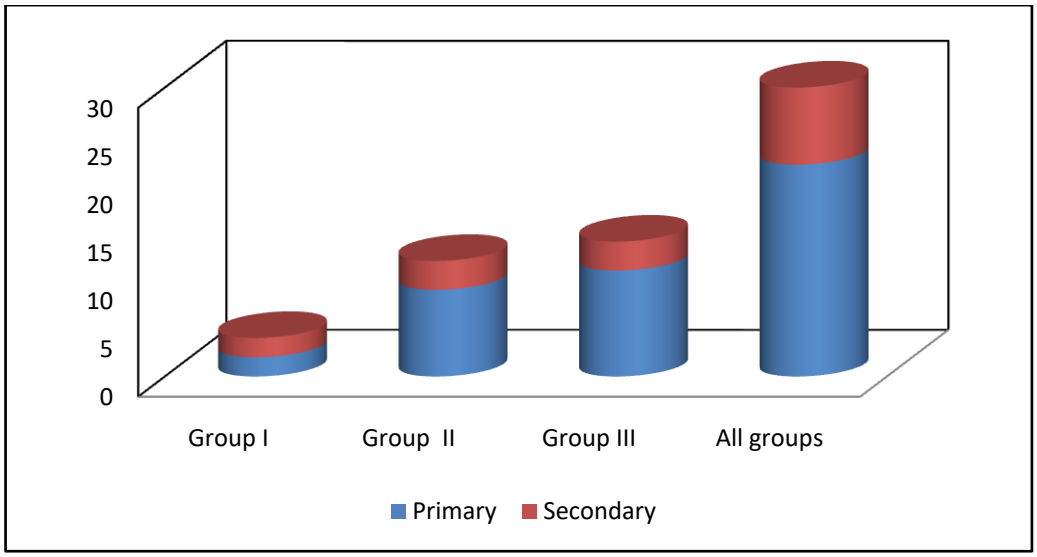

FIG. 3.1.4. GRAPHICAL REPRESENTATION OF DISTRIBUTION OF SAMPLE RESPONDENTS BASED ON OCCUPATION

3.1.5 Distribution of sample respondents based on experience

Table 3.1.5 depicts the experience details of the respondents in ornamental fish business. A total of 63.33 per cent respondents had an experience in between 10-20 years, while 20 and 16.67 per cent respondents had less than 10 years and more than 20 years experience respectively. In group I, 75 per cent of the respondents fell in the experience group of 10-20 years and the remaining 25 per cent respondents had experience of more than 20 years. Group II showed the similar trend with all group distribution where 58.34 per cent respondents had experience in between 10-20 years. In group III, more than 85 per cent of the respondents had experience of more than 10 years in ornamental fish business.

Table 3.1.5. Distribution of sample respondents based on experience

Size groups	No. of firms	Experience		
		< 10 years	10-20 years	> 20 years
Group I	4 (100.00)	-	3 (75.00)	1 (25.00)
Group II	12 (100.00)	4 (33.33)	7 (58.34)	1 (8.33)
Group III	14 (100.00)	2 (14.29)	9 (64.29)	3 (21.42)
All groups	30 (100.00)	6 (20.00)	19 (63.33)	5 (16.67)

(Figures in parentheses indicate percentage to total)

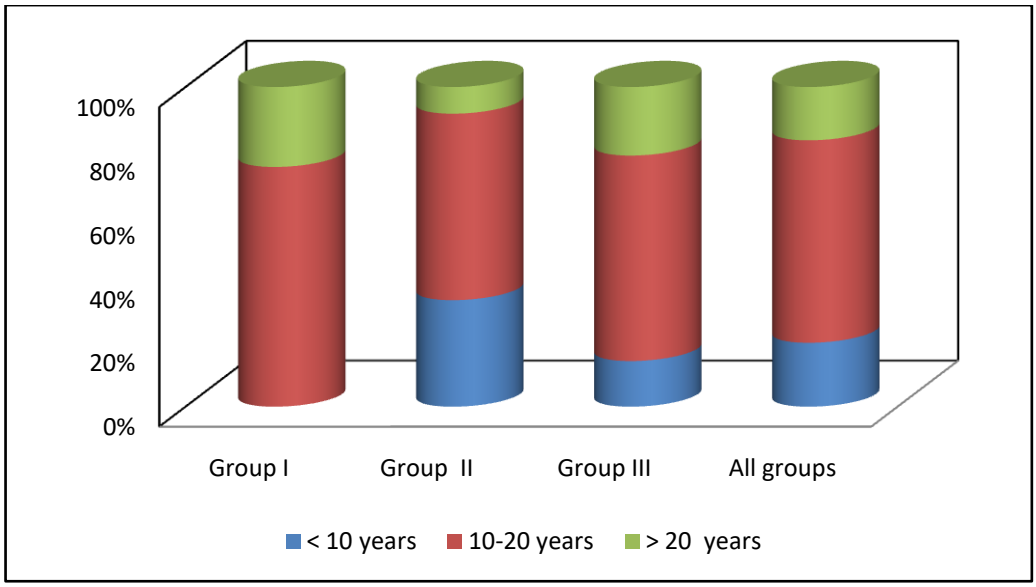

FIG. 3.1.5. GRAPHICAL REPRESENTATION OF DISTRIBUTION OF SAMPLE RESPONDENTS BASED ON EXPERIENCE

3.2 Present status and progress of ornamental fish industry

Ornamental fishes can be defined as attractive colourful fishes of peaceful nature that are kept as pets in confined spaces of an aquarium or a garden pool with the purpose of enjoying their beauty for fun and fancy (Dey, 1996). Keeping ornamental fishes as pets in home aquarium or garden pools gives pleasure to the young and old alike with their glittering colours and graceful movements. Aquarium keeping has emerged as the second most popular hobby in recent years next to photography (Chapman, 1997). In offers a feast to our eyes and relaxation to the mind, especially when we feel tired or depressed. Mills (1990) viewed aquarium fishes as visually exciting objects. Next to birds, ornamental fishes are perhaps the most cheerful living beings. They have unique shapes, colouration, body forms and movements (Bhattachrjya and Choudhury, 2004). Ornamental fishes are also called 'live jewels' for their beautiful colours and playful behaviour.

3.2.1 History of keeping ornamental fishes

Though pond fish culture reportedly originated about 4500 years back in the Sumerian civilization (presently under Iraq), colourful fishes could not be kept in indoor tanks as pets till the requirements of aquatic animals were known. The hobby of keeping ornamental fishes as pets is said to have originated with keeping of gold fish in glass bowls in China several hundred years ago. During the 17th century, gold fish was

introduced to several countries and became popular in England and Scotland. Keeping of fish in glass aquarium started in 1805. The first public display aquarium was opened at Regent's Park in England in 1853 (Swain *et al.*, 2003).

In India, the hobby of keeping ornamental fishes as pets bloomed with the opening of the Taraporevala aquarium in Mumbai in 1951.

3.2.2 History of ornamental fish industry and trade in North East India

Aquarium keeping as a hobby got a boost in the North-Eastern India when the Gauhati Nursery set up the first aquarium shop in Guwahati at around 1977. Mr. Prabal Sarma, proprietor of the erstwhile Matsya Aquarium, Guwahati initiated the trade of ornamental fishes in the North-Eastern region in 1984 by sending small consignments of indigenous ornamental fishes to exporters based at Kolkata. There were nearly 20 aquarium shops in Guwahati up to 2004 (Bhattacharjya and Choudhury, 2004). About 80 per cent of ornamental fishes from India to International market were exported via Kolkata Airport, of which the lion's share (more than 80%) was contributed from North Eastern Region.

3.2.3 Ornamental fish species availability in North Eastern states

Out of 250 ornamental fish species available in North Eastern region, Assam recorded the highest number of fish species (187), followed by Arunachal Pradesh (165), Meghalaya (159), Manipur (139), Tripura (103), Nagaland (71), Mizoram (46), and Sikkim (29), respectively.

Table 3.2.1. State-wise availability status of ornamental fish species

State	Ornamental fish species available	% to the region total
Assam	187	74.80
Arunachal Pradesh	165	66.00
Meghalaya	159	63.60
Manipur	139	55.60
Tripura	103	41.20
Nagaland	71	28.40
Mizoram	46	18.40
Sikkim	29	11.60

(Source: Department of Fisheries, Govt. of Assam)

3.2.4 Demand of indigenous ornamental fish species of Assam in global market

Assam has been recognized as a global hot spot of freshwater fish biodiversity. As many as 51 indigenous ornamental fish species occurring in Assam are currently being exported (Table 3.2.2). The demand for different indigenous ornamental fish species changes from year to year. For example, certain species like *Puntius gelius*, *P. conchonius* and *Hara hara*, which were exported earlier do not have overseas demand at present. Apparently some of these species were either bred in captivity by overseas culturists or are now imported from elsewhere so as to reduce the costs. Other species such as *Channa bleheri* have more or less consistent demand over the past two decades.

Table 3.2.2. Ornamental fish species currently exported from Assam

Sl. No.	Fish Species	Assamese Name	English Name
1	*Chitala chitala*	Chital	Humped feather back
2	*Notopterus notopterus*	Kandhuli	Feather back
3	*Gonialosa manmina*	Karoti	Ganges river gizzard
4	*Chela cachius*	Laupati	Silver hatchet chela
5	*C . labuca*	Laupatia	Indian hatchet fish
6	*Salmostoma bacaila*	Selkona	Large razorbelley
7	*Barillius dogarsinghi*	-	Manipur baril
8	*B. shacra*	Korang	Shacra baril
9	*B. tileo*	Selleng/Boolla	Tileo baril
10	*B . vagra*	Korang	Vagra baril
11	*Bengala elanga*	Elang	Bengala barb
12	*Brachydanio rerio*	Laupati	Zebra danio
13	*Danio aequipinnatus*	Saldarikana	Giant danio
14	*D . dangila*	Laupati	Dangila danio
15	*D . devario*	Laupati/ Dahrie	Devario danio
16	*Esomus danricus*	Darikana	Flying barb

Sl. No.	Fish Species	Assamese Name	English Name
17	*Parluciosoma daniconius*	Darikana	Blackline rasbora
18	*Rasbora rasbora*	Darikana	Gangetic scissortail
19	*Osteobrama cotio cotio*	Hato / Hamto	Hafua
20	*O. cotio cunma*	-	-
21	*Puntius chola*	Puthi	Swam barb
22	*P . clavatus*	-	Stedman barb
23	*P . conchonius*	Puthi	Rozy barb/ Red barb
24	*P . sarana sarana*	Cheniputhi / Maraputhi	Olive barb
25	*P. ticto*	Puthi	Fire-fin barb
26	*Psilorhynchus balitora*	-	Balitora minnow
27	*Acanthocobitis botia*	Balibotia	Stripped loach
28	*Nemacheilus corica*	Botia	Loach
29	*Lepidocephalus caudofurcatus*		
30	*Aorichthys aor*	Arii	Long-whiskered catfish
31	*A. seenghala*	Arii	Giant river catfish
32	*Batasio tengana*	Batasimas	Assamese batasio
33	*Mystus cavasius*	Barsingorah	Gangetic mystus
34	*M. tengara*	Tingorah	Tengara mystus
35	*M. vittatus*	Singorah	Striped dwarf catfish
36	*Rama chandramara*	Tingorah	Asian cory
37	*Rita rita*	Litha	Rita
38	*Ailia coila*	Kadali/ Bardaia	Gangetic ailia
39	*Conta conta*	-	Conta catfish
40	*Erethistes pussilus*	Sakmaka	-
41	*Erethistoides montana*	-	-

Sl. No.	Fish Species	Assamese Name	English Name
	montana		
42	*Gagata cenia*	Kayakatta	Dwarf blotched catfish
43	*G. gagata*	Kayakatta	Gangetic gagata
44	*Hara hara*	Hilgaruah	-
45	*H. jerdoni*	-	Sylhet hara
46	*Laguvia ribeiroi*	-	-
47	*L. shawi*	-	-
48	*Xenentodon cancila*	Kokila	Freshwater gar fish
49	*Chaudhuria indica*	-	-
50	*C. khajurial*	-	Garo spineless eel
51	*Tetraodon cutcutia*	Gangatope	Ocellated puffer fish

(Source: Department of Fisheries, Govt. of Assam)

3.2.5 Present status of ornamental fish industry at Guwahati

A total of 88 aquarium shops were available only at Guwahati up to August, 2016 (Department of Fisheries, GoA). Presently only 11 persons are associated with breeding of ornamental fishes in Guwahati. The trade of indigenous ornamental fishes has remained unorganized and mostly based on natural collections. As a result, the number of indigenous fish species and their volume of export from Guwahati as well as from North Eastern region are yet to be estimated precisely.

3.2.6 Initiatives of National Fisheries Development Board for development of ornamental fish industry

The National Fisheries Development Board (NFDB), Hyderabad has set up an exclusive division for promoting the ornamental fisheries in the country. Currently NFDB has financial assistance schemes for establishment of backyard rearing units, medium scale rearing units, integrated (breeding-cum-rearing) units, aquarium fabrication units and ornamental fish markets. To popularize the ornamental fish

keeping as hobby, NFDB is also giving assistance to schools and colleges. NFDB is currently emphasizing following activities:

- Freshwater ornamental fish culture
- Live feeds production unit
- Aquarium fabrication, accessories and feed production.

An ornamental fish project can be (i) rearing only, (ii) breeding only, or (iii) both breeding and rearing depending upon the space available/ scale of operations desired and the expertise. So far the NFDB has sanctioned Rs. 41.77 crores towards development of ornamental fisheries in the country. Till now they have released maximum fund to Kerala (Rs. 14.64 crores) and West Bengal (Rs. 14.41 crores); followed by Tamil Nadu (Rs. 4.14 crores) and Karnataka (Rs. 3.08 crores).

Table 3.2.3. NFDB funding to States / UTs for development of ornamental fish industry

Sl. No.	State / UT	Amount (Lakh)	Sl. No.	State/ UT	Amount (Lakh)
1	Andhra Pradesh	90.85	11	Mizoram	1.24
2	Assam	87.27	12	Odisha	44.60
3	Bihar	38.03	13	Pondicherry	1.60
4	Gujarat	5.55	14	Punjab	21.00
5	Himachal Pradesh	12.00	15	Rajasthan	6.56
6	Jammu & Kashmir	14.25	16	Sikkim	14.30
7	Karnataka	308.46	17	Tamil Nadu	414.18
8	Kerala	1464.20	18	Telangana	16.26
9	Lakshadweep	80.30	19	Uttar Pradesh	20.50
10	Maharashtra	94.51	20	West Bengal	1441.64

3.2.7 Role of MPEDA for development of ornamental fish industry

With a view to develop the ornamental fish sector in North Eastern region of India, MPEDA under Ministry of Commerce, Government of India has

opened a sub-regional office at Guwahati which have jurisdiction over all the states of the region. The scheme evolved by MPEDA to support the ornamental fish sector as follows:

- Provide subsidy of 50%, subject to a maximum of Rs. 40,000/- for setting up ornamental fish breeding unit.
- Assistance at the rate of 10% of FOB value of ornamental fishes exported to overseas market with maximum limit of Rs. 3.0 lakh per annum.
- For participation in international trade fairs, as co-exhibitor in the MPEDA pavilion, an exporter need pay only 50% of stall rental, that too in Indian currency.
- The exporter also eligible for refund of 33.33% of the to and fro air fare, by economy class.

Agencies like National Bank for Agriculture and Rural Development (NABARD), North Eastern Development Financial Institutions (NEDFi) etc. are also taking keen interest for promoting the development of culture of ornamental fishes in North Eastern region.

3.2.8 Future perspectives

There is a vast scope for expansion of trade in indigenous ornamental fishes occurring in the region, which will generate enormous employment opportunities for the local people besides earning valuable foreign exchange for the country. This is high time that the North Eastern states become aware of the potential ornamental fish species and take advantage of its biological wealth. In addition to the ornamental fishes well known in overseas markets, the region has many more potential species. These can be introduced in overseas ornamental trade. However, in doing so care should be taken by all concerned to see that the species concerned is not a threatened one.

3.3 Managerial aspects of production, rearing and distribution of ornamental fishes

In the present study an attempt was made to interact with the persons associated with breeding, rearing and marketing of ornamental fishes. At each level proper managerial measures should be followed by the businessmen. The various aspects of managerial measures related to production, rearing and marketing of ornamental fishes are thoroughly discussed below:

3.3.1 Utilization of facilities and materials required for rearing of ornamental fishes by the firms

Though keeping fishes in ponds and other water bodies is an age practice, rearing of ornamental fish species in cement tanks or aquariums is a new concept. Along with the cement tanks and aquariums, other facilities and materials such as quarantine tanks, electricity, aerators, quality feeds, ornamental plants, medicines and heating apparatus should be used by the respondents during the rearing process. It was observed from the study that the respondents use most of the facilities and materials except cement tanks, quarantine tanks and heating apparatus [Table 3.3.1 (a)].

Table 3.3.1(a) Number of firms using facilities and materials required for rearing of ornamental fishes

Particulars	Size groups		
	Group I (N=4)	Group II (N=12)	Group III (N=14)
Cement tanks	0 (0.00)	0 (0.00)	0 (0.00)
Aquarium	4 (100.00)	12 (100.00)	14 (100.00)
Quarantine tanks	0 (0.00)	0 (0.00)	0 (0.00)
Electricity	4 (100.00)	12 (100.00)	14 (100.00)
Aerators	4 (100.00)	12 (100.00)	14 (100.00)
Quality feeds	4 (100.00)	12 (100.00)	14 (100.000
Ornamental plants	4 (100.00)	12 (100.00)	14 (100.00)
Medicines	4 (100.00)	12 (100.00)	14 100.00)
Heating apparatus	3 (75.00)	12 100.00)	12 (85.71)

The respondents revealed that they did not use cement tanks for rearing because of the involvement of high cost of establishment, requirement of extra manpower for management, more maintenance costs and difficulty in moving the tanks. Similarly, involvement of more establishment costs was one of the reasons for not using the quarantine tanks by them. They also said that maintaining quarantine tanks separately from the main tanks and aquariums was difficult and hence they did not

prefer to use the quarantine tanks. The few respondents who did not use heating apparatus for rearing of ornamental fishes said that these were not required since most of the fishes can tolerate the changing water temperature.

Table 3.3.1(b) Reasons for not using the recommended facilities and materials by the firms involved in rearing

Particulars	Group I	Group II	Group III
1. **Cement tanks**			
a) High cost in establishment	4 (100.00)	9 (75.00)	12 (85.71)
b) Extra manpower needed for management	1 (25.00)	5 (41.67)	5 (35.71)
c) Extra maintenance cost	3 (75.00)	6 (50.00)	10 (71.42)
d) Difficulty in movement	1 (25.00)	5 (41.67)	3 (21.42)
2. **Quarantine tanks**			
a) More establishment cost	1 (25.00)	3 (25.00)	6 (42.85)
b) Difficult to maintain quarantine tanks separately from the main tanks and aquarium	4 (100.00)	11 (91.97)	8 (57.14)
3. **Heating apparatus**			
a) Not required throughout the year, only in the winter months it is required	-	-	1 (50.00)
b) Not so required since most of the fishes can tolerate the temperature change	1 (100.00)	-	2 (100.00)

3.3.2 Utilization of facilities and materials required for breeding of ornamental fishes by the firms

Facilities and materials like cement tanks, aquarium, iron stands, brood fish species, electricity, different types of accessories, feeds, hormones and medicines are very necessary to use in the process of breeding of ornamental fishes. It was found that cement tanks, accessories, and hormones and medicines were not used by a few breeders in their breeding units [Table 3.3.2 (a)].

Table 3.3.2 (a) Number of firms using facilities and materials required for breeding of ornamental fishes

Particulars	Size groups		
	Group I (N=2)	Group II (N=2)	Group III (N=1)
Cement tanks	0 (0.00)	2 (100.00)	0 (0.00)
Aquarium	2 (100.00)	2 100.00)	1 (100.00)
Tables, iron stands etc.	2 (100.00)	2 (100.00)	1 (100.00)
Brood fish species	2 (100.00)	2 (100.00)	1 (100.00)
Electricity	2 (100.00)	2 (100.00)	1 (100.00)
Different accessories	1 (50.00)	2 (100.00)	1 (100.00)
Feeds	2 (100.00)	2 (100.00)	1 (100.00)
Hormones and medicines	0 (0.00)	2 (100.00)	0 (0.00)

The respondents said that they did not use cement tanks for rearing because of the involvement of high cost of establishment, more maintenance costs and difficulty in moving the tanks. Only one breeder who did not use accessories for breeding said that accessories were mainly required for rearing of ornamental fishes and not so required in breeding activities was found not to be using accessories for breeding only because of the reason that Similarly, involvement of more establishment costs was one of the reasons for not using the quarantine tanks by them. They also said that maintaining quarantine tanks separately from the main tanks and aquariums was difficult and hence they did not prefer to use the quarantine tanks. The few respondents who did not use heating apparatus for rearing of ornamental fishes said that these were not required since most of the fishes can tolerate the changing water temperature. One of the important reasons for not using hormones and medicines was the illiteracy of the breeder on proper use of these drugs.

Table 3.3.2(b) Reasons for not using the recommended facilities and materials by the firms involved in breeding

Particulars	Group I	Group II	Group III
1. Cement tanks			
a) High cost in establishment	2 (100.00)	-	1 (100.00)
b) Extra maintenance cost	2 (100.00)	-	1 (100.00)
c) Difficulty in movement	1 (50.00)	-	-
2. Different accessories			
a) Accessories are not so required for breeding, but important for rearing	1 (100.00)	-	-
3. Hormones and medicines			
a) Some fishes do not need hormone injections for breeding, hence did not used	2 (100.00)	-	1 (100.00)
b) Do not know proper use and benefits	1 (50.00)	-	1 (100.00)

3.3.3 Utilization of recommended management practices in rearing of ornamental fishes by the firms

Water quality maintenance, regular application of feeds, use of medicines at regular intervals, involvement of labour, proper handling of fish, water temperature adjustment during shifting of fish and aquarium cleaning at regular intervals are some of the recommended management practices required in rearing of ornamental fishes. It was found that most of the firms had used almost all the recommended practices in their respective firms [Table 3.3.3 (a)].

Table 3.3.3(a) Number of firms using recommended management practices in rearing of ornamental fishes

Particulars	Management practices followed		
	Group I (N=4)	Group II (N=12)	Group III (N=14)
Water quality maintenance	4 (100.00)	12 (100.00)	14 (100.00)
Regular application of feeds	4 (100.00)	12 (100.00)	14 (100.00)
Use of medicines at regular intervals	4 (100.00)	10 (83.33)	14 (100.00)
Involvement of labour	4 (100.00)	9 (75.00)	14 (100.00)
Proper handling of fish	3 (75.00)	10 (83.33)	13 (92.85)
Water temperature adjustment during shifting of fish	2 (50.00)	12 (100.00)	14 (100.00)
Aquarium cleaning at regular intervals	4 (100.00)	10 (83.33)	12 (85.71)

Table 3.3.3 (b) shows the reasons behind not using the recommended management practices by the firms involved in rearing activities. A few firms did not involve labour in their firms because of involvement of higher costs of labour and difficult in getting trustworthy labour. Shortage of time due to the involvement in other income activities, increased costs and shortage of aquariums for shifting of fishes during cleaning works were the reasons for improper handling of fishes in case of some firms. Few firms said that fishes can handle slight change of water temperature and hence they did not adjust temperature during shifting of fish. Lack of time and involvement of extra costs were the reasons for not cleaning the aquariums at regular intervals by a few respondent firms.

Table 3.3.3(b) Reasons for not using the recommended management practices by the firms involved in rearing

Particulars	Group I	Group II	Group III
1. Use of medicines at regular intervals			
a) Use medicines as and when required to cure the diseases, but not use as preventive measures	-	2 (100.00)	-
b) Cannot use medicines at regular intervals due to proper knowledge on usage	-	1 (50.00)	-
2. Involvement of labour			
a) Can complete the works by the owner himself	-	3 (100.00)	-
b) Higher costs of labour	-	1 (33.33)	-
c) Trustworthy labours are difficult to get	-	2 (66.67)	-
3. Proper handling of the fish			
a) Not get enough time due to involvement in other income activities	1 (100.00)	2 (100.00)	-
b) Difficult to handle at regular intervals due to involvement of extra costs	-	1 (50.00)	1 (100.00)
c) Shortage of aquariums for shifting of fishes during cleaning works	-	1 (50.00)	1 (100.00)
4**. Water temperature adjustment during shifting of fish**			
a) Not so required as fishes can adjust with slight changes in water temperature	2 (100.00)	-	-
b) Enough time not available in all the instances	1 (50.00)	-	-
5. Aquarium cleaning at regular intervals			
a) Cannot devote so much time	-	2 (100.00)	2 (100.00)
b) Involvement of extra costs	-	1 (100.00)	2 (100.00)

3.3.4 Opinion of firms about breeding process of different fish species

All the firms said that breeding of gold fish was easy as it takes supplementary feeds without any difficulty and can adjust with all the environments. According to majority of firms breeding of guppy, moly, sword tail and platy were easy as they are the live bearers i.e. they directly release young ones. Breeding of gourami and freshwater shark were considered as moderately difficult by the firms, while breeding of angel and discus were found to be difficult.

Table 3.3.4. Opinion of firms about breeding process of different fish species

Fish Species	Group I (N=2)			Group II (N=2)			Group III (N=1)		
	Easy	Moderately difficult	Difficult	Easy	Moderately difficult	Difficult	Easy	Moderately difficult	Difficult
Exotic									
Gold fish	2 (100.00)	-	-	2 (100.00)	-	-	1 (100.00)	-	-
Platy	1 (50.00)	1 (50.00)	-	1 (50.00)	1 (50.00)	-	1 (100.00)	-	-
Moly	2 (100.00)	-	-	1 (50.00)	1 (50.00)	-	-	1 (100.00)	-
Sword tail	2 (100.00)	-	-	1 (50.00)	1 (50.00)	-	-	1 (100.00)	-
Guppy	1 (50.00)	1 (50.00)	-	1 (50.00)	1 (50.00)	-	1 (50.00)	-	-
Angel	-	-	2 (100.00)	-	-	2 (100.00)	-	-	1 (100.00)
Discus	-	-	2 (100.00)	-	-	2 (100.00)	-	-	1 (100.00)
Freshwater sharks	-	2 (100.00)	-	1 (50.00)	1 (50.00)	-	-	1 (100.00)	-
Gourami	1 (50.00)	1 (50.00)	-	-	2 (100.00)	-	1 (100.00)	-	-
Indigenous									
Common cup	1 (50.00)	1 (50.00)	-	2 (100.00)	-	-	1 (100.00)	-	-
Puthi	1 (50.00)	1 (50.00)	-						

3.3.5 Opinion of firms about rearing process of different fish species

All the firms coming under group I, II and III mentioned that rearing of gold fish, sword tail, moly and platy were not difficult. They can be reared without much problem if feeds are applied at regular interval of time. A few firms under all the groups said that rearing of guppy was little bit difficult as it was difficult to maintain their attractive body colour with normal foods. It was found that rearing of angel and discus was quite difficult due to their non-adaptation with different water and temperature conditions. Nearly half of the firms ranked rearing of freshwater shark and gourami as moderately difficult. The main problem associated with rearing of freshwater shark was the requirement of heated water in the winter months to prevent diseases. A slight deviation in water temperature may lead to the outbreak of fungus disease in freshwater sharks. The main problem observed by the firms in gourami was that it attacked other aquarium fishes if foods were not applied in time. Almost all the firms said that rearing of local ornamental fishes such as common carp and puthi were easy due to its compatibility with other fish species and different environments.

Table 3.3.5 Opinion of firms about rearing process of different fish species

Fish species	Group I (N=4)			Group II (N=12)			Group III (N=14)		
	Easy	Moderately difficult	Difficult	Easy	Moderately difficult	Difficult	Easy	Moderately difficult	Difficult
Exotic									
Gold fish	3 (75.00)	1 (25.00)	-	6 (50.00)	6 (50.00)	-	14 (100.00)	-	-
Platy	3 (75.00)	1 (25.00)	-	7 (58.33)	5 (41.67)	-	8 (57.14)	6 (42.86)	-
Moly	2 (50.00)	2 (50.00)	-	6 (50.00)	6 (50.00)	-	5 (35.71)	9 (64.29)	-
Sword tail	2 (50.00)	2 (50.00)	-	4 (33.33)	4 (33.33)	4 (33.33)	10 (71.42)	4 (28.57)	-
Guppy	1 (25.00)	2 (50.00)	1 (25.00)	6 (50.00)	5 (41.67)	1 (8.33)	8 (57.14)	3 (21.42)	3 (21.42)
Angel	-	2 (50.00)	2 (50.00)	-	-	12 (100.00)	-	-	14 (100.00)
Discus	-	-	4 (100.00)	-	-	12 (100.00)	-	-	14 (100.00)
Freshwater sharks	2 (50.00)	2 (50.00)	-	8 (66.67)	4 (33.33)	-	9 (64.28)	5 (35.71)	-
Gourami	2 (50.00)	2 (50.00)	-	6 (50.00)	6 (50.00)	-	10 (71.42)	4 (28.57)	-
Indigenous									
Common cup	2 (50.00)	2 (50.00)	-	12 (100.00)	-	-	14 (100.00)	-	-
Puthi	4 (100.00)	-	-	6 (50.00)	6 (50.00)	-	14 (100.00)	-	-

3.3.6 Marketing channels

Marketing channel is referred as the path through which the product passes from the producer to the ultimate consumer. In the present study an attempt was made to identify the marketing channels for both the exotic and local ornamental fish species. Two important marketing channels were identified for local ornamental fish species through which fishes were sold to the customers. In case of the exotic fish species, though four (4) important marketing channels were listed out with the help of the respondent firms, it was not possible to collect information on quantity handled by each of the marketing channels due to the limitation of the study area.

3.3.6.1 Marketing channels for exotic ornamental fish species

Four main marketing channels were identified with the help of firm owners through which exotic fish species reach to the local customers of Kamrup (Metro) district of Assam. The channels are as follows:

Channel I: Breeder located outside the country – Kolkatta agent – Guwahati agent – Firm at Guwahati – Customer

Channel II: Kolkata breeder – Kolkata agent – Guwahati agent – Firm at Guwahati – Customer

Channel III: Kolkata breeder cum saler – Guwahati agent – Firm at Guwahati – Customer

Channel IV: Kolkata breeder – Kolkata agent – Firm at Guwahati – Customer

3.3.6.2 Marketing channels for indigenous fish species

Two major marketing channels for local indigenous fishes were identified. It is important to note down that local ornamental fish collection process is not well organized and lots of people knowingly or unknowingly catching and selling the fishes in local and distant markets at reasonably higher prices. The marketing channel comprising of Fishermen – Local fish collector – Shop owner – Customer was reported to handle 82 per cent of the local ornamental fish sold.

Table 3.3.6.2. Marketing channels for local ornamental fish species

Particulars	Marketing channel	Quantity handled
Channel I	Fishermen – Local fish collector – Shop owner - Customer	82%
Channel II	Fishermen – Shop owner – Customer	18%

3.3.7 Monthly total marketing costs of procurement and maintenance of fish per firm

An attempt was made to find out the monthly total marketing costs of procurement and maintenance of fish per firm and the results are shown in Table 3.3.7. A total monthly marketing costs of Rs. 9636 per firm was found in case of all groups. Among the groups monthly marketing costs was highest in group III (Rs. 12,270), followed by group II (Rs. 10,335) and group I (Rs. 8285), respectively. Firms of all the groups incurred highest monthly costs on beautification items used in the aquarium (Rs. 1574, Rs. 2276 and Rs. 2996 per month for group I, II and III respectively). It was also observed that the firms spent a reasonably high amount on electronic accessories and fish feeds, which were used in their shop’s aquarium.

Table 3.3.7. Monthly total marketing costs of procurement and maintenance of fish per firm

Sl. No.	Particulars	Costs (Rs.)			
		Group I	Group II	Group III	All groups
1	Electronic accessories used in shop's aquarium	1118 (13.50)	1597 (15.45)	1747 (14.24)	1394 (14.46)
2	Beautification items used in the aquarium	1574 (19.00)	2276 (22.02)	2996 (24.42)	2044 (21.22)
3	Feeds used for rearing fish	1399 (16.88)	1469 (14.21)	1563 (12.74)	1449 (15.03)
4	Any medicines	559 (6.75)	847 (8.20)	1071 (8.73)	743 (7.71)
5	Plastic packets for packing the fish	1398 (16.87)	1530 (14.80)	1555 (12.67)	1471 (15.27)
6	Oxygen requirement	559 (6.75)	628 (6.08)	958 (7.81)	640 (6.64)
7	Bulbs for the aquarium	1398 (16.87)	1448 (14.01)	1582 (12.89)	1442 (14.97)
8	Others	280 (3.38)	541 (5.23)	767 (6.25)	449 (4.66)
	Total	8285 (100.00)	10335 (100.00)	12270 (100.00)	9636 (100.00)

3.3.8 Monthly quantity of fish species bought and sold per firm

In pooled data, on an average each firm had purchased maximum 175 pieces of gold fish per month, followed by discus (132 nos.) and freshwater sharks (130 nos.), respectively. The highest purchase price was found in discus (Rs. 180/piece), followed by arawana (Rs. 177/piece). It was observed that each firm had sold maximum 151 pieces of gold fish per month to the customers, followed by crocodile fish (131

nos.) and freshwater shark (117 nos.), respectively. The selling price was highest for arawana, which was Rs. 741 per piece.

In group I, on and average each firm had purchased maximum 98 pieces of gold fish per month, followed by guppy (88 nos.) and platy (86 nos.), respectively. The highest purchase price was found in discus (Rs. 182/piece), followed by parrot fish (Rs. 136/piece). It was observed that each firm had sold maximum 96 pieces of gold fish per month to the customers, followed by platy and moly (80 nos. each). The selling price was highest for discus, which was Rs. 548 per piece. Interestingly all the group I firms said that they did not keep arawana at their shops, because of its higher price and unexpected demand.

In group II, on an average each firm had purchased maximum 176 pieces of moly per month, followed by gold fish (168 nos.) and parrot fish (152 nos.), respectively. The highest purchase price was found in arawana (Rs. 208/piece), followed by discus (Rs. 179/piece). It was observed that each firm had sold maximum 168 pieces of moly per month to the customers, followed by gold fish (146 nos.) and crocodile fish (136 nos.), respectively. The selling price was highest for arawana, which was Rs. 870 per piece.

In group III, on an average each firm had purchased maximum 202 pieces of gold fish per month, followed by crocodile fish (172 nos.) and discus (166 nos.), respectively. The highest purchase price was found in arawana (Rs. 202/piece), followed by discus (Rs. 180/piece). It was observed that each firm had sold maximum 170 pieces of gold fish per month to the customers, followed by crocodile fish (144 nos.) and freshwater shark (134 nos.), respectively. The selling price was highest for arawana, which was Rs. 843 per piece.

Table 3.3.8. Monthly quantity of fish species bought and sold per firm

Species Name	Group I					Group II				
	Purchase per month		Sale per month		Quantity unsold (No.)	Purchase per month		Sale per month		Quantity unsold (No.)
	Qty. (No.)	Price/ piece (Rs.)	Qty. (No.)	Price/piece (Rs.)		Qty. (No.)	Price/ piece (Rs.)	Qty. (No.)	Price/ piece (Rs.)	
Gold fish	98	8	96	61	2	168	8	146	62	22
Platy	86	10	80	72	6	108	10	96	74	12
Moly	62	13	58	65	4	176	12	168	63	8
Sword tail	50	14	44	56	6	136	13	88	54	48
Guppy	88	18	80	55	8	80	15	76	85	4
Angel	46	130	36	265	10	78	124	62	268	16
Discus	34	182	28	548	6	124	179	120	555	4
Freshwater shark	66	16	60	81	6	116	15	116	82	0
Arawana	-	-	-	-	-	60	208	50	870	10
Parrot fish	66	136	58	273	8	152	129	128	307	24
Crocodile fish	78	20	74	87	4	142	20	136	82	6

Table 3.3.8 Contd.

Species Name	Group III					All groups				
	Purchase per month		Sale per month		Quantity unsold (No.)	Purchase per month		Sale per month		Quantity unsold (No.)
	Qty. (No.)	Price/ piece (Rs.)	Qty. (No.)	Price/piece (Rs.)		Qty. (No.)	Price/ piece (Rs.)	Qty. (No.)	Price/ piece (Rs.)	
Gold fish	202	8	170	60	32	175	8	151	61	24
Platy	110	9	78	72	32	106	10	85	73	21
Moly	94	12	76	62	18	123	12	110	63	13
Sword tail	138	13	100	50	38	125	13	88	52	37
Guppy	122	15	110	81	12	101	15	92	79	4
Angel	96	125	86	259	10	82	125	70	263	12
Discus	166	180	128	535	38	132	180	111	545	21
Freshwater shark	160	16	134	80	26	130	16	117	81	13
Arawana	60	202	56	843	4	52	177	46	741	6
Parrot fish	154	130	120	286	34	141	130	115	293	26
Crocodile fish	172	23	144	75	28	147	21	131	79	16

3.3.9 Monthly marketing costs incurred and margins earned per firm from different fish species

The marketing costs per month and marketing margin per month for all groups were Rs. 10,998.00 and Rs. 1,20,060.00 respectively. Marketing costs was found highest for crocodile fish (Rs. 1267.00), followed by parrot fish (Rs. 1175.00). Similarly, marketing margin was highest for discus (Rs. 35,913.00), followed by arawana (Rs. 28,364.00) and parrot fish (Rs. 14,288.00) respectively.

The marketing costs per month and marketing margin per month for group I were Rs. 8531.00 and Rs. 37,435.00 respectively. Marketing costs was found highest for crocodile fish and gold fish (Rs. 1205.00 each), followed by guppy (Rs. 1082.00). Marketing margin was highest for discus (Rs. 8738.00), followed by parrot fish (Rs. 6047.00). The firms of this group mainly concentrated on those fish species whose purchase price was less and required low maintenance during the time of rearing.

The marketing costs per month and marketing margin per month for group II were Rs. 10,335.00 and Rs. 1,38,253.00 respectively. Marketing costs was found highest for moly (Rs. 1357.00), followed by gold fish (Rs. 1296.00). On the other hand, marketing margin was highest for discus (Rs. 43,448.00), followed by arawana (Rs. 30,557.00) and parrot fish (Rs. 18,516.00) respectively, which follows the same trend just like the pooled data.

The marketing costs per month and marketing margin per month for group III were Rs. 12,271.00 and Rs. 1,28,075.00 respectively. Marketing costs was found highest for gold fish (Rs. 1682.00), followed by crocodile fish (Rs. 1432.00). Similarly, marketing margin was highest for discus (Rs. 37,218.00), followed by arawana (Rs. 34,589.00) and parrot fish (Rs. 13,018.00) respectively.

Table 3.3.9. Monthly marketing costs incurred and margins earned per firm from different fish species

Species	Group I		Group II		Group III		All groups	
	Marketing cost (Rs)	Marketing Margin (Rs)	Marketing cost (Rs)	Marketing Margin (Rs)	Marketing cost (Rs)	Marketing Margin (Rs)	Marketing cost (Rs)	Marketing Margin (Rs)
Gold fish	1205	3867	1296	6412	1682	6902	1464	6301
Platy	1057	3843	833	5191	916	3710	902	4320
Moly	762	2202	1357	7115	782	2802	1009	4447
Sword tail	615	1149	1049	1935	1149	2057	1038	1887
Guppy	1082	1734	617	4643	1016	6064	865	4918
Angel	565	2995	602	6342	799	9475	689	7358
Discus	418	8738	956	43448	1382	37218	1083	35913
Freshwater shark	811	2993	895	6877	1332	6828	1088	6336
Arawana	0	0	463	30557	499	34589	418	28364
Parrot fish	811	6047	1172	18516	1282	13018	1175	14288
Crocodile fish	1205	3867	1095	7217	1432	5412	1267	5928
Total marketing cost/month	8531		10335		12271		10998	
Total margin/ month	37435		138253		128075		120060	

3.3.10 Monthly total marketing costs of procurement of accessories

An attempt was made to find out the monthly total marketing costs of procurement of accessories per firm and the results are shown in Table 3.3.10. A total monthly marketing costs of Rs. 7964 per firm was found in case of all groups. Among the groups monthly marketing costs was highest in group III (Rs. 8751), followed by group II (Rs. 7308) and group I (Rs. 7180), respectively. Firms of all the groups incurred highest monthly costs on labour charges for loading and unloading works (Rs. 2375, Rs. 2458 and Rs. 3393 per month for group I, II and III respectively). It was also observed that the firms spent a reasonably high amount on transportation and storage costs.

Table 3.3.10. Monthly total marketing costs of procurement of accessories

Sl. No.	Particulars	Costs (Rs.)			
		Group I	**Group II**	**Group III**	**All groups**
1	Labour costs for loading and unloading	2375 (33.08)	2458 (33.63)	3393 (38.77)	2883 (36.20)
2	Transportation costs	1950 (27.16)	2025 (27.71)	2143 (24.49)	2070 (25.99)
3	Storage costs	1225 (17.06)	1210 (16.56)	1350 (18.47)	1277 (16.03)
4	Costs associated with damaged products	680 (9.47)	633 (8.66)	750 (10.26)	694 (8.71)
5	Others	950 (13.23)	982 (13.44)	1115 (12.74)	1040 (13.06)
	Total	7180 (100.00)	7308 (100.00)	8751 (100.00)	7964 (100.00)

3.3.11 Monthly quantity of fish species bought and sold per firm

In pooled data, on an average each firm had purchased maximum 57 numbers of fish feed packets per month, followed by aerators and pebble packets (42 nos. each). Purchase price of power filter (Rs. 131/piece) was found highest among all the accessories, followed by aquarium heater (Rs. 110/piece). It was observed that each firm had sold maximum 53 packets of fish feeds per month to the customers, followed by fresh plants (38 nos.) and power filters (36 nos.), respectively. The selling price was highest for power filter, which was Rs. 543 per piece.

In group I, on an average each firm had purchased maximum 39 numbers of fish feed packets per month, followed by aerators (34 nos.) and medicine packets (31 nos.), respectively. Purchase price of power filter (Rs. 132/piece) was found highest among all the accessories, followed by aquarium heater (Rs. 110/piece). It was observed that each firm had sold maximum 37 packets of fish feeds per month to the customers, followed by aerators (30 nos.) and medicines and fresh plants (24 nos. each), respectively. The selling price was highest for power filter, which was Rs. 546 per piece.

In group II, on an average each firm had purchased maximum 56 numbers of fish feed packets per month, followed by power filter (41 nos.) and medicine packets (39 nos.), respectively. Purchase price of power filter (Rs. 129/piece) was found highest among all the accessories, followed by aquarium heater (Rs. 110/piece). It was observed that each firm had sold maximum 50 packets of fish feeds per month to the customers. The selling price was highest for power filter, which was Rs. 542 per piece.

In group III, on an average each firm had purchased maximum 64 numbers of fish feed packets per month, followed by aerators (52 nos.) and fresh plants (51 nos.), respectively. Purchase price of power filter (Rs. 132/piece) was found highest among all the accessories, followed by aquarium heater (Rs. 109/piece). It was observed that each firm had sold maximum 60 packets of fish feeds per month to the customers, followed by fresh plants (49 nos.) and power filters (43 nos.), respectively. The selling price was highest for power filter, which was Rs. 544 per piece.

Table 3.3.11. Monthly quantity of accessories bought and sold per firm

Accessories name	Group I					Group II				
	Purchase per month		Sale per month		Quantity unsold (No.)	Purchase per month		Sale per month		Quantity unsold (No.)
	Qty. (No.)	Price/ piece (Rs)	Qty. (No.)	Price/ piece (Rs)		Qty. (No.)	Price/ piece (Rs)	Qty. (No.)	Price/ piece (Rs)	
Aquarium heater	22	110	16	378	6	37	110	34	382	3
Power filter	17	132	14	546	3	41	129	34	542	7
Aerator	34	37	30	147	4	32	36	29	149	3
Pebble	30	8	21	50	9	39	8	32	53	7
Electronic motor	21	79	15	371	6	36	76	31	376	5
Plastic plants	16	32	16	112	0	28	32	26	112	2
Fresh plants	25	51	24	190	1	32	45	29	192	3
Feeds	39	26	37	93	2	56	25	50	91	6
Medicines	31	52	24	151	7	39	54	34	149	5

Table 3.3.11 Contd.

Accessories name	Group III					All groups				
	Purchase per month		Sale per month		Quantity unsold (No.)	Purchase per month		Sale per month		Quantity unsold (No.)
	Qty. (No.)	Price/ piece (Rs.)	Qty. (No.)	Price/ piece (Rs.)		Qty. (No.)	Price/piece (Rs.)	Qty. (No.)	Price/ piece (Rs.)	
Aquarium heater	35	109	34	374	1	34	110	32	378	2
Power filter	46	132	43	544	3	40	131	36	543	4
Aerator	52	37	37	146	15	42	37	33	147	9
Pebble	48	8	39	53	9	42	8	34	53	8
Electronic motor	33	78	28	377	5	33	77	27	376	6
Plastic plants	42	31	40	116	2	33	32	31	114	2
Fresh plants	51	47	49	194	2	40	47	38	193	2
Feeds	64	27	60	91	4	57	26	53	91	4
Medicines	32	53	27	151	5	35	53	29	150	6

3.3.12 Monthly marketing costs incurred and margins earned per firm from different accessories

The marketing costs per month and marketing margin per month for all groups were Rs. 9735.00 and Rs. 61,194.00 respectively. Marketing margin was found highest for power filter (Rs. 13,173.00), followed by aquarium heaters (Rs. 7320.00) and electronic motor (Rs. 6929.00) respectively.

The marketing costs per month and marketing margin per month for group I were Rs. 8778.00 and Rs. 26,150.00 respectively. Marketing margin was found highest for power filter (Rs. 4602.00), followed by electronic motor (Rs. 3108.00) and aquarium heater (Rs. 2830.00) respectively.

The marketing costs per month and marketing margin per month for group II were Rs. 8932.00 and Rs. 60,909.00 respectively. Marketing margin was found highest for power filter (Rs. 12,327.00), followed by electronic motor (Rs. 8108.00) and aquarium heater (Rs. 8106.00) respectively.

The marketing costs per month and marketing margin per month for group III were Rs. 10,692.00 and Rs. 71,453.00 respectively. Marketing margin was found highest for power filter (Rs. 16,348.00), followed by aquarium heaters (Rs. 7929.00) and electronic motor (Rs. 7010.00) respectively.

Table 3.3.12. Monthly marketing cost incurred and margin earned per firm from different accessories

Accessories name	Group I		Group II		Group III		All groups	
	Marketing cost (Rs.)	Marketing Margin (Rs)	Marketing cost (Rs)	Marketing Margin (Rs)	Marketing cost (Rs)	Marketing Margin (Rs)	Marketing cost (Rs)	Marketing Margin (Rs)
Aquarium heater	798	2830	812	8106	972	7929	885	7320
Power filter	798	4602	812	12327	972	16348	885	13173
Aerator	798	2354	812	2357	972	2506	885	2426
Pebble	798	12	812	572	972	711	885	562
Electronic motor	798	3108	812	8108	972	7010	885	6929
Plastic plants	798	482	812	1204	972	2366	885	1650
Fresh plants	798	2487	812	3316	972	6137	885	4522
Feeds	798	1629	812	2338	972	2760	885	2440
Medicines	798	1214	812	2148	972	1409	885	1679
Aquarium heater	798	2830	812	8106	972	7929	885	7320
Power filter	798	4602	812	12327	972	16348	885	13173
Total marketing cost / month	8778		8932		10,692		9735	
Total margin / month	26,150		60,909		71,453		61,194	

3.3.13 Attributes influencing customer purchasing behaviour of fish species

In pooled data, the most important attribute influencing customer purchasing behaviour was found to be colour of fish, followed by fish breed and size of fish, respectively. According to feedback given by the group I firms, colour of fish was the main attribute influencing customer purchasing behaviour, followed by size of fish. Colour of fish and fish breed were the main attributes influencing customer purchasing behaviour of fish species in group II. In case of group III, fish breed was found to be main attribute influencing customer purchasing behaviour.

Table 3.3.13. Attributes influencing customer purchasing behaviour of fish species

Sl. No.	Attributes	Group I		Group II		Group III		All groups	
		Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank
1	Color of fish	73.50	I	73.17	I	63.00	II	77	I
2	Fish breed	45.50	III	49.67	II	69.07	I	63	II
3	Size of fish	54.50	II	44.33	III	58.14	IV	54.74	III
4	Price	33.00	IV	44.08	IV	60.35	III	46.02	IV
5	Compatibility with other fish species	29.50	V	41.33	V	54.00	V	37.64	V
6	Long survivality	26.50	VI	37.16	VI	42.78	VI	23.06	VI

3.3.14 Problems faced by the firms in ornamental fish breeding

Manpower problem

Manpower problem was emerged as the most severe problem in breeding of ornamental fishes. The firms said that knowledgeable and skilled manpower was very difficult to find who could serve for a longer period of time. Their knowledge are inadequate with regards to fish nutrition, prevention and management of diseases as well as the management of water quality, all of which are critical areas which directly affect the quality and quantity of the fish seeds.

Breeding problem

Breeding problem holds the second position among all the problems studied in the research work by using Garret Ranking technique. This is so because suitable breeding packages are not available for most of the aquarium fish species.

High cost

According to the firms, the cost of production of fish seeds has increased drastically during recent years due to increase in price of different items used for breeding practices; but at the same time they instantly cannot charge higher sale prices for the fish species.

Electricity problem

Electricity problem turns out to be the fourth ranked among all the problems. Continuous supply of electricity is the utmost necessary for the success of the fish breeding programme. But the firms said that they had faced electricity problem severely at any time of the day.

Non availability of good quality brood fish, mortality of new born babies, deterioration of fish seed quality, post production maintenance problem and deterioration of ground water quality used for breeding were the other problems identified during the present study.

Table 3.3.14. Problems faced by the firms in ornamental fish breeding

Sl. No.	Problems	Mean score	Rank
1	Manpower problem	78.6	I
2	Difficulty in breeding process	76.2	II
3	High cost	74.8	III
4	Electricity problem	73.4	IV
5	Non-availability of good quality brood fish	72.4	V
6	Mortality of new born fishes	69.6	VI
7	Deterioration in fish seed quality	64.8	VII
8	Post production maintenance problem	58.2	VIII
9	Deterioration of ground water quality used for breeding	55.6	IX

3.3.15 Problems faced by the firms in ornamental fish rearing

Mortality of reared fish

Mortality of reared fish was identified as the main rearing problem for the firms. Some of the important reasons for mortality of fishes are mistakes in handling the fish, temperature shock during shifting from one aquarium to the other, poor water quality, low availability of oxygen due of over stocking etc.

Higher transportation cost

Ornamental fishes are mainly purchased from outside markets such as Kolkata, Bangalore etc. Fishes are sent by flight by the outside suppliers and hence the firms have to bear higher transportation costs for each consignment.

Financial problem, lack of sufficient infrastructure facilities, electricity problem, manpower problem, non availability of sufficient stock in the market, price fluctuations and body colour deterioration are the other important problems faced by the firms during rearing of ornamental fish.

Table 3.3.15. Problems faced by the firms in ornamental fish rearing

Sl. No.	Problems	Mean score	Rank
1	Mortality of reared fish	78.54	I
2	Higher transportation cost	63.56	II
3	Financial problem	52.80	III
4	Lack of sufficient infrastructural facilities	51.56	IV
5	Electricity problem	50.96	V
6	Manpower problem	47.13	VI
7	Non availability of sufficient stock in the market	41.9	VII
8	Price fluctuations	36.13	VIII
9	Body colour deterioration of fish during rearing	35.06	IX

3.3.16 Problems faced the firms in marketing of ornamental fish

Fluctuations in demand was found to be the major problem faced in marketing of ornamental fishes. Change of customer choice and manpower problem were the next two important problems identified in the present study.

Table 3.3.16. Problems faced by the firms in marketing of ornamental fish and accessories

Sl. No.	Problems	Mean score	Rank
1	Fluctuations in demand	80.21	I
2	Change of customer choice	68.06	II
3	Manpower problem	60.45	III
4	High selling price of fish species and accessories	53.01	IV
5	Mortality of fishes	47.39	V
6	Body colour deterioration of fish during rearing	41.70	VI
7	Knowledge of customer on ornamental fishes	32.01	VII
8	Unexpected behaviour of the customers	20.91	VIII

3.3.17 Suggestions to overcome the problems

Suggestions to overcome the problems faced by the firms in breeding, rearing and marketing of ornamental fish and accessories are presented in table 3.3.17.

Table 3.3.17. Suggestions to overcome the problems

Sl. No.	Problems faced	Suggestions
Breeding problems		
1	Manpower problem	a) Proper remuneration to attract skilled manpower
2	Difficulty in breeding process	a) Arrangement of training for support staff b) Exposure visit to successful breeding farms
3	High cost	a) Efficient use of resources b) Signing contracts with raw material suppliers
4	Electricity problem	a) Purchase of electric generator
5	Non-availability of good quality brood fish	a) Stock farm bred good quality fish for next breeding season b) Purchase of good quality brood fish from govt. certified breeders
6	Mortality of new born fishes	a) Maintain water quality at required level b) Proper feeding c) Species-specific special measures
7	Deterioration in fish seed quality	a) Use of good brood fish for breeding b) Feed the brood fishes with protein rich diets at least three months prior to breeding
8	Post production maintenance problem	a) Consultation with experts
9	Deterioration of ground water quality used for breeding	a) Ground water should be filtered first before using in breeding
Rearing problems		
1	Mortality of reared fish	a) Provide sufficient oxygen b) Avoid over stocking in the tanks and aquariums c) Management of water quality
2	Higher transportation cost	a) Try to produce seeds at own firm by following proper scientific guidelines b) Certified suppliers from nearby areas may be selected

Sl. No.	Problems faced	Suggestions
3	Financial problem	a) Continuous flow of already used money b) Financial assistance from financial institutions
4	Lack of sufficient infrastructural facilities	a) Try to fulfill the needs with low cost financial models
5	Electricity problem	a) Purchase of electric generator
6	Manpower problem	a) Proper remuneration to retain the existing firm labour
7	Non availability of sufficient stock in the market	a) Advance purchase based on present market conditions and demand forecasting
8	Price fluctuations	a) Price should be at par with the existing market prices
9	Body colour deterioration of fish during rearing	a) Feed the fishes with artificial foods prepared by using carotenoid pigments
Marketing problems		
1	Fluctuations in demand	a) Try to announce offers in lean seasons
2	Change of customer choice	a) Brand building strategies
3	Manpower problem	a) Proper remuneration to attract experienced salesman/woman
4	High selling price of fish species and accessories	a) Cost plus pricing strategy b) Announcement of offers
5	Mortality of fishes	a) Providing all the requisite conditions to the stocked fishes
6	Body colour deterioration of fish during rearing	a) Feed the fishes with artificial foods prepared by using carotenoid pigments
7	Knowledge of customer on ornamental fishes	a) distribution of leaflets, catalogues etc. to the customers
8	Unexpected behaviour of the customers	a) Try to be honest while dealing with the customers b) Try to maintain good relationship with the customers

CHAPTER IV

SUMMARY AND CONCLUSION

This chapter deals with a brief summary of findings of the present study. Ornamental fishes can be defined as attractive colourful fishes of peaceful nature that are kept as pets in confined spaces of an aquarium or a garden pool with the purpose of enjoying their beauty for fun and fancy. Keeping ornamental fishes as pets in home aquarium or garden pools gives pleasure to the young and old alike with their glittering colours and graceful movements. Aquarium keeping has emerged as the second most popular hobby in recent years next to photography. In offers a feast to our eyes and relaxation to the mind, especially when we feel tired or depressed. Ornamental fishes are also called 'live jewels' for their beautiful colours and playful behaviour.

Presently ornamental fish business is showing a tremendous growth throughout the country in general and in Guwahati in particular. In this connection the present study is undertaken to examine the various management aspects in relation to production, rearing and distribution of ornamental fishes and identify the problems and challenges associated with the sector in Kamrup (Metro) district of Assam with the following objectives:

1. Study the present status and progress of ornamental fish industry in the district
2. Examine the managerial aspects of rearing, production and distribution of ornamental fishes
3. Identify the problems encountered and suggest suitable measures

Necessary data were collected from the respondents with the help of pre-tested semi-structured questionnaires. The data thus collected were coded, tabulated, analyzed and interpreted using frequency, percentage and Garett Ranking analysis. The major findings of the present study are summarized hereunder.

4.1 Study the present status and progress of ornamental fish industry in the district

Out of 250 ornamental fish species available in North Eastern region, Assam recorded the highest number of fish species (187), followed by Arunachal Pradesh (165), Meghalaya (159), Manipur (139), Tripura (103), Nagaland (71), Mizoram (46), and Sikkim (29), respectively. A total of 88 aquarium shops were available only at Guwahati up to August, 2016 (Department of Fisheries, GoA). Presently only 11 persons are associated with breeding of ornamental fishes in Guwahati.

The National Fisheries Development Board (NFDB), Hyderabad has set up an exclusive division for promoting the ornamental fisheries in the country. Currently NFDB has financial assistance schemes for establishment of backyard rearing units, medium scale rearing units, integrated (breeding-cum-rearing) units, aquarium fabrication units and ornamental fish markets. To popularize the ornamental fish keeping as hobby, NFDB is also giving assistance to schools and colleges. NFDB is currently emphasizing following activities: freshwater ornamental fish culture; live feeds production unit; and aquarium fabrication, accessories and feed production.

With a view to develop the ornamental fish sector in North Eastern region of India, MPEDA under Ministry of Commerce, Government of India has opened a sub-regional office at Guwahati which have jurisdiction over all the states of the region. Agencies like National Bank for Agriculture and Rural Development (NABARD), North Eastern Development Financial Institutions (NEDFi) etc. are also taking keen interest for promoting the development of culture of ornamental fishes in North Eastern region.

There is a vast scope for expansion of trade in indigenous ornamental fishes occurring in the region, which will generate enormous employment opportunities for the local people besides earning valuable foreign exchange for the country. This is high time that the North Eastern states become aware of the potential ornamental fish species and take advantage of its biological wealth. In addition to the ornamental fishes well known in overseas markets, the region has many more potential species. These can be introduced in overseas ornamental trade. However, in doing so care should be taken by all concerned to see that the species concerned is not a threatened one.

4.2 Examine the managerial aspects of rearing, production and distribution of ornamental fishes

Though keeping fishes in ponds and other water bodies is an age practice, rearing of ornamental fish species in cement tanks or aquariums is a new concept. Along with the cement tanks and aquariums, other facilities and materials such as quarantine tanks, electricity, aerators, quality feeds, ornamental plants, medicines and heating apparatus should be used by the respondents during the rearing process. It was observed from the study that the respondents use most of the facilities and materials except cement tanks, quarantine tanks and heating apparatus. The respondents revealed that they did not use cement tanks for rearing because of the involvement of high cost of establishment, requirement of extra manpower for management, more maintenance costs and difficulty in moving the tanks. Similarly, involvement of more establishment costs was one of the reasons for not using the quarantine tanks by them. They also said that maintaining quarantine tanks separately from the main tanks and aquariums was difficult and hence they did not prefer to use the quarantine tanks. The few respondents who did not use heating apparatus for rearing of ornamental fishes said that these were not required since most of the fishes can tolerate the changing water temperature.

Water quality maintenance, regular application of feeds, use of medicines at regular intervals, involvement of labour, proper handling of fish, water temperature adjustment during shifting of fish and aquarium cleaning at regular intervals are some of the recommended management practices required in rearing of ornamental fishes. It was found that most of the firms had used almost all the recommended practices in their respective firms.

All the firms said that breeding of gold fish was easy as it takes supplementary feeds without any difficulty and can adjust with all the environments. According to majority of firms breeding of guppy, moly, sword tail and platy were easy as they are the live bearers i.e. they directly release young ones. Breeding of gourami and freshwater shark were considered as moderately difficult by the firms, while breeding of angel and discus were found to be difficult.

All the firms coming under group I, II and III mentioned that rearing of gold fish, sword tail, moly and platy were not difficult. They can be reared without much problem if feeds are applied at regular interval of time. A few firms under all the groups said that rearing of guppy was little bit difficult as it was difficult to maintain

their attractive body colour with normal foods. It was found that rearing of angel and discus was quite difficult due to their non-adaptation with different water and temperature conditions. Nearly half of the firms ranked rearing of freshwater shark and gourami as moderately difficult. The main problem associated with rearing of freshwater shark was the requirement of heated water in the winter months to prevent diseases. A slight deviation in water temperature may lead to the outbreak of fungus disease in freshwater sharks. The main problem observed by the firms in gourami was that it attacked other aquarium fishes if foods were not applied in time. Almost all the firms said that rearing of local ornamental fishes such as common carp and puthi were easy due to its compatibility with other fish species and different environments.

In the present study an attempt was made to identify the marketing channels for both the exotic and local ornamental fish species. Two important marketing channels were identified for local ornamental fish species through which fishes were sold to the customers. In case of the exotic fish species, though four (4) important marketing channels were listed out with the help of the respondent firms, it was not possible to collect information on quantity handled by each of the marketing channels due to the limitation of the study area.

The marketing costs per month and marketing margin per month for all groups were found to be Rs. 10,998.00 and Rs. 1,20,060.00 respectively. Marketing costs was found highest for crocodile fish (Rs. 1267.00), followed by parrot fish (Rs. 1175.00). Similarly, marketing margin was highest for discus (Rs. 35,913.00), followed by arawana (Rs. 28,364.00) and parrot fish (Rs. 14,288.00) respectively.

4.3 Identify the problems encountered and suggest suitable measures

Manpower problem was emerged as the most severe problem in breeding of ornamental fishes. Breeding problem, high cost, electricity problem, non availability of good quality brood fish, mortality of new born babies, deterioration of fish seed quality, post production maintenance problem and deterioration of ground water quality used for breeding were the other problems identified during the present study.

Mortality of reared fishes and higher transportation costs were identified as the major two problems faced by the firms in rearing of ornamental fishes. Fluctuations in demand was found to be the major problem faced in marketing of ornamental fishes. Change of customer choice and manpower problem were the next two important marketing problems faced by the respondent firms.

4.4 Conclusions

The following conclusions are emerged from the results discussed above:

1. The trade of indigenous ornamental fishes in Assam is unorganized and mainly based on natural collection. The whole ornamental trade is dependent on exotic varieties.
2. Most of the ornamental fish firms try to follow the ornamental trade related guidelines issued by the government.
3. The ornamental fish trade is a very lucrative business and it provides scope for employment opportunities to the youths of the country.

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www.fishassam.gov.in.

APPENDIX - I

QUESTIONNAIRE

on

Management of ornamental fish marketing in Kamrup (Metro) district of Assam

Dear Sir/Madam,

I am a student of Dept. of Agricultural Economics (Agri. Business Management), Assam Agricultural University, Jorhat. I am conducting a survey on the topic management of ornamental fish marketing in Kamrup (Metro) district of Assam. I request you to kindly spare a few minutes and help me in the survey. Your co-operation will be highly obliged.

General information

a) Name:

b) Address:

c) Contact number:

d) Age: e) Sex: Male / Female

f) Education: illiterate / upto 10 / upto 12 / Graduate / P.G.

g) Occupational status: Primary / Secondary

if not primary, main occupation is :

h) Involved i) in breeding, rearing and marketing

ii) in rearing and marketing

iii) only in marketing

i) Experience:

j) Annual Income:

Management related information

A. Production related management

a) Size of the production area:

b) Fish species used for seed production: Indigenous / Exotic

c) Name the important fish species used for seed production:

d) Difficulties associated in breeding of different fish species: (mark in appropriate box)

Fish species	Easy	Average	Difficult	Reason for the answer
Exotic				
Gold fish				
Platy				
Moly				
Sword tail				
Guppy				
Angel				
Discus				
Freshwater sharks				
Indigenous				

e) Infrastructure and materials required:

Particulars	Presently in use	Reasons for not using
Cement tanks		
Aquarium		
Tables and iron stands		
Electricity		
Sophisticated breeding unit		
Aerators		
Heaters		
Plastics trays and bowls		
Protein rich feeds		
Hormones		
Medicines		
Aquarium plants		

f) Manpower availability:

Permanent: Temporary:

g) Costs mainly associated with: (Give ranks properly)

Sl. No.	Particulars	Rank
1	Cement tanks	
2	Aquariums	
3	Tables, iron stands etc.	
4	Brood fish species	
5	Electricity	
6	Different accessories	
7	Feeds	
8	Hormones and medicines	
9		
10		

i) Problems faced: (Give ranks properly)

Sl. No.	Particulars	Rank
1	High cost	
2	Electricity problem	
3	Manpower problem	
4	Non-availability of good quality brood fish	
5	Breeding problem	
6	Post production maintenance problem	
7	Mortality of new born babies	
8	Deterioration in fish seed quality	
9	Lack of sufficient infrastructural facilities	

j) Future plans

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k) Expectations from relevant departments and Government

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B. Rearing related management

a) Total rearing area:

b) Rearing is done with: own bred fishes/ fishes imported from outside the state

c) Facilities and materials required

Particulars	Presently in use	Reasons for not using
Cement tanks		
Aquarium		
Quarantine tanks		
Electricity		
Aerators		
Quality feeds		
Ornamental plants		
Medicines		
Heating apparatus		

d) For how many days you normally rear the fishes:

e) Management requirement in rearing activities

Particulars	Presently in use	Reasons for not using
Water quality maintenance		
Regular application of feeds		
Use of heating apparatus		
Use of medicines at regular intervals		
Involvement of labour		
Proper handling of the fishes		
Water temp adjustment during shifting of fishes		
Aquarium cleaning		

f) Reasons for not using recommended rearing activities

g) Problems faced: (Give ranks properly)

Sl. No.	Particulars	Rank
1	Financial problem	
2	Electricity problem	
3	Manpower problem	
4	Lack of sufficient infrastructural facilities	
5	Higher transportation cost	
6	Mortality of reared fishes	
7	Body colour deterioration of fish during rearing	
8	Non availability of sufficient stock in outside market	
9	Sometimes unable to sale the reared fishes in time	
10		

h) Expectation from relevant department and Government

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C. Marketing related management

a) Size of the shop (floor space):

b) Rent per month:

c) Staff availability: i) Permanent ii) Temporary

d) Operational hours/day:

e) Total number of working days per month:

f) Mainly dealing with which group of fishes: i) Indigenous ii) Exotic

g) Fish species availability details

- Indigenous fish:
- Exotic fish:

i) Buying and selling prices of ornamental fishes

Fish species	**Buying price (Rs.)**	**Buying place**	**Selling price (Rs.)**
Exotic			
Gold fish			
Platy			
Moly			
Sword tail			
Guppy			
Angel			
Discus			
Freshwater sharks			
Tetra			
Knife fish			
Arawana			
Milk carp			
Gourami			
Parrot fish			
Crocodile fish/ Sucker fish			
Indigenous			

j) Buying and selling prices of other appliances

Particulars	Buying price (Rs.)	Buying place	Selling price (Rs.)
Aquarium heaters			
Power filter			
Aerators			
Pebbles			
Electronic motors			
Ornamental plastic plants			
Ornamental fresh plants			
Feeds			
Medicines			

k) Most demanded aquarium fishes:

l) Approximate customers per month:

m) Approximate costs associated per month:

n) Approximate earnings per month:

o) Attributes influencing customer purchasing behaviour: (Rank properly)

- Fish bred
- Colour
- Size
- Price
- Long survivality
- Compatibility with other fish species

p) Details of promotional measures (if any)

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q) Marketing channels involved in ornamental fish marketing:

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r) Problems faced: (Give ranks properly)

Sl. No.	Particulars	Rank
1	Higher cost of accessories	
2	Electricity problem	
3	Manpower problem	
4	Higher costs of fish species	
5	Higher transportation cost	
6	Mortality of fishes	
7	Body colour deterioration of fish during rearing	
8	Unexpected customer behaviour	
9		
10		

r) Expectation from relevant department and Government

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Signature of the respondent

PHOTO GALLERY

Plate 1. Involvement of labour in fish marketing

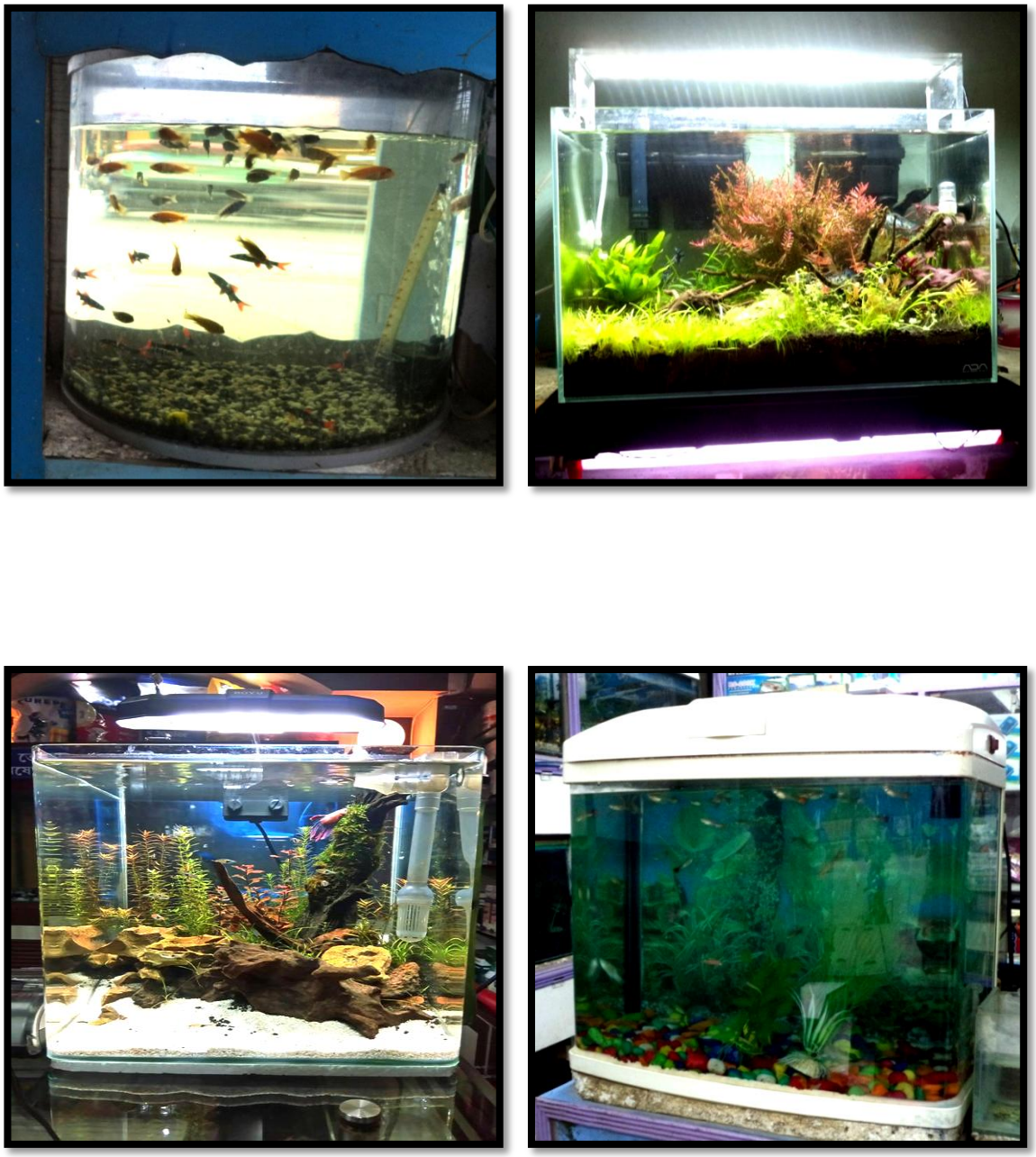

Plate 2. Different types of aquarium available in aquarium shops at Guwahati

Plate 3. Availability of different accessories in aquarium shops

Plate 4. Interaction with the shop owners at different aquarium shops

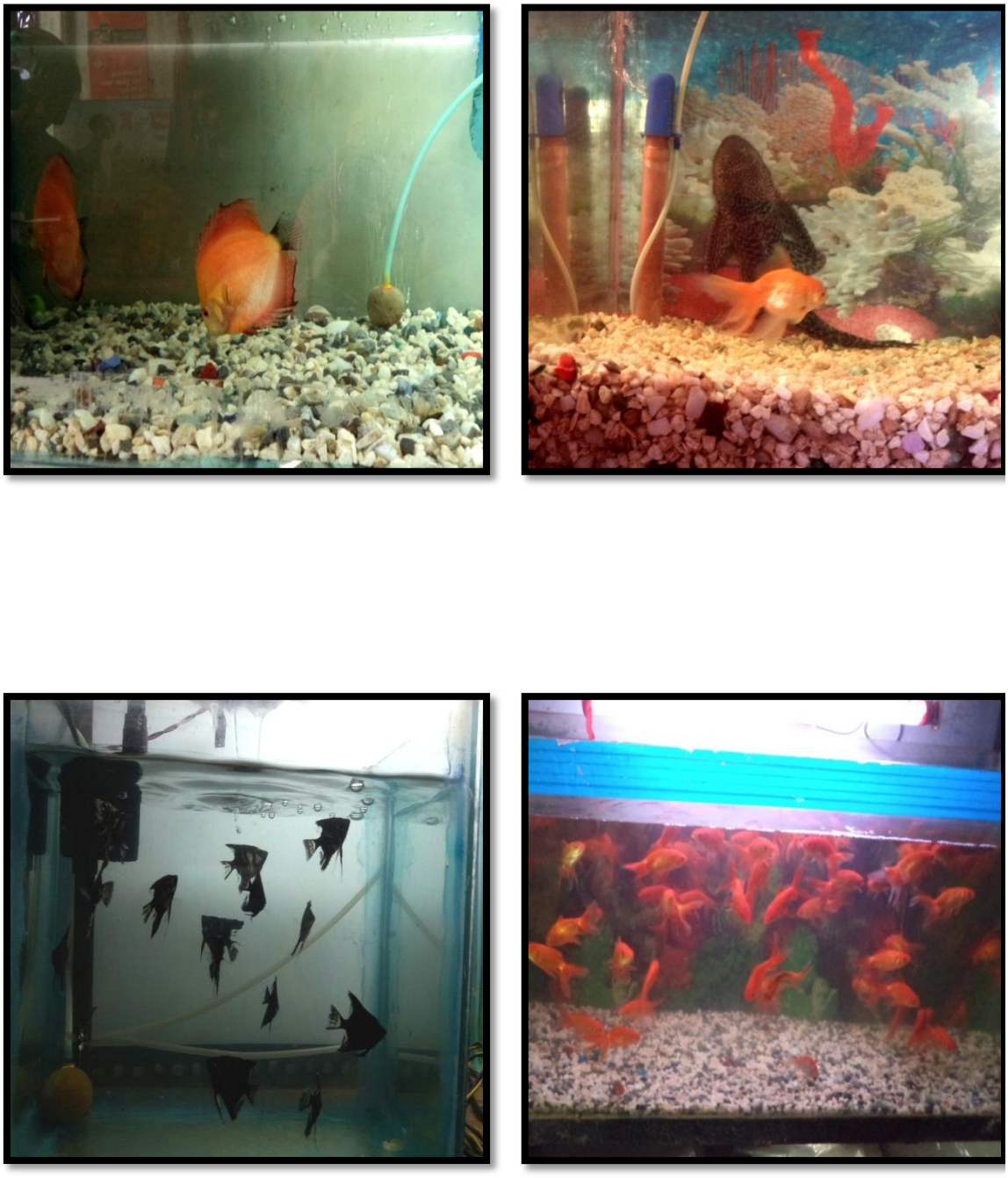

Plate 5. Different types of colourful ornamental fishes in aquariums