DEVELOPMENT OF CONSUMER ORIENTED STRATEGIES FOR MARKETING OF FISH IN ASSAM

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Abstract

Fish has long been an important food item and associated with the social life of the people of the Northeast India, especially in Assam and Tripura. Assam is the most resourceful State in surface water coverage in the Northeast India with coverage of 0.39 million hectare in the form of rivers, beels (floodplain wetlands), ponds and tanks, derelict water bodies, reservoirs, forest fisheries, and community tank. These resources yielded 0.23 million tonnes of fish during 2010-11 (Economic Survey, Assam, 2011-12; 99) against an annual demand of 0.31 million tonnes (calculated on the basis of minimum nutritional requirement of 11 kg per capita per annum as recommended by WHO and considering 90% of the state's population is fish consumers). Despite the efforts of the government through various departmental schemes of fisheries it has been assessed that the production level of fish has not made any strident progress over the past plan periods, but attained a steady annual growth of about 2.65% (Bhuyan and Dutta164). In spite of having potential aquatic resources for fisheries development, fish production in the state has not attained self-sufficiency. Though rice and fish are the two basic diets of the Assamese people where 95% of the state population consumes fish as an important protein rich food (Das and Goswami 33), the per capita consumption of fish in the State during 2010-11 is 8.3 kg which is below the national average 9.8 kg (Manual on Fishery Statistics 1). A proper marketing plan is a major factor for the success of fisheries development programmes.The marketing plan should help in timely harvesting and delivery of fish in order to fetch remunerative price. Fish production as well as marketing strategy is essential for reinforcing each other for the development of fisheries. The concept of marketing calls for understanding the needs of the consumers so that they achieve satisfaction. The key to successful fish marketing lies in understanding the needs of the consumers. Modern fish marketing tries to achieve consumer satisfaction and provide remunerative price to producers. The marketing process of fish is complicated as fish and fisheries products are perishable and demand is seasonal.

In order to improve the fish production scenario and better acceptance of fish among consumers, this study has been undertaken with the following objectives-

1. To examine the segmental variation in consumption and preference patterns for fish among different classes of population.

2. To investigate the constraints and exploring possibilities of marketing fish as per consumption and preference patterns of the consumer.

3. To formulate effective strategies for marketing of fish in Assam.

The study has been carried out in two different phases. The **first phase** consisted of finding out the taste and preferences of the consumers of fish, their buying behavior and their willingness to pay for different value added fish and fish products. The **second phase** consisted of a study of the constraints related to production and marketing of fish in the study area. Quota sampling technique was used for selection of consumer samples. One district from each of the agro-climatic zone (there are six agro-climatic zones in Assam) has been selected based on urbanization and fish production potential following judgment sampling. The total sample size for consumer survey was 660. The data pertaining to fish consumption and other household expenditure were collected for the year 2010-11 using a structured pre-tested questionnaire.

During the **second phase** of the study 240 fish farmers, 245 marketing intermediaries and 300 eating joints were interviewed. Farmers were selected through simple random sampling from each of the selected districts. Thirty two constraints had been considered following a Focus Group Discussion. After collecting the perceived seriousness of the constraints from the fish farmers, the data was put through factor analysis. Marketing intermediaries and eating joints were selected based on judgment sampling.

Data collection was carried out during February, 2011 to March, 2012.

Different descriptive, parametric test (t- test and ANOVA) and non-parametric test (Chi-square test) tests were applied on the basis of necessity.

Major findings of the study are as follows

a) Fish consumption patterns:

1. Majority of the non-vegetarian consumers (60.3%) in the study area have the highest preference for fish followed by chicken, and mutton.

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2. The per capita fish consumption in the study area is estimated at 14.27 kg/year. The annual per capita consumption of fish in rural area is 14.54 kg and in the urban area 13.99 kg.

3. The annual per capita consumption of fish is highest among the Assamese community (19.11 kg), followed by the Bengali (15.41kg), the Nepali (8.83 kg) and North Indians (8.31 kg).

4. The per capita consumption of fish increases as income increases.

5. Majority of consumers (53.7%) consume fish twice a week, 25.2% daily and and 13% once a week.

6. The average quantity of fish purchased at a time by majority of consumers (48.3%) is 500 gm.

7. The average monthly expenditure on fish per family in the study area was Rs.662.42 which constituted 14.56% of monthly household expenditure on food.

8. Majority of respondents (93.9%) prefer local fish over imported (chalani) fish.

9. Among Indian Major Carps, rohu (Labeo rohita) is the highest preferred species followed by catla (Catla catla), and mrigal (Cirrhinus mrigala).

10. Among exotic carps, common carp (Cyprinus carpio) is the highest preferred fish followed by grass carp (Ctenopharyngodon idella), and silver carp (Hyophthalmicthys molitrix).

11. Among minor carps bhangon (Labeo bata) is the highest preferred fish followed by kurhi (Labeo gonius), and koliajara (Labeo calbasu).

12. Among different types of live fish the most preferred variety is magur (Clarias batrachus) followed by singi (Heteropneustes fossilis), koi (Anabas testudineus), sol (Channa striatus), and goroi (Channa punctatus).

13. Among three big varieties of fish chital (Notopterous chitala) is highly preferred by consumers followed by arii (Aorichthys seenghala) and borali (Wallago attu).

14. Majority of consumers (69.8%) prefer curry followed by fried (26.7%), steamed (2.7%) and roasted (0.8%) form of cooking.

15. Palatable taste, high nutrition value, habit, and easy digestibility are ranked by the consumers as 1st, 2nd, 3rd, and 4th respectively as the factors responsible for fish consumption.

16. Majority of respondents (52%) in the study area purchase fish from local market.

17. A vast majority of respondents (98.9%) have shown their willingness to purchase fish as dressed and chopped fish, 46.5% as ready to eat fish.

18. Majority of respondents (87.9%) are willing to pay 5% extra for value addition as cleaning, dressing and chopping.

19. Majority of respondents (59.7%) agreed to pay extra if quality and weight of fish is certified. A high percentage of respondents (48.8%) agreed to pay extra if convenient, clean and hygienic markets are dedeloped and maintained.

20. Respondents were largely agreed to the statement 'dirty and unhygienic market area', followed by 'chances of getting cheated', 'unavailability of preferred fish', 'irregularity of supply', and 'quality difficult to ascertain' as constraints of purchasing fish.

21. Decision on the type of fish to buy and frequency of eating fish were mainly taken by the family head/husband. The decision about preparation and cooking of fish was taken mainly by the housewife.

22. The frequency of going to restaurant for meals was rare as reported by 82.7% of consumers. There is a positive relationship between income and frequency of going to restaurants for meals.

23. 35.9% of respondents took fish/fish items sometimes in eating joints.

24. 39.8% of respondents irrespective of geographic and demographic profile agreed choosing fish items if different delicacies are made available.

b) **Constraints and possibilities of production and marketing of fish and value added fish**

1. Four major constraints related to higher yield and better production of fish have been identified with respect to production of fish. These are "Support

system constraints", "Infrastructural constraints", "Financial and technical constraint", and "Societal constraints".

2. The constraints perceived by wholesalers as per degree of seriousness are fluctuation of demand and supply, lack of cold storage, lack of proper drainage and waste disposal system, lack of supply of consumer preferred fish, and inadequate facilities for fish handling and storage.

3. Fluctuations of demand and supply is perceived as main constraint by the retailers followed by problems like unavailability of consumer preferred fish, lack of good provision for water supply, lack of cold storage, and lack of proper drainage and waste disposal system.

4. Fluctuation in demand and supply of fish in auction place is perceived as one of the main constraints by majority of vendors followed by high price of local fish during April to August, irregular supply of fish, and lack of insulated containers/carriers to carry fish to the door step of consumers.

5. The demand for fish is higher in those restaurants where rice is the core item to serve.

6. The widely used species in eating joints is rohu and it is followed by catla, *bhangon*, small variety of fishes (*borolia, singorah, moa*, and *puthi*), *arri, chital*, illish, prawn, *borali, kurhi, pabha*, mrigal, and koi.

7. Alltogether 18 (eighteen) fish items are sold in different eating joints.

8. Overall, 60% of eating joints opined that there is a possibility of consumers choosing fish items if they are made available.

9. On an average, 54.0 % managers/owners of eating joints opined that there is probability of utilizing low-valued fish for preparation of value added fish items.

10. A total of 15 constraints associated with preparing and selling value added fish items have been identified. The main constraints are less demand for fast food fish item, non-availability of suitable varieties of fish, and lack of awareness about fast food fish items in the eating joints.

Based on the findings of the study and review of literature certain strategies have been formulated. The proposed strategies were distributed among experts to find out their

validity and practicability. Experts were selected based on their contribution/experience in fisheries development in the state. Interview with the experts were conducted in two rounds and the strategies finalized. The strategies so developed discussed below –

Strategy I: Providing more extension support to fish farmers

For fulfilling this strategy the suggested ways are conducting specialized training and demonstration on varied aspects of fish production for farmers as well as for fishery extension workers, establishment of Fish Feed Mill with initiation from the government with involvement of entrepreneurs/NGOs/SHGs to make available formulated feed, establishment of Fishery Clinic, and establishment of Fishery Extension Unit at least one in each block with necessary infrastructure and manpower.

Strategy II: Providing infrastructural support to farmers

The methods/tactics suggested for fulfilling the strategy are making provision for icing, packaging, and transporting fish ; establishment of 'One stop Aqua Shop'(OAS) by naming as 'Matsya Sewa Kendra' as single outlet in strategic locations to make available all inputs required for fish culture such as fish seed, fish feed, fertilizer, chemicals etc. and formation of fish producers' consortium which will provide a suitable delivery system of fishery inputs to the fish farmers in time as well as participate in the distribution channel.

Strategy III: Providing financial and technical support to farmers

The constraints of institutional credit can be reduced through making available credit package for providing financial linkage to fish farmers, and inviting the banking sector to a single window loan provision in the form of loan mela. Formation of SHG can also generate fund by themselves through collection of monthly premium from members and giving it to members at low rate of interest which will ultimately help the farmers to meet the necessary expenses of fish culture to certain extent.

Quality fish seed (fry and fingerlings) at right time of stocking should be made available among fish farmers through judicious carp breeding and hatchery management and proper distribution system with initiation from Department of Fisheries, Government of Assam. Assam Fish Seed Act, 2005 should be strictly followed which provides guidelines for quality seed production and management.

Adoption of Multiple Stocking and Multiple Harvesting of carp culture technology should be encouraged in order to make regular supply of fish throughout the year. In order to achieve this, package of practice of this technology should be developed by the fisheries scientists of the State and diffusing to the farmers.

Strategy IV: Constant monitoring and community based management

This strategy can be implemented through employing community based watchmen, installing substrates for periphyton growth that in turn work as hurdle to poach inside ponds, social fencing through community participation, and providing fishery insurance coverage which can ameliorate the problem of poisoning and poaching.

Strategy V: Standardization of breeding and culture technology for high valued
indigenous fish

In order to fulfill this objective, package of practices based on location specific standardized breeding and culture technology of magur as well as other indigenous varieties of fish like koi, *sol, chital, arri, pabha,* and *moa* should be developed through research in agro-climatic situation of Assam.

Proper conservation measures against habitat destruction and measures to stop indiscriminate fishing during breeding season should be taken. In this case, Assam Fisheries Rule (1953) which was amended in 2005 should be strictly enforced creating awareness among public.

Strategy VI: Development of an elaborate network for handling, transporting,
distributing, displaying, and holding facilities to support marketing of fish
and value added fish products

The important measures suggested to attain this strategy include provision for specially designed or modified tanks and containers; transport vehicles equipped with aeration or oxygenation facilities to keep fish alive during transportation with government initiation and support, establishment of hygienic fish market and post harvest preservation facilities in selected potential locations by the Department of Fisheries, providing technical and financial assistance for transportation facilities, establishment of ice plants, landing platforms, weighing sheds, cleaning tables, storage facilities, modern fish selling stalls, and retail vending kiosks.

Strategy VII: Development of hygienic retail outlet, and branding of fish and fish items

To fulfill this strategy the Department of Fisheries (Government of Assam), Assam Apex Co-operative Fish Marketing and Processing Federation Ltd. (FISHFED), business firms and SHGs should work together and take pro-active role in opening hygienic fish retail outlets at consumer-friendly locations.

Strategy VIII: Creation of awareness among consumers about nutritional value of fish and different value added fish products

In order to achieve this, the suggested measures include promotional campaign using different mass media to create awareness and popularity of different value added fish and fish products with their nutritional value in line with that of egg by National Egg Coordination Committee (NECC).

The STP (Segmentation, Targeting and Positioning) approach of marketing has been used to develop marketing strategies for fish in the study area. After segmenting the market using different demographic and geographic variables, the target market has been identified using the information revealed by the study. The position of fish to be created in the minds of the target segment has also been identified. To create the identified position, the marketing mix has been developed.

A business model for procurement and distribution of fish and value added fish products has been designed. The business model proposes that a body, whether NGO or SHG or cooperative society, take up the responsibility of collecting and distributing fish, including branded fish items with profit motive in a small geographic area centering a township. This body will take up the activity of collecting fish from the different sources like culture and capture fisheries. This body will act as a wholesaler of fish, as well as provider of ready to eat fish items through the 'Matsya Biponi.' The ideal infrastructure requirement of this body is suggested in the study.

Declaration by the Scholar

I, Sri Pradip Ch. Bhuyan, Research Scholar in the Department of Business Administration, School of Management Sciences of Tezpur University, Assam, hereby declare that this research work entitled, "Development of Consumer Oriented Strategies for Marketing of Fish in Assam" is a legitimate work carried out by me under the guidance and supervision of Dr. Chandan Goswami. This research work has not been submitted elsewhere for any other purposes.

Date: 9th May, 2013

Place: Tezpur

(Pradip Ch. Bhuyan)

Registration No. 023 of 2010

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Certificate of the Supervisor

This is to certify that the thesis entitled **"Development of Consumer Oriented Strategies for Marketing of Fish in Assam"** submitted to the School of Management Sciences, Tezpur University in part fulfillment for the award of the degree of **Doctor of Philosophy** in **Management Sciences** is a record of research work carried out by **Mr. Pradip Ch. Bhuyan** under my supervision and guidance.

All help received by him from various sources have been duly acknowledged.

No part of this thesis has been submitted elsewhere for award of any other degree.

Signature

Supervisor: **Dr. Chandan Goswami**
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INTRODUCTION

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INTRODUCTION

Fish is described as the meat of the third world (Jolly and Clonts 1). It provides important contributions to employment generation, income generation and foreign exchange earnings in developing and developed countries. Fish is considered as "rich food for poor people" and it is the major source of animal protein for over a billion people in developing countries (Gupta 7). Consumption of fish has great importance on human nutrition. It is an excellent source of readily digestible high quality animal protein with all essential amino acids necessary for human body that has a nutrient profile superior to all terrestrial meat. Kudi, Bako and Atala (17) reported that fish is a good source of thiamine as well as a rich source of Omega-3 polyunsaturated fatty acids, fat soluble vitamins (A, D and E), water soluble vitamins (B complex), and minerals (Calcium, Phosphorus, Iron, Iodine and Selenium). Consumption of fish reduces the blood cholesterol level and high blood pressure which ultimately reduces the arteriosclerosis conditions in adult populations. Low rates of cardiovascular diseases is reported in populations with high intakes of fish which is due to health preserving effects of the long chain n-3 (ω-3) polyunsaturated fatty acids (eicosapentaenoic acid and docosahexaenoic acid) present in fish. Mortality from coronary heart disease is low among Greenland Inuit who eat large amounts of fish and whale meat and among Japanese fish eaters (Prichard et al. 819). Rao and Raju (4-5) also reported that consumption of fish reduces the cholesterol level due to presence of omega-3 fatty acid in fish and prevent heart attacks and hypertension. Premature birth and an abnormally low birth weight and hyperactivity in children have been linked to insufficient intake of omega–3 fatty acids. It is reported that children who regularly eat fresh fish with fat content have four times lower risk of developing asthma than children who rarely eat such fish. Studies show that countries with high levels of fish consumption have fewer cases of symptoms of depression. A high intake of fish reduces the age-related memory loss and a lower risk of developing Alzheimer's disease (Gomna 2006, 45). The Report of the Joint Expert Consultation on the Risks and Benefits of Fish (FAO/WHO 2011, 50) emphasized the benefits of fish consumption on reducing the mortality from coronary heart disease for the general adult population and emphasizes the net neuro

developmental benefits to offspring of fish consumption by women at childbearing age, particularly pregnant women and nursing mothers. According to Akpaniteaku, Weimin and Xinhua (28), the contribution of small fish to food and nutrition security is especially important as they are consumed whole, including bones. Some small fish species contain large amount of vitamin. In small fish, vitamin A is present as retinol and anhydroretinol, which are readily absorbed by human body. Freshwater fish represents an essential, irreplaceable source of high quality, inexpensive animal protein crucial to balanced diets in marginally food secure communities.

Fisheries sector plays an important role through producing valuable protein-rich food. It is a source of income and livelihood for millions of people around the world. According to the report of 'the State of World Fisheries and Aquaculture' (FAO 2012, 3-10), fisheries and aquaculture have provided a source of income and livelihood for 54.8 million people in the primary sector in 2010. Of these, an estimated 7 million people were occasional fishers and fish farmers distributed over India, China, Myanmar, Bangladesh and Indonesia. Employment in the fisheries sector has grown faster than the world's population and than employment in traditional agriculture. In 2010, more than 87% of all people employed in the fisheries sector were in Asia, followed by Africa (more than 7%), and Latin America and the Caribbean (3.6 %). China is the country with the highest number of fisherman and fish farmers, representing nearly one-third of the world's total. Global fish production scenario reveals that out of total fish production of 154 million tonnes, capture fisheries contributed 90.4 million tonnes (11.5 million tonnes from Inland and 78.9 million tonnes from Marine) and aquaculture contributed 63.6 million tonnes (44.3 million tonnes from Inland and 19.3 million tonnes from Marine) during 2010-11. Aquaculture represents the fastest-growing animal based food producing sector showing an impressive annual growth of 6-7% (Ayyappan 2012).

Fisheries sector of India has become a sunrise sector of Indian economy due to its increasing food supply, employment generation, income augmentation, nutrition security and foreign exchange earnings. This sector has witnessed an impressive growth from a subsistence traditional activity to a well developed commercial and diversified enterprise. During the previous five year plans contribution of fisheries sector is estimated around 1.10% to the GDP and 5.3% to the agricultural GDP (Ayyappan et al., 2011, 2). Fisheries

sector of India has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries as well as earning foreign exchange (Ayyappan and Krishnan, 2004, 392). As per the report of the Department of Animal Husbandry, Dairy and Fisheries (DAHDF 51), fisheries sector provides livelihood to approximately 14.49 million people in the country.

Blue revolution in the country started in 1971 with the launching of a nation-wide demonstration on composite culture of Indian and exotic carps under the All India Coordinated Research Project (AICRP). This project was carried out by the Central Institute of Fisheries and Research Institute (CIFRI) with enormous success throughout the country. A series of standardization and development of methods in different aspects of aquaculture, i.e., resource survey, their characterization and effective utilization, production and rearing of seed, and grow out farming technology have been implemented resulting in holistic development of aquaculture over the years (Jayasankar and Das 54).

India ranked as the second largest country in aquaculture production in the world during the year 2010-11 and fish production has increased from 4.16 million tonnes in 1991-92 to 8.29 million tonnes in 2010-11 (DAHDF 11). This production was recorded from both marine and inland fisheries resources. Marine fisheries mainly comprised of a long coastline of 8118 km with an Exclusive Economic Zone (EEZ) extending to 2.02 million square km and continental-shelf area of 0.53million square km. Inland fisheries comprised of 2.91 million ha reservoirs, 2.41 million ha pond and tanks, 0.81 floodplain lake and derelict water bodies, 1.24 million ha Brakish water bodies, and 0.2 million km rivers and canals (DAHDF 89-90). About 35% of Indian population is fish eaters and the per capita consumption is 9.8 kg (2010-11), whereas the recommended intake is 13 kg (Manual on Fishery Statistics 1). According to the NSS 66th Round report (A1-A147), annual per capita consumption of fish was found 25.44 kg in Kerala, 9.72 kg in West Bengal, 14.16 kg in Tripura, and 8.04 kg in Assam.

The Northeastern States of India, comprised of landlocked states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura, is one of the richest region of India in terms of biodiversity and natural resources. The total water spread area of the Northeast is about 0.41 million hectare in the form of riverine fisheries, flood plain wetlands, reservoirs, forest fisheries, swamps and derelict water

bodies, ponds and tanks etc. Fish have long been an important food item for the inhabitants of the region. Fish has been associated with the social life of the people of Northeast India from time immemorial. Not only it provides nutritious food, but also forms an unbreakable relationship with the culture, religion, and traditions of the region. With more than 95% of population being fish eaters, there is a huge gap between supply and demand (Munilkumar and Nandeesha 399). Among the Northeastern states, fish production is highest in Assam (0.227 million tonnes) contributing around 2.73% to the total fish production of the country followed by Tripura (0.049 million tonnes), Manipur (0.02 million tonnes), Nagaland (0.007 million tonnes), Meghalaya (0.004 million tonnes), Arunachal Pradesh (0.004 million tonnes), and Mizoram (0.003 million tonnes). The total fish production in the region during 2010-11 has been reported to be 0.31million tonnes (DAHDF 88).

Assam is blessed with inland water bodies covering about 0.39 million ha in the form of flood plain wetlands, locally known as *'beels'* (0.100 million ha), rivers (0.205 million ha), ponds and tanks (0.035 million ha), swamp and derelict water bodies (0.039 million ha), forest fisheries (0.005 million ha), reservoir fisheries (0.002 million ha), and community pond (0.004 million ha) which have a greater potentiality for fish production (Economic Survey, Assam, 2011-12, 99). These resources yielded 0.23 million tonnes of fish during 2010-11 against an annual demand of 0.31 million tonnes (based on minimum nutritional requirement of 11kg/person and considering 90% of the state's population is fish eaters). Though rice and fish are the two basic diets of the Assamese people where 95% of the state population consumes fish as an important protein rich food (Das and Goswami 33), the per capita consumption of fish in the state is 8.3 kg which is below the national average 9.8 kg. Cognizant to the importance of fisheries sector in rural economy, a number of programmes have been implemented in different time but the growth rate in the fisheries sector of Assam is almost at the same level with an annual increase of about 2.65% since last 10 years (Bhuyan and Dutta 164).

For development of Inland fisheries and aquaculture in India, several government programmes have been formulated and implemented. A centrally sponsored scheme is being implemented through the State Governments/Union Territories under macro-management approach. This scheme covers all inland fishery resources available in the

country in the form of freshwater, brackish water, coldwater, waterlogged areas, saline/alkaline soils for aquaculture and capture fishery resources (reservoir/rivers etc.). The scheme has seven components, viz., Development of Freshwater Aquaculture, Development of Brackish water Aquaculture, Development of Coldwater Fisheries and Aquaculture in the Hilly Regions, Development of Water-logged Areas into Aquaculture Estate, Utilization of Inland Saline/Alkaline Soils for Aquaculture and Inland Capture Fisheries (Reservoirs/Rivers etc.) and Innovative projects for implementation in the 11th Five Year Plan. A network of 429 Fish Farmers Development Agencies (FFDAs) has been established in the country with the main objectives of popularizing fish farming, creating employment opportunities and diversifying aquaculture practices, and providing assistance to fish farmers with a view to creating a cadre of trained and well organized fish farmers to be engaged in aquaculture. National Fisheries Development Board (NFDB), an autonomous organization under the administrative control of the Department of Animal Husbandry, Dairy and Fisheries, under the Ministry of Agriculture, Government of India was established on 9th September 2006 at Hyderabad which plays an important role in the development of fisheries sector in the country (DAHDF 51-64).

The success in fisheries development programmes depends on good marketing systems. Fish marketing plays a pivotal role not only in making available the produce to the consumers but also stimulating further production and consumption leading ultimately to the overall economic development of Fisheries sector (Rao 1-7). Fish production as well as marketing technology is essential for reinforcing the progress of fisheries development. But fish marketing in Assam is yet to be streamlined in a sound manner. Assam Apex Co-operative Fish Marketing and Processing Federation (FISHFED) was established in 1978 as an apex co-operative body to look after marketing and processing activities of fish in the State. Though fish marketing is one of the major activities of FISHFED, due to low procurement and fixation of price by the Board of Director, the primary member societies are reluctant to sell their harvest to FISHFED. Barik and Katiha (151-52) also revealed that the activities of FISHFED was more or less defunct and conducted limited activities like marketing of fish. The study expressed that informal institutions like non-government organizations (NGOs), informal groups, social institutions, village communities, and Self-Help Groups (SHGs) can play an important

role in fisheries activities. These institutions emerged with the need for a collective effort or a legacy of the past. They are efficient in terms of mutual reciprocity, information flow and accountability within the system. These organizations are very flexible and therefore, highly efficient in their operations.

In the present system of fish marketing in Assam, producers who produce fish at a commercial level carry their fish to the wholesale fish market of district head quarters or to a market where they expect more remunerative price either in the early morning or in the afternoon. Before taking it to the market, the fish farmer segregates the fish according to size and species. Fishes are usually packed in different containers like, aluminum containers, bamboo baskets, jute bags etc. On arrival of fish at the wholesale market it is usually sold by auctioning system which is also prevalent in other parts of the country. The auctioneers present in the market take the responsibility of auctioning the fish to the highest bidder with a commission charged to the farmers. There are some commission agents in the market who engage middlemen to facilitate the marketing process who usually sit in a particular place of the market, locally known as 'kata'. These middlemen perform the job of advertising and publicity for attracting fish farmers, grading the fish according to species, size and freshness, auctioning, keeping the record of weight of fish, and collecting money from buyers. After the auctioning process, fish farmers are paid for their fishes after deducting commission and other market charges. There are some village traders/producers who purchase the fish from different fish farmers and bring them to prospective wholesale fish market. Fishes are then sold in the same method of auctioning. Fish harvested from 'beel' (floodplain wetlands) and riverine fisheries are also marketed in the same method of auctioning. Sometimes, instead of carrying fish to the market the 'Mahaldar' (Lessee) and fishermen auction their fish at beel/river site. The village traders then carry the fish for selling it to retail market (Nath, Kalita, and Bhuyan 28-30).

The key to successful fish marketing lies in understanding the needs of the consumers. Modern fish marketing tries to achieve consumer satisfaction as well as provide remunerative price to the producers. Understanding consumer motivation and knowing the relative importance of various attributes of fish and criteria of choosing fish products for different consumer groups are essential for development and promotion of local products. The development of attractive and convenient processed food from local

staples combined with active marketing can succeed in increasing demand of such domestically produced food (Delisle 1-77).

The fishery economy in the country over the years has significantly changed from one of subsistence level to a market oriented economy. In the absence of an efficient fish marketing system, the producer fails to convert the production activities to profitable opportunities. One of the major advantages of aquaculture is that the supply can be made market-oriented as opposed to the production oriented marketing. A proper understanding of consumer's demand, attitudes and behaviour are major aspects in planning a viable aquaculture production programme. To achieve marketing success, consumer's preference and acceptance have to be the criteria of fish species selection, value addition, place of purchasing, frequency and average quantity purchase at a time. Production programmes without consumer survey, have experienced considerable marketing problems by silver carp, milk fish, and mussels in certain countries (Pillay and Kutty 274). Proper understanding of important factors associated with fish consumption guides fish producers and marketers in their decision making process. Such information helps to improve market promotion, product perceptions and distribution. Shift in dietary pattern, higher economic growth, rising population, availability of fish, tastes and preferences are the driving forces for rapid growth in domestic fish demand and trade (P. Kumar and G. Kumar 2009, 22). Market oriented approach lays greater emphasis on consumer's taste and preferences by providing desired services through incorporation of the variables like product, price, promotion, and place (distribution) in the most effective manner (Khobragade and Sonawane 54). Hence, the consumer demand for fish and fish products needs to be studied so as to identify, understand and finally foresee the future potential of fisheries sector.

Considering this background in mind, this study has been undertaken with the aim of invesigating both the demand and supply forces for fish and fish products and brings in a convergence to develop marketing strategies. The study has been carried out in two different phases. The first phase consisted of finding out the consumer's buying behavior and their willingness to pay for different value added fish and fish products. A consumer sample of 660 have drawn from different geographic and demographic profile using quota sampling technique and information about fish consumption patterns were

collected through personal interview with a pretested questionnaire. The collected data were analyzed by applying different statistical tools. The second stage consisted of the analysis of the constraints related to production and marketing of fish in the study area.

For identifying the constraints of fish production, sample survey of the fish farmers (240) was undertaken where they were asked to give their response in a 5 point Likert scale questionnaire. Factor analysis of the responses has been done to make the number of problem variables manageable. To bring in convergence mentioned above, marketing strategies, including new product development with respect to fish have been suggested in the study. To develop strategies related to new product development and promoting and delivering these products to the target market, the information collected from the consumers and stakeholders of fish marketing chain were analyzed to segment the market on the basis of preference of fish products, demography, economic situation, community, and willingness to pay. The total supply chain with respect to fish has been addressed from a holistic point of view. Needs of the consumers have been identified and supply of fish and fish products have been linked to this. Again on the basis of needs of the consumer's new products and methods of delivering them to the consumers conveniently with different pricing strategies are proposed in the study.

Since no marketing strategies have been formulated so far based on consumption and preference patterns of fish in the study area (as revealed from literature review), the strategies developed and finalized in the present study would help the producers and marketers in their decision making process and also may help the researchers and policy makers to frame developmental fisheries projects and programmes for the State. This is expected to be a major contribution of the study the body of knowledge.

The entire study is presented in five chapters. The introduction of the study, stating statement of the problem, is placed in Chapter-I. Chapter-II deals with review of various studies made in the line of the objectives framed in the present study. The Methodology along with the statistical tools used in the study is described in the Chapter-III. The results and discussions are presented in Chapter-IV. Major findings, strategies formulated, proposed conclusions drawn and specific policy issues are presented in Chapter- V.

CHAPTER: II

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

2.1. Fish consumption patterns

Fish is an important source of animal protein which is consumed by people almost all over the world. Dietary fish consumption patterns are influenced by complex interactions of several factors such as geographic and demographic profile, availability, income, tradition and customs, etc. The study of York and Gossard (293) reveals that fish consumption is influenced by cultural/geographical region, and economic development stimulates Asians to eat considerably more fish. But in non-Asian regions, economic development stimulates consumption of meat. The pattern of consumption of fish is different in terms of quantity, frequency and type of consumption depending on region and country, which reflect the different levels of natural availability of aquatic resources in adjacent waters as well as diverse food traditions, tastes, income levels, prices and seasons (FAO 2012: The State of World Fisheries and Aquaculture 85). According to this report, annual per capita fish consumption varies from less than1.0 kg in a country to more than 100 kg in another. The annual per capita consumption of fish was highest in Oceania (24.6 kg), followed by North America (24.1 kg), Europe (22.0 kg), Asia (20.7 kg), Latin America and Caribbean (9.9 kg), and Africa (9.1kg) during the year 2009. The report reveals that global per capita fish consumption increased from 9.9 kg in the 1960s to 11.5 kg in the 1970s, 12.6 kg in the 1980s, 14.4 kg in the 1990s, 17.0 kg in the 2000s, and 18.4 kg in 2009. The most substantial increases in annual per capita fish consumption have occurred in East Asia (from 10.6 kg in 1961 to 34.5 kg in 2009), Southeast Asia (from 12.8 kg in 1961 to 32.0 kg in 2009), and North Africa (from 2.8 kg in 1961 to 10.6 kg in 2009). China has been responsible for most of the increase in world per capita fish consumption due to the substantial increase in its fish production from aquaculture. China's share in world fish production grew from 7.0% in 1961 to 34% in 2009. Per capita fish consumption in China has also increased dramatically, reaching about 31.9 kg in 2009, with an average annual growth rate of 4.3% in the period 1961–2009 and of 6.0 % in the period 1990–2009. Excluding China, the annual per capita fish supply to the rest of the world was about 15.4 kg in 2009. Japan leads in annual per capita consumption of fish in the Asian region with significant level of 70 kg and it constitutes 10% of the

global demand for fish products. Global annual per capita consumption of fish is projected to increase between 19 kg and 21 kg (live weight equivalent) in 2030. But regional picture of fish consumption will be very diverse. Per capita fish consumption is projected to increase in South Asia (up by almost 60%), Latin America and the Caribbean (up by almost 50%) and China (up by more than 84 %). On the other hand, per capita fish consumption may stagnate or decline in Africa (decline by 3%), the Near East in Asia (decline by 17%), Oceania (decline by 8%), and decline by 4% in the countries of the former USSR (Malhotra and Sinha 2: 620).

All the population of Japan consumes fish and it is the staple food in Japan. The total diet in Norway, Sweden, Iceland and Denmark consists of fish except a little amount of meat products which are added to their daily diets. In Britain, the majority of the people consume fish and they prefer fish more than chicken (Rao and Raju 7). The mean consumption rate of US population of the 48 conterminous states for all fish is estimated at 15.65 gm/person/day of which 4.71 gm/person/day is for freshwater/estuarine fish and 10.94 gm/person/day is for marine fish (Jacobs et al. 287). More than 84% of Taiwanese consumers prefer to eat fish and the annual per capita consumption of fish in Taiwan is 23.57 kg (Li et al. 1-7). But fish is the third preferred animal product after pork and poultry for Taiwanese consumers. Fish products convey an overall good perception to consumers in Taiwan.

Limited statistical information is available regarding fish consumption patterns in India. Only the National Sample Survey Organization (NSSO) has been conducting household consumer expenditure survey since 1973-74. Composite data on consumption of meat, egg and fish are available but exclusive data on fish consumption are not found in India and only rough estimates are generally found about per capita consumption of fish in the country. There is an urgent need to collect reliable statistics on per capita and total fish consumption in India (Malhotra and Sinha 1:283).

There are differential patterns of fish consumption in India. Consumption of fish in the country is influenced by caste among the Hindu population. In certain states, it is a religious taboo among the upper caste to consume fish. In West Bengal 99% of the population consume fish including Brahmins and Vysyas. Only Brahmin and Vysyas widows do not take fish in West Bengal. In Assam and Orissa, Brahmins consume fish.

But, only 30% of the population of Andhra Pradesh, Karnataka, Tamilnadu, Gujarat and Rajasthan consume fish and a few castes such as Brahmins, Vysyas and communities like Marwadis and Jains of those states do not eat fish. The main reason for not eating fish is religious restrictions (Rao and Raju 6-7).

Many studies have shown that fish consumption patterns differ from rural to urban areas. Per capita consumption of fish is substantially higher in rural areas than in urban areas of Asian countries and freshwater fish species constitute a major share (15% to 53%) in total per capita fish consumption (Dey et al. 2005, 89). In Bangladesh, per capita fish consumption in urban areas increased by 17.5% to 18.1 kg against a national average of 15.4 kg, while consumption in rural areas climbed 4.8% to 14.5 kg during the period 2000-2005 (The World Fish Center). The study conducted by Bhatta (2003, 17-42) on fish consumption patterns of urban and rural fish consumers in five Indian states viz. Haryana, Karnataka, Orissa, Uttar Pradesh, and West Bengal revealed that monthly average household consumption of fish was 3.17 kg and overall consumption of fish among rural producer-consumer households was almost double the consumption in urban households. The average household monthly consumption of fish was found highest in West Bengal (7.87 kg) followed by Karnataka (2.20 kg), Orissa (2.26 kg) and Uttar Pradesh (3.33 kg). The study indicated that there was an impact of increased production and accessibility of fish on consumption pattern. Bhatta (2001, 182-183) in another study conducted in Mysore and Raichur districts of Karnataka reported that fish consumption was higher in rural areas as compared to urban areas. According to his study, the rural consumers consumed on an average 24 kg per year irrespective of income classes. But for urban consumers, per capita consumption of fish per month increased if income increased. But Mugaonkar et al. (133) revealed that the annual consumption per households in India was about 7.40 kg in urban India and about 6.25 kg in rural India. About 60 million families consumed fish on a regular basis, and the estimated annual per capita consumption of fish was 2.4 kg. The study carried out by Sabat, Sharma and Salim (19) in Haryana, Punjab, and Delhi revealed that when price of fish, price of the substitutes, income of family, and family size were used as independent variables, variation in demand of fish was about 39% in urban area, 24% in semi urban area and 22 % in rural area. All the respondents have purchased fish at least once in 15 days and 63%

of respondents had frequency of fish purchase once in a week and 30% had taken more than once a week.

The study of fish consumption pattern in five states of North East Region of India revealed that per capita consumption of fish in Arunachal Pradesh, Tripura, Manipur, Mizoram and Meghalaya were 28.35 kg, 18.14 kg, 17.66 kg, 10.5 kg and 14.27 kg respectively (Nandeesha et al. 37). Upadhyay and Pandey (2009, 193-96) studied the urban consumer behavior for fish in Agartala of Tripura. The result of the study revealed that per capita consumption of fish in the study area was higher than the consumption of chicken, mutton, and egg. Frequency of eating fish on an average was four times a week. The fish consumers preferred small sized, live, and locally produced fish.

Most of the studies carried out on fish consumption patterns reveal that frequency and quantity of fish consumption are dependent on income of the household. Generally, higher-income groups consume more fish, but the proportion of the food budget allocated to fish expenditure is higher among low-income groups (FAO 2001, Fisheries Circular No. 973, v). Dey et al. (2005, 89) in a study reported that fish consumption patterns were dependent on economic conditions of households and per capita fish consumption increased with increase in income. The low-priced fishes were consumed more by the low income groups than the high income groups and high income group spent a significant portion of their budget on expensive fish. P. Kumar and G. Kumar (22-23) also reported that when total income increases, people tend to spend more on fish, and relatively less on other types of meat. The frequency and quantity of fish consumption increases with income (Belton et al. 53) and people with higher incomes eat significantly more fish meals than those with lower incomes (Burger et al. 2003, 254).

The study on fish consumption in Madras (presently Chennai) conducted by the Bay of Bengal Programme (BOBP) under the Post-Harvest Fisheries Project in 1991 in coordination with the Marketing and Research Group (MARG), Madras, revealed that more than 50% respondents of lower income groups consumed less than 5 kg/capita/year only. The annual per capita consumption of fish for all groups was 7.2 kg whereas it was 2.4 kg in case of mutton or chicken. Generally, the quantity of fish purchased at a time was ranges between 250-500 gm. The incidence of consumption of fresh water fish was only 20% and it was due to the fact that consumers were unfamiliar regarding taste and

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nutritive value of freshwater fish. The study further revealed that all income groups highly accepted fish as food due to its easy availability, affordable price, taste and nutritive value (BOBP 8-11). The study conducted by Sekar and Senthilnathan (27-30) on fish consumption pattern in Coimbatore city of Tamilnadu revealed that the per capita expenditure on fish increased with increase in income. Sekar, Randhir, and Meenhakshi (56-60) also reported that the average fish consumption increases with increase in income. They found that the average expenditure share of fish across different income groups increased from 0.29% to 0.33% from the lowest to the highest income class.

Gopal and Annamalai (62-65) investigated the food consumption profile of selected households in Cochin, Kerala (India) with reference to different income categories. Food expenditure has been classified into expenditure on staple food, fish, meat, milk, and egg. The result of the study showed that food consumption expenditure decreases as the income increases. The study stated that higher the income, higher the percentage of component of fish in the daily diet. The study suggested development of fish product considering the preference of high income group to get more monetary return per quantity of raw fish. Out of the four items of meat, fish, milk, and egg, fish was the most preferred food and egg constituted the least favored. The study clearly indicated that no other non-vegetarian food such as meat, milk and egg had positive association with income like fish. Bhatta (2003, 30-34) also revealed that the monthly household fish consumption increases with increase in income except for 'rich' income class.

The study conducted by Jamdade et al. (144) on fish consumption patterns in Kolhapur city of India revealed that among different income groups whose annual income ranged from Rs. 0.5 lakh to Rs.1.0 lakh and from Rs.1.0 lakh to 2.0 lakh per annum preferred fish as highest source of food followed by milk, meat and eggs. The study suggested creation of awareness related to the positive health aspects of fish consumption amongst the poorest socio-economic groups and drive away some of the myths and taboos. The study further suggested adoption of more centralized and organized production and distribution systems in line with Egg Produce Association of India, the Poultry Producers' Association, and the Milk Marketing Board.

According to Delgado et al. (2003, 38-40), increasing income and urbanization shall be responsible for increasing demand for fish and meat by 2020 in the developing

countries. There is an increasing demand for high-value fish species in developed countries where urbanization is high. Thus, the demand for high-value species may increase in developing countries as urbanization increases. Hence, the study of influence of income and urbanization on fish consumption is important for calculation of future fish demand and knowledge about preferred fish species.

Contrary to the finding of the previous studies that fish consumption rises with rise in income, the study conducted by the Bay of Bengal Programme (BOBP 8) on fish consumption in Madras revealed that consumption of fish decreased with increasing income. Consumers with low and middle incomes perceived fish as one of the cheapest sources of protein that added value to their food intake. The study of Burger et al. (427) revealed that people with lower incomes ate fish significantly more often than those with higher incomes. Trondsen et al. (301) also reported that income was not significantly associated with fish consumption levels among those who like to eat more fish. They concluded that improvements in the supply of high-quality fresh and processed fish products which can satisfy children's wishes, health-oriented family members, and convenience-oriented consumers, could significantly increase at-home consumption of fish. Fish consumption does not have relation with income alone at the macro-level, but rather to consumer's cultural and traditional food habits (Malhotra and Sinha 2: 428). It is stated that in general "rice and fish" is popular diet to the eastern India while "bread and butter" is to the northern and western India.

Fish consumption patterns are different among different ethnic groups depending on their traditional backgrounds. Very few studies have found association between fish consumption pattern and ethnicity. Food consumption experiences of ethnic minorities are little reported in the literature despite the fact that ethnic minorities are increasingly becoming an integral part of urban life in many regions of the country (Jamal 221-27). B. Kumar, Engle and Quagrainie (1977, 12) evaluated responses on purchase of fish based on ethnicity. The highest percentage of fish buyers were among African Americans (70%), followed by Asians (67%), Caucasians (60%) and Hispanics (23%).

Columbia River Inter-Tribal Fish Commission (CRITFC) conducted a survey among Indian tribes dwelling in Columbia River Basin to determine the level and nature of fish consumption among individual tribal members (CRITFC i). The survey was

initiated to test the hypotheses that Indians in that region consume more fish than non-Indians. Information regarding consumption of fish by age group, season, species consumed, parts of the fish consumed, preparation methods, and changes in patterns of consumption over time, and during ceremonies and festivals were collected. The study revealed that respondents of age 18 years and above consumed an average of 58.7 gm per day while children aged 5 and younger consumed an average of 19.6 gm per day. The average fish consumption rate of tribal members was approximately nine times greater than the national average consumption rate (USEPA). Both adults and children consumed salmon and trout more than any other fish species. The fish fillet and skin were the two most popular parts but respondents also consumed the head, eggs, bones and organs of almost all fish species.

Burger, Fleischer, and Gochfelda (254) examined the consumption patterns of meal of people living in Singapore with respect to fish, shellfish, pork, chicken and other meats. The study revealed that the average frequency of eating fish meals was10 per week by the whole population which indicates people ate fish every day and twice a day on some days.

Olsen et al. (84) explored cultural differences in the relationships between convenience, attitudes and fish consumption in five European countries. The results indicated that the meaning of meal convenience is not culture specific. Convenience orientation was highest in Poland, followed by Spain, and was lowest in the Netherlands. The relationships between convenience orientation and attitudes towards fish, and convenience orientation and fish consumption, were insignificant in most countries. But, convenience orientation was positively related to the perceived inconvenience of fish. Perceived inconvenience of fish was negatively related to both attitudes towards fish and fish consumption. The results of the study confirmed some earlier findings that fish is generally perceived as a relatively inconvenient type of food. This study concluded that convenience orientation could be crucial for food choice and consumption. Since people perceive fish as inconvenient, it should be a challenge for the fish marketers to develop more convenient products, educate consumers about where to buy and how to prepare fish in convenient forms.

Pieniak, Verbeke and Scholderer (2010, 480) carried out a cross-sectional consumer survey with representative household samples from five European countries - Belgium, the Netherlands, Denmark, Poland, and Spain. The study revealed that there were significant differences with respect to the belief that eating fish is healthy, have interest in healthy eating, subjective and objective knowledge about fish, and the fish consumption frequency between the five European Union countries. The study reported that despite scientific evidence on the positive effects of seafood consumption on human health, the consumption of fish remains below the recommended intake levels for the majority of Europeans.

Verbeke and Vackier (67) investigated individual determinants of fish consumption behaviour in Belgium. The study revealed that favourable attitude, high subjective norm and high perceived behavioural control have a positive impact on fish consumption decisions. The study found that the most important driver for eating fish was taste, followed closely by health. Davidson et al. (136-54) examined both consumer attitudes and willingness to pay for farm-raised and wild-caught fish in Hawaii. Consumers were willing to pay more for wild-caught fish than farm raised fish. Price, product form, and labeling had been identified as important attributes that determine utility values for seafood. Taste was found as the most important reason for consuming seafood, followed by dietary preferences and health aspects.

A socio-economic survey was carried out amongst communities living around seven selected dams in south-eastern Botswana (Sen). Results showed that approximately 20% of the households had eaten fresh fish. The reasons for unpopularity of fresh fish were non availability of fish followed by lack of skill of household to catch fish. Tilapia was the preferred species among all the communities. Households usually preferred to take fried fish followed by boiled and sun-dried fish. Other methods of cooking such as roasting and baking obtained negligible responses. Over 80% of the total sample ate tinned fish. Frozen or salted fish were eaten by a negligible number of the households, because these products were not easily available except in the larger supermarkets. Due to presence of too many bones, fresh fish was usually not fed to children. There were no cultural taboos concerning the consumption of fish.

According to Jamdade et al. (145) fish consumption patterns in Kolhapur city of India were heavily dependent on the religion and caste of the consumer in the population. The fish consumption frequency among Hindus was more than that among the Muslims. Gomna (2006, 215-17) stated that age and educational level were identified as the best predictors of fish consumption. The older and better-educated adults wanted to consume more fish.

There are several other factors that influence fish consumption patterns. According to Trondsen et al. (301-14) consumption of fish is subject to many influences such as socio-economic background of consumers, their general food consumption patterns, their personal health status, and a number of attitudinal dimensions. According to Gomna delicious taste of fresh fish was the main reason for eating fresh fish and frequency of eating particular species of fish was dependent on its availability, palatable taste, bone content, and odours. The main reasons for eating fish were health and taste (Brunso et al. 699). According to Westlund (1-13) prices of substitutes and complements, tastes as well as availability of fish also influenced consumption. Taste, texture, colour, shape and nutritional quality of fish have influenced consumer's preferences and product-value (Malhotra and Sinha 2: 392). The study of Bay of Bengal Project (BOBP 8) revealed that all income groups highly accepted fish as food due to its easy availability, affordable price, taste and nutritive value. Among other factors influencing selection of fish for consumption, familiarity with fish variety, freshness, intramuscular bones, price of fish, and nutritional values were found as important factors. The consumption pattern does not depend on the availability of fisheries resources within the country but on nutrition habits of the people, fish imports price and supply of alternative sources of animal protein, especially poultry (Akpaniteaku, Weimin and Xinhua 28). According to Jamdade et al. (143) fish consumption patterns is influenced by price, taste, quality, availability and hygiene at point of sale. The most important reason of eating fish was the nutritional aspects of fish among the more educated group whereas less educated people consumed fish especially due to the taste of fish. Batzios et al. (27) also revealed that tradition, taste, and high nutritional value of fish were the reasons for choosing fish among the consumers with higher education.

According to Arvanitoyannis et al. (259–79) prices, season, and size of fish according to fish type were the important factors influencing fish purchase/fish consumption. Sayin et al. studied the fish consumption pattern and the factors affecting fish consumption in West Mediterranean Region in Turkey. The study revealed that the most striking factor that affected household fish consumption was the price. The factors affecting fish purchasing behaviors were tastes, and freshness. Freshness was found to be the most important factor for consumers (85.7%).

Logar et al.(1) examined the factors affecting consumer demand for certain species of fish and how fish farming can address that demand. The analysis revealed that health benefit was the major reason of consuming fish and fish products, followed by freshness, quality, and price. The demand for fish is perceived within the industry in two different points of view. The first was the consumers' demand for a species of fish and second was the influence of the distributors on consumer preference and demand for a species of fish. Depending on this, farming of these species of fish should be encouraged. Foster carried out research on fish consumption, production and processing. The study analysed the factors influencing consumer behavior and found that consumers perceived fish as healthy food. The probable reasons for this as stated by the author were the low fat content of fish and the belief that fish is good for brain. Upadhyay and Pandey (2009, 193-96) reported that higher consumption of fish in Tripura was mainly attributable to food habit. Their analysis showed that majority of fish consumers agreed that fish is good for health, relatively cheap, tasty, and easy to cook.

Ecological conditions in a nation such as resource availability (per capita availability of land and water) and climate have impact on fish and meat consumption as ecological conditions influences the productivity of ecosystem (York and Gossard 293). Result of the study indicated that the nations with more water area consume more fish. Trondsen et al. (301-14) also reported that consumption of fish is strongly related to the availability of fresh and inexpensive fish. Their study indicated that people of the coastal Northern Norwegian region had fish for dinner every alternate day. The most common type of fish at dinner was lean fish such as cod and haddock which are available in this region. Processed fish products were the second most important product which was made from lean fish.

The reasons for eating less fish or barriers of fish consumption as found in different literatures are presence of the unpleasant physical properties such as intramuscular bones in some varieties of fish and foul smell, lack of stability of supply, quality variation, low development of fish products which can meet consumer wishes, perceived difficulty in buying, difficulty of processing and cooking fish (Verbeke and Vackier 67-82; Hulya and Aliye 87-91; Sen). According to Prell, Berg and Lena (184), the reasons for not eating or eating less fish were negative attitude towards both the smell and fear of finding bones. Less satisfaction from fish as compared to meat was another reason for eating less fish (Brunso et al. 699). Trondsena et al. (301) stated that the important reasons for not eating more fish are attributed to lack of supply of fresh fish, variations in quality, too few product variations, and high price.

Segmentization of consumers based on consumption pattern can play an important role in marketing of consumer preferred products. Market segmentation help in determining the kind of promotional devices that are effective for a particular segment which in turn helps in efficient use of marketing resources and helps in appropriate decision making relating to introduction of new products, promotion, distribution, and pricing (Papageorgiou 14). Arvanitoyannis et al. (259) in a study evaluated the Greek consumers' attitude towards wild and farmed fish in order to segment the Greek demand in terms of consumer perceptions of fish. The study identified a number of clusters based on socio-demographic and behavioural profiles of fish consumption. The results of the study indicated that the most preferred form of fish for the vast majority of the sample was fresh, whole, marine fish. On the other hand, Pieniak et al. (2010a, 448) segmented the consumers based on their consumption of and attitudes towards fish, knowledge level, interest in potential information cues about fish and finally classical socio-demographic characteristics. The segmenting variables were selected to identify specific market opportunities and formulate strategies to promote fish consumption. The study recommended the food marketers, food policy makers and health practitioners for delivering tailored marketing and communication messages and to provide specific fish information to each of the identified consumer segments.

Dijk et al. (227–34) carried out a study to identify differences in Russian consumers according to their perceptions of health risks and benefits associated with fish

consumption. The study identified four groups of Russian consumers based on difference in perceptions of personal risks and benefits associated with fish consumption.

Birch and Lawley (12-21) segmented the Australian consumers into three categories- regular fish consumers, light fish consumers, and very light fish consumers. Regular fish consumers are those who purchase and eat fish 2–3 times per week to at least once a week. Light fish consumers purchase and eat fish about once per fortnight, while very light fish consumers purchase and eat fish once per month. The empirical findings of this study revealed that perceived risks associated with fish consumption include functional, social, physical, psychological, and financial risks. Lighter fish consumers were more likely to perceive functional risk such as do not know much about how to prepare and serve fish, less familiar with preparing fish, cannot easily prepare tasty dishes from fish, not well informed about fish, do not know how to select fish, fish is not easy to prepare and serve, cannot recognize if fish is fresh. Based on these results, strategies for reducing perceived risks as a means of stimulating fish consumption were proposed.

Varieties of fish preferred were also found to be different depending on geographic and demographic profile. The detailed analysis of fish consumption by type of consumers and by individual species/product category is very less. Most of the studies on fish consumption in Asia are based on national level data held by FAO (Dey et al. 2005, 91). The study of consumer preferences for variety of fish has formed the coordination between the producer and the consumer. This market coordination has led to the emergence of a system of wholesaling and retailing (Lai et al. 289). The study conducted by Belton et al. (56-57) among consumers of Dhaka revealed that out of total consumption of fish, cultured fish constituted for 31%. Among cultured fish, Indian Major Carp, Pangasius and Tilapia accounted for three quarters of total consumption. Exotic carps accounted for only 8% of the total and climbing perch accounted for 12 %. The study indicated that smaller farmed fish (rohu, silver carp, etc.) and small capture fish ('puthi', 'moa' etc.) were the most commonly available species in rural markets, while larger farmed and wild fish were more abundant in urban markets.

According to the FAO report (FAO 2001, Fisheries Circular. No. 973, 15-17), rohu is the most preferred species of carps by consumers in Bangladesh and India

followed by catla and mrigal. Common carp was preferred by consumers in Indonesia and southern Viet Nam, followed by snakehead and silver carp. Consumers in northern Vietnam ranked grass carp as the preferred species, followed by mud carp and common carp. Chinese consumers preferred Crucian carp first, followed by grass carp and common carp. In Thailand, the preferred freshwater fish was tilapia, followed by snakehead and catfish. Freshwater fish species constitute a major share in total per capita fish consumption and total intake of fish protein constituted 15% to 53% in Bangladesh, China, India, Indonesia, the Philippines, Thailand, and Vietnam. Dey et al. (2005, 102-107) reported that silver carp and common carp are the most important species for the lower income groups in China. In India, lower income households spent a higher share of their total fish expenditure on mrigal and other exotic carp fish. There is no significant difference in the share of expenditure dedicated to carp (rohu and catla) across income groups in India, as these are the popular and most available fish across the country.

The study conducted by Bhatta (2001, 182-83) in Karnataka, India, revealed that rohu and catla are the most preferred species in both rural and urban areas. Mrigal is the least preferred fish among both rural and urban areas. P. Kumar, Dey and Paraguas (2005, 168) examined the fish consumption pattern with analysis of fish demand by species group. A household dietary-pattern survey was conducted in the states of Andhra Pradesh, Haryana, Karnataka, Uttar Pradesh, West Bengal and Orissa in the year 2002. The study revealed that the Indian major carps constituted almost half of the total fish consumption, followed by the pelagic low-value (17.6 %), fresh water carps (13.2 %), shrimps, both freshwater and marine (6.6 %), pelagic high-value (6.1 %), demersal (4.4 %) and molluscs (2.7%). The study revealed that the estimated price and income elasticities of demand vary across species and income classes. Different fish species considered in the study have been found to have positive income elasticity greater than one for all the income levels which indicates that with higher income, fish demand has been projected to increase substantially with change in the species mix. The study indicated that the fish production and consumption in India is characterized by a large number of species coming from marine and inland sources. Each species varies in commercial value, which is governed by catch and production pattern, and consumers' taste and preference.

Sugunan (7) stated that there is a differential regional preference for fish species which has good market opportunities. The study reported that magur (*Clarias batrachus*), singi (*Heteropneustes fossilis*) and koi (*Anabas testudineus*) fetch lucrative price in the eastern region of India but they are not preferred in South India. Small fishes like carp, minnows *Amblypharyngodon mola, Punitins sophore* and *Ompok spp* have high consumer preferences and high prices in Assam and West Bengal but they are not liked by people in the South. Cat fishes fetch premium prices in the North India while they do not fetch good price in other parts of the country. The study conducted by Upadhyay and Pandey (2009, 193-96) revealed that among carps, rohu (*Labeo rohita*), catla (*Catla catla*), mrigal (*Chirrhenous mrigala*), silver carp (*Hypopthalmicthys molitrix*) are most commonly consumed fish in Tripura by all income groups.

Type of preparation of fish also varies depending on demographic and geographic profile of consumers. The CRITFC Technical Report (43) revealed that most of the respondents (98.3%) of individual tribal members of Columbia River Basin consumed baked fish and 79.5% of respondents consumed fried fish. Although only 39.3% of respondents boiled their fish, 68.2% of these persons used this method at least once per month. In addition, the methods of smoking or roasting fish were used by 66.2% and 71.3% of respondents respectively, but only 41.0% of persons roasted their fish at least once per month. According to Jamdade et al. (145), the largest part of population of Kolhapur city (55.07%) preferred fish in both fry and gravy form while 36.31% preferred fish in gravy form. The study conducted by BOBP (5-13, 55-72) among the consumers of Madras (presently Chennai), India, revealed that the curry and the fried form were the preferred preparations. Curry was more popular in the lower income group, suggesting a substitution of *dal* (lentils) and vegetables with fish. The fried form was preferred more in the upper income groups. The shark is the only fish which is usually steamed and tempered. The research revealed that consumers gave more emphasis on enhancing and ensuring taste while preparing fish dishes rather than retaining the nutritive value. Again, fish recipes were felt to be fewer compared to other non-vegetarian foods.

2.2 Prospects of Marketing of fish and value-added fish

Marketing is an important aspect of any enterprise. The American Marketing Association defined marketing as "an organizational function and a set of process for creating, communicating, and delivering value to customers and for managing customer relationship in ways that benefit the organization and its stakeholders"(Kotler and Keller 5). In simple, marketing is defined as "all processes involved from the production of a commodity until it gets to the final consumer" (Nwabueze and Nwabueze 690-93). Coming to marketing of aquacultural products, Jolly and Clonts (259), in their book 'Economics of Aquaculture', defined marketing of aquacultural products as "the performance of all business activities involved in the flow of aquacultural products and services from the point of initial aquacultural production until they are in the hands of consumers". The concept of marketing calls for understanding the needs of the consumers well so that they can be satisfied. In order to fulfill consumer needs one has to study consumers and their consumption behavior in depth (Schiffman and Kanuk 22-39). Under the marketing concept, consumer is the fulcrum around which the entire marketing activities revolve (Santhakumar and Sanjeeviraj 51). An analysis of the consumer's behavior in terms of consumption patterns, consumer preferences, consumer motivation, consumer buying process and shopping behavior are helpful parameters to formulate a firm's marketing strategy (M. K. Reddy 1-9). For any business which wishes to exchange its products with customers for money or other goods, customers' requirements have to be understood and products offered which meet these requirements (Shaw 1).

In order to sustain fish farming as profitable ventures in the long run, value addition is a necessity. Value addition implies processing of the end product or addition of ingredients which increases the acceptability of the product in terms of either convenience to the consumer, or increase in shelf life. A broad definition of value addition is to economically add value to a product by changing its current place, time, or form in conformation with preference in the marketplace (Coltrain, Barton and Boland 5). Value addition means making changes in a product either in its form or place so that it becomes more attractive and convenient to customers to procure and use the product. As a result, they are willing to pay more leading to increase in the price of the product. Value can be added to fish and fishery products ranging from live fish to ready to serve

convenience products such as fish fingers, fish burgers, fish cake, fish balls, fish steaks, fish silage, etc. according to the requirements of different markets. Value addition may mean different aspects under different national background. In a poor country, even icing of fresh fish is a high level of value addition (Sharma and Sharma 69-74). Value addition to farm products can enhance farm income and provide employment in processing businesses which may play vital role for rural growth. According to Coltrain, Barton and Boland (5-17), value added product development provides excellent opportunities to stimulate economic growth in the rural sector.

Value-added products in the fisheries sector are comparatively new to the market. There are different types of value added fish. Among different value added fish, there is a great demand for live fish and they fetch maximum price compared to all the other forms of value- added products as they maintain the highest freshness. Value addition in case of live fish can be obtained in two different aspects - transferring the fish from the point of harvesting (aquatic habitat) in live condition to the point of consumption (place utility), and selling the live fish in dressed and chopped form in front of the customer (form utility). According to the report of 'the State of World Fisheries and Aquaculture'(FAO 2012, 63), preference for live or fresh-fish form was the highest with a share of 46.9%, followed by frozen fish (29.3%), prepared or preserved fish (14.0 %) and cured fish (9.8 %) during the year 2010. Gopal et al. (60-65) in a study reported that carps are preferred in fresh condition in Asian countries like China, Thailand and Vietnam.

Many studies have stated that there is immense scope for adding value to 'low-value fish' which can give product diversification as well as remunerative price to the marketers. Based on geographical area, seasonal changes in catch, and fishing methods the term 'low-value fish' has different meanings. 'Low-value fish' is used to refer to fish that have low-commercial value, mostly fish species and fish products that cannot attract foreign markets. According to Kabahenda and Husken (29), the term 'low-value fish' products refer to fish that has low commercial value by virtue of their low quality, small size or low consumer preference, and by-products from fish processing. Ahmed (2010, 15-21) studied the existing marketing systems of low-valued cultured fish in Trishal and Bhaluka sub-districts of Mymensingh district of north-central Bangladesh. The study analysed the impact of efficient marketing systems of low-valued cultured fish to enhance

nutritive food supply. The study suggested to maintain better marketing facilities, transportation, fish marketing infrastructure, institutional and organizational support, government support, extension services, more researches and public-private partnership in order to ensure efficient distribution of low-valued culture fish. The study stated that there is a need to improve marketing strategies, including all important parameters of marketing mix (production, promotion, distribution and pricing strategy) in order to develop a sustainable fish marketing systems.

The study conducted by Sehgal and Sehgal (291–93) at Fisheries Research Division of Punjab Agricultural University reported that carps have a low market value due to the presence of intra-muscular bones which results in low consumer acceptability. To enhance the consumer acceptability of the carps, three value-added de-boned fish products- fish patty, fish finger and fish salad were prepared from carp flesh and compared with a reference product ('fish pakoura'). The study on sensory evaluation of these products yielded highly encouraging results. All the three products scored higher than the reference product in terms of taste and overall acceptability. The authors opined that development of value-added products from carp flesh could play a significant role in raising the socio-economic conditions of the people associated with carp culture. Karmakar and Banerjee suggested designing and market development of ready to eat fish products like fish tikkas, kababs, sausages, salami etc. Rao and Raju (1 -14) revealed that fish sausage is very popular in Japan. In Tokyo, fishes are fried and sold to consumers in small stalls. They reported that fish biscuits and fish wafers can be manufactured and these products have already been sold in Kerela and some other states of the country.

Species diversification is also a part of product diversification. It is a fact that Indian major carps and Chinese carps form the major component of Indian aquaculture. But cultures of some other species have also shown good results. The study conducted at Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar, India on seed production and culture of other medium carp and barb species have shown promising result in terms of compatibility with major carps as well as in increasing the biomass. These medium carps have initial higher growth rate and market acceptability at smaller size of 300-400 gm for which they are ideal species for intercropping in the major carp farming system, particularly during the initial six months of farming. Air-breathing

catfishes like magur and singhi are also being cultured in ponds with Indian major carps. Two species of murrel have been identified to be potential candidates for cage aqua farming for their higher growth potential in the system (Jayasankar and Das 54-59).

Price of fish is an important aspect of marketing. Price has a major effect on the types and quantity of fish that people buy. Price of fish highly fluctuates due to its perishability, seasonality in production, species diversity, consumer's choice and preferences, ignorance of fish producers/marketers about efficient marketing systems etc. Hence, price is a major concern of fish producers. Break-even points and profit margins are determined by consumer demand and the availability of products to satisfy this demand (Northeastern Regional Aquaculture Center 23).

Place refers to the methods of distributing finished products from the manufacturing unit to the final consumer. This involves transportation and storage of fish till they are availed by the customer. Choosing the right distribution path makes a major contribution to successful marketing. At present, restaurants and super markets are important places where customers find opportunity to purchase and taste different types of fish and fish products. Supermarkets offer one of the best places to sell larger volumes of fish products (Swann and Riepe 5). Logar et al. in a study expressed that consumers considered restaurants as the number one location where they try new fish and fish products for the first time. The study clearly indicated that supermarkets can play a critical role in educating the consumers about fish and fish products. Arvanitoyannis et al. (260-61) revealed that Greek customers purchased fish over the supermarket counter due to convenience and they prefer to buy whole, fresh fish. Their study estimated that 80% of the quantity of fish consumed domestically was distributed through wholesalers to cities' central fish markets or local fishmongers and the remaining 20% through supermarket chains.

Meira, Engle and Quagrainie (231-47) assessed the potential for increasing sales of farm-raised tilapia through the domestic restaurant market in Nicaragua. Direct personal interviews were conducted among 118 restaurant managers selected at random from telephone directory. The study revealed that the older restaurants offer a variety of food prepared out of tilapia on the menu. This study demonstrated some ways to develop

a restaurant market for farm-raised tilapia in the country and identified those types of restaurants that would be best to target in a marketing campaign.

Fish marketing is simple in small- scale rural aquaculture where the producers sell fish directly to the consumers. This practice exists especially in developing countries like India. Fish and fish products have to be distributed in fresh condition as far as possible as consumers prefer freshness of fish and fish products. In highly dispersed and distant markets, it is not always possible for producers to distribute fish themselves. So involvement of marketing intermediaries in the process becomes necessary, even though this results in higher retail price and/or lowering the profit margin of the producers (Pillay and Kutty 274-83). The marketing channels of freshwater fish are, by and large, similar across the country. Fishers sell their fish to wholesalers directly or through commission agents and retail intermediaries. Wholesalers sell fish to retailers either through commission agents or directly. Fish marketing through cooperatives and public fish marketing corporations is very limited. Even in the case where fishers sell fish to cooperatives, private intermediaries are also involved in the marketing chain. In some cases, cooperatives become an additional intermediary in the marketing channel. In case of cultured fish, subsistence level production is consumed locally while commercial scale production is invariably sent to urban centers. There is involvement of three to four market intermediaries in commercial fish marketing. Fish farmers sell their fish to a fish trader who in turn transports the fish to urban markets, where it is disposed through auction to a wholesaler. The latter sells the fish at auctions to a retailer. In the case of export of fish products, only a few intermediaries such as an auctioneer, a fish trader-cum-preprocessor and the final processor are involved in the marketing channel. In some fish marketing and export centres, fish is directly delivered to the processor-cum-exporter at a predetermined price. Intermediaries such as auctioneers and agents are also involved in certain states such as West Bengal, where auctioneer-cum-financier-cum-preprocessor and selling agents are involved in the marketing channel between farmers and processor-cum-exporters (FAO 2008, 8-12).

In different parts of India fishes are generally marketed through the market channels having five or less intermediaries. Fishermen's net share gets reduced with rise in number of middlemen in the market channel (Reddy and Prakash 49). Suresh et al.

(43) studied the marketing channels involved in farmed carp marketing in Thanjavur and Thiruvaur districts of Tamilnadu. Raghuram and Gurunathan (24-27) revealed that transaction of fish through Producer-wholesaler-retailer-consumer in Tamil Nadu was more expensive compared to the channel Producer-village trader-consumer and the producer's share in consumer's rupee is 80% and 67% respectively in channels Producer-wholesaler-retailer-consumer and Producer-village trader-consumer.

G. Kumar et al. (345-54) identified fish marketing channels prevalent at Howrah fish market as the following-

Channel I: Fishermen → Fish collector/local dealer → Auctioneer →

Wholesaler → Retailer → Consumer

Channel II: Fishermen → Auctioneer → Retailer → Consumer

Channel III: Fishermen → Wholesaler → Retailer → Consumer

However, (Roy 425) identified three different fish marketing channels in Dakshin Dinajpur district of West Bengal

(i)   Fishermen → Consumers,

(ii)   Fishermen → *Beopari* (small trader) → *Aratdar* (big wholesaler) → *Paikar* (small scale wholesaler)/Retailer → Consumers

(iii)   Fishermen → *Aratdar* (big wholesaler) → Retailer → Consumers.

The study revealed that the length of marketing channel for freshwater fish was relatively small due to non-existence of value addition/processing. This led to a higher share for the producer in the study area. The study suggested some measures for development of production and marketing of fish such as proper provision of credit to the poor and small fishers, ensuring availability of good seed, maintaining minimum size of pond through cooperative/group approach, maintenance of water quality and up-gradation of environmental aspects, higher investment for development of market infrastructure (e.g. road, transport, grading, weighing, icing, shelter, electricity, etc.), and initiatives for processing/value-addition activities as per the choice and demand of the consumer. The study concluded that to facilitate access to scientific fish production techniques and efficient marketing system for the poor fish farmers in the district, the Government, NGOs, private entrepreneurs, extension functionaries, research institutions, local governance, financial organizations, and marketing agencies should come forward.

G. Kumar et al. (2010, 105-113) studied the marketing channels for Indian Major Carps. The study revealed that carp marketing channel was most efficient at the Coimbatore market, followed by Hyderabad, Bhubaneswar, Howrah and Mumbai markets. Four marketing channels exist within the state Andhra Pradesh through which only 5 percent of fish is marketed. They are

.Channel- I: Producers → Consumers (negligible quantities)

Channel- II: Producers → Wholesalers →Retailers →Consumers (2%)

Channel- III: Producers →Wholesalers →Vendors →Consumers (2%)

Channel- IV: Producers → Retailers →Consumers (< 1%)

The Marketing channels for other states where 95% of fish is marketed mainly to eastern, north-eastern and southern states are-

Channel- I: Producers →Local traders →Other states (Tamil Nadu, Kerala, Karnataka,

Maharashtra)

Channel-II: Producers →Brokers →Traders (Packers) → Other states (West Bengal,

Bihar, Assam, Tripura and Nepal)

Channel -III: Producers → Local traders → Traders (Packers) →Other states (West

Bengal, Bihar, Assam, Tripura and Nepal)

Channel- IV: Producers → Brokers →Traders (Packers) → Local traders →Other states

(Tamil Nadu, Kerala, Karnataka, Maharashtra)

After reaching respective states, fishes are again distributed in different marketing channels mainly through Dealers →Wholesalers →Retailers →Consumers.

Marketing White Paper, 2005, commissioned by the Board of Directors for the North Central Regional Aquaculture Center (NCRAC) of United States revealed that live fish were sold directly to the consumer which fetched usually the highest price but required more time and interaction with the public. The study suggested for low cost production and marketing of consumer preferred fish/fish products. The study emphasized that the producers should efficiently coordinate or integrate with processors and wholesaler/retailer so that farmed fish is produced and distributed at the right quantities, to the right locations, and at the right time (Peterson and Fronc 2-9).

Most of the marketing channels are not suitable to trade value added production (Maqsood et al.). It is argued that super market chains must be considered as a new and

an appropriate channel for marketing of these products. In case of value added fish products, marketing is dynamic, sensitive, complex, and expensive and most of the marketing channels prevalent in India are not adequate to undertake sales of value added products in a sustainably profitable manner (Pedro, Barb and Candelaria).

Promotion, from a marketing perspective, consists of four interrelated activities- advertising, sales promotion, personal selling, and publicity/public relations. Most people equate marketing with sales or advertising, two of the sub-areas of promotion when in fact, marketing strategy's focus is on managing the relationship between product, price, place (distribution) and promotion to meet consumer needs (NRAC 29).

Fish marketing processes are inherently complex with interaction among fishermen, processors, merchants and family consumers (Bhatta 2008, 3). In such a situation, efficient marketing system can play an important role in maximizing the return from fish culture. An effective marketing system is required to ensure the supply of fish to consumers in good condition at reasonable prices, at right time and place. Marketing system not only provides remunerative price to the producers but enhances consumer's satisfaction also. Market is one of the crucial driving forces to sustain fish production in future, along with advancement of technology and infrastructure (G. Kumar et al. 2010, 105- 6).

Unlike many other research issues, fish marketing researches in India have been based largely on case studies (Bhatta 2008, 3). Katiha and Chandra (21-24) evaluated operational and pricing efficiency as measures of fish marketing efficiency in Allahabad fish market. The study revealed that the markets had all the characteristics of perfect competition. The fishermen were price taker as their catches were too little of the total market arrivals to influence the market price.

G. Kumar et al. (2008, 345-54) studied the domestic marketing of fish in India covering all the major coastal states and some selected inland states. The role of market intermediaries, major marketing channels, structure of fish markets, viz. fish landing centers, wholesale / retail fish markets and fish retail outlets, and current policies relevant to fish marketing in India have been analyzed. The marketing efficiencies for Indian major carps (IMC), sardine and seer fish have been found to vary from 34% to 74%, depending on the length of market channel. The marketing efficiency was more in the

case of marine species than freshwater species and it was due to the fact that freshwater fish had to be carried longer distances from the point of production to consumption centre and have to pass through many intermediaries as compared to marine fish.

The system of fish marketing in India has traditionally been highly unorganized and unregulated, which is the prime cause of inefficiency in the whole process (Sugunan 7; G. Kumar et al. 2010, 495-504). Auction markets are most common for fish marketing which is believed to ensure best competitive price for the producers and customers. But G. Kumar et al. (2008, 345-54) stated that fish trading starts with the auction system which is highly unorganized and unregulated in most states of India. In this marketing system, there is a financial barrier for entry of any new professional into it. In order to ensure better price by fishermen in the auctioning process there is a need of regulation by the cooperative federations, as in Kerala. The study suggested that transportation and storage of fishes need to be facilitated by creating and maintaining the needed infrastructures such as approach roads to landing centres/fishing villages/pond-river-reservoir sites from the main markets, establishing cold storages at major collection points, ice factories, etc. can facilitate better marketing of fish. Chand and Das (53-54) gave an account of basic requirements for an organized fish market. They specified the essential infrastructure facilities needed for an organized market.

Ayyapan and Krishnana (392-412) and G. Kumar et al.(2010, 105-13) studied the fish marketing system prevalent in Kolleru Lake area in Andhra Pradesh. It is a prominent carp culture area and is also known as the 'Carp Pocket of India'. The study compared the marketing system of Kolleru Lake area with marketing system of Indian Major Carps (IMC) in other major aquaculture states like West Bengal (Howrah market), Orissa (Bhubaneswar market), Maharashtra (Mumbai market), Tamil Nadu (Coimbatore market) and Andhra Pradesh (Hyderabad market). Comparisons and analysis of the marketing channels, market intermediaries, price spread and marketing efficiencies, revealed that the price spread for IMC from Kolleru was highest at Mumbai and lowest at the Coimbatore market. Fishermen's share in consumer price on the other hand was highest at Coimbatore (61.54%) but lowest at Mumbai (47.06%). Marketing efficiency was highest at Coimbatore (2.60) whereas lowest at Mumbai (1.89).

A research study on 'Exploring Market Opportunities for Fisheries Sector in India' was undertaken by National Centre for Agricultural Economics and Policy Research (411-12) during the year 2008 in different parts of the country, especially in major maritime states like Tamil Nadu, Andhra Pradesh, Kerala, Karnataka, Orissa, West Bengal, Maharashtra, Gujarat and some inland states like Assam, Tripura and Delhi. The study suggested some strategies such as promotion of Producer companies, Fishermen societies, Self Help Groups in order to have better bargaining power in the auctioning or selling process to the next intermediary in the value chain in fish marketing. It also suggested training in Responsible Fisheries/Good Harvest and Management Practices to the fishermen/aquaculturists, and grading and branding for achieving better price in the market.

The fishers in most part of India have to sell large quantities of fish catch from *beels* and reservoirs at low price to local fish merchants. When these catches reach the retail outlet in cities, the price multiplies many times and consumers seldom get the fish of their choice at affordable price. Inland fishers get just 30% or less of the price paid by the consumers. Many times, the local fisher groups or marchants do not have the capacity to store fish or transport it in good condition to distant markets. Strategies for improvement of domestic marketing such as good market infrastructure, research support for development and commercialization of value-added products, government support in the form of policy, institutional and legislative instrument etc. have been suggested in the study (Sugunan 7).

Sathiadhas, Narayanakumar and Aswathy (125-31) stated that rapid economic growth and expansion of domestic retail sector in India had created a significant market for fresh and processed fish and fishery products within the country. According to Mugaonkar et al. (133), there is a slow transformation of unorganized fish retail marketing into an organized marketing and it is visible through the entry of private retailing giants like Spencer's, Reliance Retail, etc. The study further reported that more and more new companies are entering into the organized fish retailing and these include private sector companies like Foodland, Aditya Birla's More, Tata's Star Bazar, Spinach, etc. In the public sector, the Tamil Nadu Fish Development Corporation Ltd. (TNFDC). '*Neidhal*', a government organization engaged in retailing of fish in Chennai is very

popular among the fish consuming public since fishes here are available at a very hygienic environment, operations are transparent, weighing is done in electronic balance, prices are lower than that prevailing in conventional fish markets, and dressing is done by trained personnel so that the consumers can get fillets and steaks. In Kerala, MATSYAFED has a chain of outlets under the name 'Fresh Fish Point'. Reliance procures fish directly from Andhra Pradesh to a centralized location (hub) near the outskirts of Bangalore. The fish outlet in each of the 24 Reliance malls in the city reports to the hub about their next day's requirement. By adopting this model, Reliance has gained control over its supply of fish. Each of the Reliance or Spar outlets in Bangalore sells about 50 to 150 kg of fish every day (Tara et al.). Tara et al. designed an integrated marketing strategy and an effective branding strategy to increase the sale and improve the profitability of the fisheries business in Karnataka. They designed a logo in order to communicate to the consumers that a product with great quality and hygiene is available for ready use as opposed to products sold from unhygienic local retail outlets. The brand name given by them was 'Matsya'. Some promotional strategies for marketing of 'Matsya' to communicate the right information to the right people at the right time have been given in the study.

The West Bengal State Fishermen's Co-operative Federation Ltd. (BENFISH) plays an important role in marketing of fish and value added fish in West Bengal. It has mobile and stationary counters to sell various ready to eat products. BENFISH has set up a modern Fish Processing Centre at Salt Lake for processing of raw fish and preparation of various value added fish products. IFB (Agro Industries limited) prepares ready to cook products and these products are available in sub urban areas also. 'TRIVENI' supplies variety of fishes to hotels and restaurants on contract basis. Their products are not available in stores. They prepare itemized value added fish product for specific consumption (Food Processing Industries Survey, West Bengal).

Vrutti Livelihood Resource Centre developed a marketing strategy for livelihood promotion of poor fishermen households in two districts, Tikamgarh and Chhatarpur of Madhya Pradesh through a value chain based assessment and planning. Vrutti is a part of Catalysts Group of Institutions, working in the social development sector in India, South East and South Asian Countries. The study indicated that with direct linkage between

local producers and consumers in the project area through retailers, the current value chain can be shortened. The gains through shortening of value chain can benefit fishing communities/producers and retailers. The study recommended some approaches like facilitating marketing of fish at cooperative level such as on site sale to retailers, on site sale to traders, bulk sale to wholesale traders in local town market including Jhansi, Lucknow and Gorakhpur markets. The core strategy focuses on selling fresh carps on site to retailers and traders at competitive price based on floor price/auction. The study opined that this strategy requires proactive sharing of harvesting plan (date/time, quantity, floor price) with traders and retailers and technical training on scientific harvesting, handling of fish, icing and smoking, on management skills like planning, enterprise management, negotiation, market facilitation skill etc. for the stakeholders (Vrutti, Livelihood Resource Centre, 1-35).

Fish marketing is a lucrative trade in the economy of Assam as it is a preferred food item of 95% of the State's population. M. Goswami, Satbiadbas and U. C. Goswami (146-55) studied the prevailing fish marketing systems in Darrang, Kamrup and Nagaon Districts of Assam. The study indicated involvement of large number of intermediaries in the distribution process of fresh fish. Women are also involved in the retail trade in the markets and door to door sales in some selected parts of Kamrup District. The study suggested the need of a well organized marketing network for distribution of fish in the state at reasonable price.

The National Institute of Agricultural Marketing (NIAM) has been conducting comprehensive Market study of Agricultural Sector of Assam Rural Infrastructure and Agricultural Services (ARIASP) since August 1988. NIAM's market study of fisheries in Assam ascertained the efficiency of the present fish marketing system in Assam and the role played by the different stakeholders. According to this report, marketing of fish has been facing many problems such as greater uncertainty with fish production, high perishability, scattered landing centers, too many species variations and as many demand patterns, frequent fluctuation in price, transportation requirement etc. The study recommended construction of auction platform in the rural markets, establishment of "Fish Farmers Marketing Support Unit" providing 'fish carrying van', and storage facilities in all the municipality markets (National Institute of Agricultural Marketing).

2.3 Constraints of production and marketing of fish and value-added fish

Production of consumer preferred varieties of fish and fish products have been facing several constraints. Identification of potential constraints is important for growth and development of fisheries sector. The constraints of production and marketing have been examined by a number of researchers in India and abroad.

Constraints of fish pond farming among Kenyan rural farmers were identified as lack of suitable soils, supply of quality water, high water evaporation, high cost of excavation of fish ponds, lack of supply of fingerlings, seasonal variations, uncoordinated government information and training-extension services etc (Shibanda 408-12). Brummett, Randall, and Williams (193 -203) reviewed the development and constraints of the expansion of aquaculture for economic and rural development at the continental, national and farm levels in Africa. The main constraints to the development of commercialized and productive aquaculture sector in Africa were poor infrastructure, small government budgets, sudden change of input prices and supplies, political instability, poverty of consumers and lack of local expertise. Analysis made in "Markets, Marketing and Production Issue for Aquaculture in East Africa - the case of Uganda" by Jagger and Pender (42-51) indicated that that lack of extension staff and infrastructure to deliver technical knowledge about aquaculture to rural small holders were the main constraints towards aquaculture development in Uganda. In addition to these, water hyacinth infestation created significant problem that threaten most of Uganda's waters.

The constraints of aquaculture development in Nigeria were shortage of fingerlings and feed, lack of pond management knowhow, inadequate funding, and poaching (Anetekhaia et al. 237-48). Akpabio and Inyang (45) identified fifteen constraints affecting aquaculture development in Akwa Ibom State, Nigeria of which three constraints were more serious. They are inadequate supply of fish fingerlings, high cost of fish pond establishment, and lack of awareness of available innovations. Akpaniteaku, Weimin and Xinhua (28) reported that the main constraint of aquaculture in most of the developing countries is the shortage of quality fish seed. Adeogun et al. (21-27) investigated producer perception on fish farming practices in Lagos State, Nigeria and found that the most common constraint was the lack of technical know-how. Other constraints were high cost of inputs, lack of adequate information on aquaculture

techniques and marketing, lack of capital etc. The study conducted by Kudi, Bako and Atala (17-21) in Kaduna state of Nigeria revealed that 98% of the respondents faced the problem of non-availability of capital whereas 82% of respondents faced problems in marketing, 57% in outbreak of disease, and 21% in water supply problem. Fish production was affected positively through effective delivery of fingerlings/juveniles and feeds to the fish farmers. Lack of organized fish marketing system was reported as marketing problem that constrained sell of live fishes at the farms. Ibrahim and Mohammed determined the role of women in homestead fish farming in Nasarawa state, Nigeria. It revealed that the major constraint of women involvement in homestead fish production was inadequate capital, followed by the pre-occupation in other household routine tasks. The study recommended the provision of training for women on feed formulation, raising fingerling, disease control, and linking women in the study area with micro-finance banks in order to obtain credits. According to Wetengere (2011, 146), perceived problems of fish farmers in Tanzania were high animal predation and human theft, high probability of ponds being washed away by floods, poor growth of fish, death of fish or fingerlings, rotting of fish due to poor preparation and preservation methods, low market and poor marketing channels, and purposeful poisoning of ponds.

Wetengere and Kihongo (2012, 107-17) examined the constraints in accessing credit facilities for fish farmers in rural Morogoro, Tanzania. The study revealed that the level of credit use was very low in the study area. The main constraints to credit access were lack of information, unfavorable terms, lack of support services, and illiteracy. The study suggested strategies to overcome these aspects such as providing information to rural farmers on the availability and management of credit, dealing in constraints hindering rural farmers from accessing credit facilities by the government/lending institutions/other stakeholders and identification of zones where most fish farms concentrate and high potential of success exist to reduce the risk and administrative costs of managing loans from financial institution.

Lee (65-71) identified constraints of aquaculture production in the developing countries and categorized them as natural and environmental (inequitable allocation of land resources, insufficient quantity and degraded quality of water, highly seasonal variation in temperature and natural disaster); socioeconomic (insufficiency of infrastructure for production and marketing, variation of prices of inputs, ageing and poor training of aqua-farmers); and institutional constraints (inefficiency of extension services, lack of a better organization of producers, shortage of rural finance). To overcome these constraints, the suggested strategies includes structural adjustment, better market management and effective institutional programmes intervened by the Government. Structural adjustment through establishment of cultivated areas, strengthening of early monitoring systems and acceleration of technological change were suggested to promote aquaculture development. For effective market management it proposed shortening marketing margins and transmitting market information to the producers and for institutional improvement, better organization of producers, better extension services and effective aid of rural credit.

Steinbronn et al. studied the constraints in fish production in Yen Chau district of Son La Province, Vietnam. The typical pond system in the study area was utilized for polyculture of grass carp, other carp species and tilapia. The study revealed that the main problem of pond farming were lack of training or extension services in the field of aquaculture, frequent outbreak of disease, poor quality of the seed, application of pesticides in paddy fields (which ultimately come to fish pond), shortage of water while irrigating the paddy fields, low water temperatures during the winter, and limited supply of feed resources in the cold dry season.

Liao and Chao (564-69) studied the constraints in the aquaculture industry of Asia- Pacific region. Constraints faced by aquaculture industry included competition for land and water with other industrial sectors, insufficient aquaculture engineering for land-based and off-shore aquaculture, unpopularity of automatic devices for super intensive aquaculture and post-harvest processing, high prevalence of disease outbreaks and natural disasters, and complete dependency of farmers on government aids.

Common constraints faced by freshwater fish farmers in Bangladesh and India, are plurality of ownership, lack of credit facilities, lack of technical know-how, illegal poaching, deliberate poisoning, inadequate marketing opportunities, non-recognition of aquaculture as a land-based activity, absence of long-term leasing policies, and non-assurance of seed supplies at appropriate times (FAO 2001, v). Dey et al. (2005, 11-37) reported that freshwater fish farming is generally profitable in Asia but fish culture practices in most of the Asian countries have some constraints.

Alam and Thomson (297–313) identified the problems against the fuller utilization of potential of Bangladesh fisheries sector. They reported that resource limitations, poor implementation of fisheries laws, limited spread of fish farming technology, low financial capacities and ineffective extension practices were the main factors responsible for the under-utilization of fishing areas. Mohsin and Haque (30-33) studied the constraints of carp production in Rajshahi district of Bangladesh. The study revealed that 34% farmers perceived financial crisis as the prime constraints for the carp farming followed by adequate availability of seed (25%), feed (14%), high mortality rate of fry (11%), poaching (6%), poisoning of pond (4%), scarcity of sufficient water (4%), and disease incidence (2%). Sarkar, Chowdhury and Itohara (68-73) analysed entrepreneurship barriers of pond fish culture in Mymensing district of Bangladesh. Their study revealed that lack of technical knowledge on pond management, unavailability of credit, poor extension service and lack of information were the potential barriers of pond fish culture entrepreneurships.

Ahmed et al. (2012, 51-70) carried out a study in order to develop sustainable tilapia marketing systems in Bangladesh. Constraints in marketing of tilapia, as perceived by the farmers were inadequate knowledge of marketing systems, low market prices, exploitation by intermediaries, and lack of infrastructure. Other constraints were higher transport costs, insufficient supply of ice, unhygienic conditions, lack of financial support, lack of credit facilities, and poor markets infrastructure, lack of standard practices for handling, washing, sorting, grading, cleaning and icing of tilapia. The strategies formulated in this study were- creating provision for capacity building for the development of stakeholder organization, government institutions for technical advice and support on marketing, proper market infrastructure, encouraging involvement of

appropriate NGOs, and the implementation of a management plan to address existing constraints.

The constraints for growth of small-scale fresh water fish culture in India are lack of basic inputs, poor fisheries extension mechanism, poaching, conflicting interests with regard to water use between agriculture and aquaculture, short lease period, inadequate institutional finance, lack of infrastructure facilities like cold storage, good approach roads from production sites to marketing centers, and quick transport facility etc. (Sinha and Ranadhir 526-38).

Occurrence of trash fishes and weeds, fish disease, and poaching are the major constraints of fish production in Tirunelveli district of Tamilnadu (Selvaraj 25-30). V. Kumar and Selvaraj (63-69) conducted a socio-economic study on composite fish culture in five districts of Tamil Nadu and categorized the constraints as production, management, and marketing constraints. Production constraints were related to availability and dearness of inputs like seed, fertilizer and labour. Untimely supply of fish seed was a major constraint faced by majority of the respondents. The management constraints were associated with predators, weeds, trash fish and poaching. Unremunerative price, lack of transportation, tied sale and spoilage were included in marketing constraints.

Padhy (9-10) identified constraints of fish culture in Birbhum district of West Bengal and categorized them as environmental and situational constraints, lack of technological intention, and socio-economic and infrastructural constraints. Environmental and situational constraints included occurrence of flood, drought and weeds. Inadequate availability of inputs such as feed, credit, transportation cost and returns, management, trained extension services, marketing, and astorage facility were included under socio-economic and infrastructural constraints.

Chakraborty (92-95) identified technological constraints of inland fish cultivation in 24 Parganas (North) district of West Bengal. The study examined and identified the gaps between potential and actual yield and real problems so as to formulate future programmes for increased fish production in inland sector. The yield rate of beneficiaries belonging to the Fish Farmers Development Agency (FFDA) schemes was significantly

higher (1650 kg/ha) than that of non-FFDA farmers (613 kg/ha), although this was less than the potential yield (2500 kg/ha/yr) for FFDA schemes.

Perceived problems of composite fish culture in 4 districts of West Bengal studied by Bhaumik and Saha (348-59) revealed that the major perceived problem in adoption of composite fish culture was high cost of inputs followed by poaching, poisoning, high rent of water body, lack of follow- up action, marketing of harvested fish, non availability of subsidy, non- availability of finance, multi ownership of water body, stagnancy of capital, and non-achievement of expected results. The study stressed upon development of low cost package of practices on the lines of single stocking- multiple harvests or multiple stocking-multiple harvest.

Srivastava (310-25) identified some of the constraints and problems faced in freshwater aquaculture development in India. Non-availability of quality fish seed of commercial species in adequate quantities at the right time, absence of cheap and acceptable supplementary feeds, difficulties in mobilizing institutional finance and credit for small fish farmers, low price realization by the producer due to the poor market structure and absence of uniform leasing policy in different states were reported as main constraints in the study.

The SWOT analysis carried out by Radheshyam (11) with participatory efforts of farmers revealed some important weaknesses in community based aquaculture in India. The major constraints were poor organizational capacity among rural farmers due to personal disputes, non existence of capable community leader, lack of infrastructures, weak research-extension support, low technical awareness, and dual leasing policy with short leasing period.

Investigations of Sasmal et al. (134-42) in Dharsiwa Block of Raipur District revealed constraints perceived by the fish farmers for adoption of recommended composite fish culture technology such as high cost of pond preparation, eradication of weeds, lack of knowledge, lack of efficient marketing structure, and restriction posed by the village community regarding the use of some of aspect of recommended technology. Maximum fish farmers were adopting the traditional practices of fish farming instead of recommended technology.

Meena, Prasad and Singh (1-5) investigated the constraints perceived by rural agro-processors of Punjab to adopt post-harvest technologies and categorized the constraints as socio-economic, technological, farming, marketing, and extension aspects. Socio-economic, technological and farming constraints were more important than extension and marketing constraints. The suggested measures for removing the constraints were appropriate policy interventions for boosting-up the rural agro-processing sector.

Abraham et.al (41-48) studied the aquaculture practices of Andhra Pradesh and West Bengal and revealed that majority of the respondent farmers of the two states cultured carps. But there were differences in farm holdings, size of the pond/farm, species cultured, stocking rate and stocking density, fish seed procurement policy, nursery management, feed and feeding rates, pond fertilization, harvesting frequency, mode of fish marketing, source of information on aquaculture, fish seeds and disease treatment, and perceptions on aquaculture practices. The major constraint faced by farmers of Andhra Pradesh and West Bengal was incidence of fish diseases. Other constraints included fluctuation of market price, irregular electricity supply, poaching, declining production, poor seed quality, floods, financial problem, siltation etc. The magnitude and impacts of these problems were different among the farmers of both the states. The study concluded that in order to enhance fish production from culture systems a strong commitment from Government organizations and research institutions in the form of more training and extension services were urgently needed.

Mohanty et al. (139-45) identified the major constraints in adopting/developing participatory agri-aquaculture in three different watershed sites in Orissa through preferential ranking technique and delineated as many as nine constraints. Those were lack of awareness and technical knowledge, high feed cost, low water depth in summer, lack of interest, priority to domestic use, and non-availability of fingerlings in time. The study suggested putting efforts to improve marketing of produce through information dissemination on prices and nutritional value among vulnerable groups; improving road access to urban markets to ensure better price, formation of marketing groups, and providing information on preservation and storage.

The status of freshwater aquaculture resources in Boudh District of Orissa was investigated by Chattopadhyay et al. (20-23) which identified some constraints faced by fish farmers such as unavailability of desired quality and quantity of fish seed, poor water retention capacity (6-7 months) of the pond, high rate of evaporation, high lease value, lack of technical knowledge among fish farmers, aquatic weed infestation, and presence of predatory fishes.

Unavailability of quality seed, inadequate technology transfer, lack of private entrepreneurship, lack of infrastructure facilities, low temperature regime, complex land ownership patterns, small fragmented land holdings etc. were the main constraints of development of fish culture in North East India (Munilkumar and Nandeesha 399-412). Major constraints in fishery sector of Tripura were identified as genetic degradation in fishes due to inbreeding in hatcheries, lack of diversification of culture fisheries research facilities, soil and water quality mapping, and recurrent flood (Barman and Mandal). Singh et al. (185-95) assessed the technical efficiency level and its determinants in small-scale fish production units of West Tripura district. Primary information collected from 101 fish farmers of three blocks through a multi-stage random sampling method revealed that farmers were not getting quality fish seed. The middlemen were the source of fish fingerling supply to the farmers who made it available as a mixture of different species and different size. Farmers had no access to other assured sources of quality fish seed. All these constituted a low technical efficiency level, whereas those farmers who purchased fingerlings from the government firms enjoyed better technical efficiency. The study suggested that the State Government needs to play a role to ascertain the supply of quality fish fingerlings adequately and timely to ensure the technical efficiency of the culture systems.

Non-availability of inputs, disease outbreaks, inadequate financial and extension support, and frequent flood problems were some of the constraints limiting the productivity of fish in Assam (M. Goswami and Sathiadhas 2000, 29-32). M. Goswami et al. (2002, 103- 110) conducted a study on socio-economic dimension of fish farming in two districts of Assam, viz., Darrang and Nagaon during the period 1998-2000. Only 16.67% of the respondents of Darrang and 25% of Nagaon had fishery as a major occupation. Majority of the respondents did not receive training on fish culture practices.

The percentage of trained respondents in Darrang and Nagaon were 25% and 20%, respectively.

The SWOT analysis of fishery enterprises, carried out by Agricultural Technology Management Agency (ATMA), in 2006 revealed some weakness of culture fishery in Nagaon district of Assam. They have been identified as low water retention capacity of the soil, occurrence of flood, dominance of aquatic macrophytes, unregulated retail fish markets, lack of storage and preservation facilities, non-streamlined institutional finance, exploitation by market intermediaries, subsistence nature of fish farming, imbalance use of organic and chemical fertilizers, non availability of quality fish seeds, non-availability of large size fingerlings, and poor soil and water management (Agricultural Technology Management Agency, Nagaon 146-47). In addition to these constraints, poor extension machineries, low pH value of soil and water, lack of proper marketing channels, lack of credit, lack of entrepreneurship, social taboo, natural calamities etc are some of the problems of fish farming in Assam (Kalita, Bhagabati and Dutta 9-11).

The adoption behaviour of composite fish culture practices was positively influenced by the factors like extension participation, economic motivation, cosmopolitanisms, scientific orientation and knowledge of fish farmers, and negatively influenced by their age (Talukdar and Sonataki 12-17). The study recommends that efforts should be made by extension agencies through various programmes to highlight the economic benefits of composite fish farming to promote large-scale adoption of this technology. Study tours, exposure visits, participation in fairs and exhibitions were recommended as the ideal methods for promoting adoption of composite fish culture. This study was carried out in Sonitpur district of Assam.

There is a good market demand for endemic fish species like magur (*Clarias batrachus*), singi (*H. fissilis*), koi (*Anabus testudineus*), Pabda (*N. notopterous*) etc. in North-Eastern parts of India (Sugunan 7). But the culture practices of these species have not received much attention due to lack of standardized package of practice of culture of these varieties. Das (2002, 19-21) revealed that inadequate supply of seed and proper feed hinders the culture of magur in the area. Again, there is good demand for the snakehead, *Channa striatus*, commonly known as striped murrel and locally known as

'*sol*' in Assam. But the culture of murrels in Assam is still not common due to the lack of seed supply (Marimuthu et al. 21). Proper technologies for captive breeding of such other alternate potential commercial fish species are necessary to diversify the culture systems for better economic returns.

Several constraints related to distribution of fish and fish products have been identified by different studies at different times and places. Fish marketing is not an easy task as it has to face many peculiar and special problems at different stages of production and marketing management. Some of the specific problems of marketing of fish are greater uncertainties in fish production, the high perishability of fish, collection of fish from too many scattered landing centres, too many varieties of fish and therefore too many demand patterns, wide fluctuation in prices, lack of proper transportation of fish etc.(Rao 197-64). According to FAO Fisheries Circular No. 973 (FAO 2001, 25-26) major constraints of fish marketing were bad transportation system, poor bargaining power, high marketing margins, low institutional credit for production and marketing of fish etc. The study reported that credit was provided by market intermediaries to the marketers as well as to the producers and force them to sell their produce. But the credit supplier often paid less than the market price. The report concluded that sustainable development policies are needed that could address issues related to use of natural resources, research, pricing, credit, trade, investment, and exchange rates.

Nine markets in the Southern Region of Malawi, Africa were studied by Brummett (243-51). Lack of proper refrigeration facilities both in urban and rural markets and lack of proper transport or storage facilities in rural areas were the major constraints of marketing in the study area. The study indicated that due to lack of availability of preferred species and sizes at the fish landing sites or at local wholesale outlets, 41% of retailers of urban market were compelled to sell fish varieties which were not desired by them.

The study of Njai (1-28) revealed that fresh fish were not readily available in rural markets (inland markets) of Gamibia due to the shortage of ice and lack of refrigeration facilities. Therefore, most consumers in these areas get access mainly to cured fish. The study emphasized on the improvement of the quality of fish through technological

advances which would reduce post harvest losses and utilize the country's resources to their full potential

The major constraints for both domestic and export markets in Cambodia were inadequate facilities for handling, sorting, weighing and packing fish, and lack of storage facilities and preservation equipment or materials (e.g., ice, ice-crushing machines, ice boxes, freezers, salt) at landing sites (Mohammed et al. 4). According to them due to lack of modern equipment or production methods, small and medium-scale fish processing operations were unable to adopt quality control measures and hygiene standards.

The study carried out by Chea and McKenney (19-20) on fish marketing from Great Lake to Phnom Penh revealed that most fishers are in a weak price negotiation position since they are compelled to sell their produce to the trader with whom they are in debt. The lack of transparent interest rate on loans for fishers is another constraint identified in the study area. Lenders are likely to take advantage of this lack of transparency to increase returns on their loans. The study further indicated that fish marketing is affected by a number of other constraints such as high financing costs, spoilage and weight loss, monopolistic control of distribution, high transportation and ice costs, and fees charges along the road during transport.

The marketing constraints identified by Ugwumba and Okoh (73-78) in case of catfish marketing in Anambra State, Nigeria were lack of market information, poor market structure, high cost of transportation, low income of the farmers etc. The study stated that operational efficiency and marketing income could be increased through good provision of infrastructural facilities such as provision for water supply, good roads and cheap means of transport. The problems of fresh fish marketing in Oshimili South Local Government Area of Delta State, Nigeria were seasonality, scarcity, poor means of transportation, lack of suitable containers, inability to access loans, and the presence of more middlemen in the distribution chain of fresh fish (Nwabueze and Nwabueze 690-93).

Mmopelwa and Ngwenya (3176-84) identified constraints and potentials of the market in the Okavango Delta, Botswana. Fish marketing in the Okavango Delta was mainly constrained by a small market, lack of transport, high transaction costs, lack of access to credit, insufficient storage facilities, lack of business and management skills,

lack of adequate fishing equipment, and lack of preservation facilities. The majority of fishers had no means of cooling during transportation and they used to sell fish during the cool hours of the morning to reduce the risk of spoilage.

The problems faced by the farmers in case of marketing of farmed fish in inland Tanzania were poor storage facilities and means of transport, low selling price, few buyers of fresh farmed fish, lack of knowledge to prepare and preserve fish etc. (Wetengere 2011, 145).

Different marketing constraints of fish marketing system of Swarighat, Dhaka were lack of modern hygienic fish landing centers, shortage of adequate ice-plants with sufficient capacity, cold and freezer storage, lack of handling and preservation facilities, inadequate transportation and distribution facilities, lack of insulated and refrigerated fish vans, etc. (Alam et al. 96). The study further revealed that the consumers had to pay higher price due to the participation of too many intermediaries in the marketing channel, but the actual fishers never got the actual price for their products and major portion went to the intermediaries. The study suggested establishment of more ice-plants, cold-storage and preservation facilities, introduction of insulated and refrigerated fish vans and fish carriers to maintain cold-chain during transportation, improvement of existing fish market structure, and establishment of modern wholesaling facilities.

There are no organized fish marketing policies that cover price structure and marketing outlets among others which are related to both export and domestic markets (Mohite and Mohite 35-36). The domestic fish marketing system in India is neither efficient nor modern and is mainly carried out by private traders with a large number of intermediaries between producer and consumer. This leads to reduction in the fisherman's share in consumer's rupee (G. Kumar et al. 2008, 345). Hence, efforts are necessary to convey the prices prevailing at the nearby fish markets for various species daily through appropriate media. Better hygienic conditions of fish markets can not only attract more consumers to the markets, but also build confidence among buyers to consume fish. The study suggested that modern retail outlets have to be promoted vigorously through public-private partnership in every major city so that fish consumption becomes an easier proposition in days to come.

A study was carried out by Upadhya, Roy and Dhanze (2011, 15-18) in one wholesale market and four retail markets in Agartala, Tripura. The study revealed that there were inadequate infrastructural facilities in terms of auction/selling platforms, market sheds, power supply, drainage facilities, water supply in both wholesale and retail markets. The study emphasized on intensive investigation on dry fish marketing covering entire Northeast region to bridge the gap on available information on demand of dry fish, seasonal variability in prices and species availability, source of supply of dry fish and employment opportunities in Northeast region. The study stated that though much progress has been made in Indian fisheries marketing system, especially in the private sector, much remain to be done with regard to improving the performance of the fish marketing system in India.

There exist some marketing constraints in fish marketing systems of Assam too. Lack of adequate transport and communication facilities in Assam has constrained the sale of fish to limited outlets and prevents the growth of specialized marketing (M. Goswami, Satbiadbas and U. C. Goswami 146-55). In addition to this constraint it was reported that insufficient credit and differential pricing policies were emerging as hindrance to the market development. The study emphasized on infrastructure development by means of providing ice plants, storage and processing facilities and improvement in transportation system for improvement of marketing system in the State. The authors also suggested motivating fish farmers/fishermen to start fish production including seed production and marketing through cooperative system.

Shil and Bhattacharjee (80-88) reported that fish markets in Barak Valley of Assam are not well organized and there is need to reform the markets by introducing proper marketing techniques. Absence of proper transportation, insufficient parking facilities, inadequate storage facilities, poor power supply, lack of proper drainage and water supply, lack of credit facilities, seasonal differentiation of price in the markets, lack of assistance from Municipal Board are some other bottleneck for development of fish marketing in the study area

Several organizations have been set up at the national level to promote the fisheries sector and help the fishermen. These include organizations such as the National Cooperative Development Corporation (NCDC), the National Federation of Fishermen's

Cooperatives Ltd. (FISHCOPFED) and the National Fisheries Development Board (NFDB). NCDC's fisheries related activities include creation of infrastructural facilities for fish marketing, ice plants, cold storages, retail outlets, etc. FISHCOPFED promotes fishery cooperatives and assists fishermen to market their produce efficiently through hygienic retail fish centres in metropolitan cities thereby providing remunerative prices to fish farmers. NFDB is promoting domestic fish marketing through modernization of wholesale markets, establishment of cold chains, popularization of hygienic retail outlets and technology upgradation. Fish is not a notified commodity under the APMC Act of 1966, leading to the exploitation of fishermen by commission agents. Unlike other agricultural commodities, where commission charges are paid by the traders, in fisheries, all commission charges are paid by fishermen. This reduces the share of fishermen in consumer's rupee and makes fishing a non-viable venture. Suitable modifications are to be introduced in the Act to overcome this situation.

Different studies suggested different measures to overcome the constraints of marketing of fish. Some of the important measures suggested for overcoming constraints and problems of marketing in India by the FAO report (FAO 2008: Fisheries Circular. No.1033, 24-25) are as follows:

- Modern fish markets should be established in major urban centers
- Development of a legal framework for the establishment and management of fish markets
- Culture of suitable species/ new species of fish should be encouraged
- The development of value-added products from low value fish species should be urgently promoted
- Women self-help groups should be promoted
- Proper training in the techniques of production and marketing should be provided;
- Fish as a healthy food needs to be popularized among consumers. A special campaign, similar to the campaign currently undertaken for dairy and poultry products, to promote eating of fish is necessary
- It is necessary to formulate a nation-wide fish marketing strategy with the specific objectives of helping fishers to market their products at a remunerative price and to supply safe and quality fish and fish products to consumers. The example of the

cooperative structure of the small-scale dairy industry in India should be followed;

- In order to promote the marketing of frozen fish products, the excise duty on these products should be waived. Value-added tax (VAT) should also be reduced;

- The improvement of fishery statistics, especially with regards to inland fisheries landings and marketing of fish from various sources are necessary.

Though there are a number of organizations and policies relating to promotion of fish marketing in the country, there is a need to formulate a uniform market policy for fishes so that it becomes easier in operation and regulation, which will not only improve the level of country's fish production but also availability to the consuming population, ensuring a remunerative price to the fishers at the same time (G. Kumar et al. 2008, 345-354). G. Kumar et al. (2010, 495-504) suggested promoting institutions like SHGs, producer/fishermen associations, cooperatives, etc. and allowing the entry of private agencies with appropriate regulatory mechanism to improve the efficiency of fish marketing in the country.

In areas where aquaculture has developed to a significant level, the general trend is to increase public awareness on the quality of farmed products and use this as a selling criterion (Pillay and Kutty 274-83). Many countries have established specialized sales federation, cooperatives or similar organizations to reduce the number of intermediaries involved, harmonize marketing within the country and compete effectively in export markets. Such organizations are able to undertake useful promotional and publicity programmes and thus improve sales.

2.4 Research Gap

The literature review reveals that very little studies have been carried out on segmental variation in fish consumption pattern in India in general and Northeast India in particular. No documented information about fish consumption pattern in Assam has been found. On the other hand, review of literature on marketing of fish showed that most of the studies are concentrated on selling concept rather than the marketing concept. The marketing concept calls for understanding consumer needs and producing products to fulfill the identified needs. It calls for building a relationship with the customers so that their satisfaction can be maximized. Moreover, it has been found that most of the studies

looked in production constraints of fish and consumption pattern of the population independently. But logically, these two aspects go hand in hand. Hence, there is a need to develop production and marketing strategies based on the consumption pattern and preference of the consumers. At the same time perception of the consumers regarding fish and fish products have to be identified so that communication to the consumers becomes meaningful.

2.5 OBJECTIVES

To fulfill the research gap, the study was undertaken with the following objectives-

1. To examine the segmental variation in consumption and preference patterns for fish among different classes of population.

2. To investigate the constraints and exploring possibilities of marketing fish as per consumption and preference patterns of the consumer.

3. To formulate effective strategies for marketing of fish in Assam.

Scope of the study

The study is restricted to the State of Assam. Though consumption and preference patterns for fish vary with variation in many demographic, geographic and psychographic variables the consumption and preference patterns for fish in Assam may be different from that of other States. Hence, marketing strategies developed for Assam may not be applicable to other States.

Limitations of the study

The study has been conducted using sample survey method. Though utmost care has been taken to reduce biasness in sample selection, hundred percent randomness could not be maintained due to lack of sampling frame in certain areas.

Secondly, most consumers do not maintain book keeping regarding expenditure of various heads. They had to rely on memory to respond to some portions of the questionnaire. Though same has been taken in the form of cross checking, some approximation may present in the data.

Thirdly, there have been difficulties in explaining constraints of fish culture to the researcher by fish farmers who are less educated. This has been tried to overcome by taking help of local people.

CHAPTER: III

METHODOLOGY

Chapter-III
METHODOLOGY

3.1 Research Design

To fulfill the objectives as described in the previous chapter of the thesis, a study was carried out in two different phases. Both the phases of the study were carried out simultaneously. The first phase consisted of finding out the taste and preferences of the consumers of fish, their buying behavior, and their willingness to pay for different value added fish and fish products. This was done so that strategies can be developed for improvement in the cultivation of preferred varieties of fish and their distribution systems and developing new products.The second phase consisted of a study to identify constraints at various level of the supply chain of fish starting from production to delivering the end product to the final consumers. This was done so that measures can be considered for production of fish species preferred by consumers and delivering the required end product to final consumers in a more efficient way.

3.2 Study locale

The study was carried out in the state of Assam which is situated in the foothills of eastern Himalayan region between 88°.25 'E to 96.0 ° E longitudes, 24.5° N and 28.0° N latitude. It is the most resourceful state of North East India in terms of fisheries resource potential and fish production scenario.

There are six agro-climatic zones in Assam comprising all 27 districts of the state. This delineation has been accepted by the Department of Economics and Statistics of the Government of Assam (World Agricultural Census Report, 1970-71) and by the World Bank (Assam Agricultural Development Project Appraisal Report Credit 1535a-IN) and it is recorded from Directorate of Extension Education, Assam Agricultural University. These agro-climatic zones differ in rainfall, terrain and soil characteristics as well as in availability of different species of fish and their production level. Therefore, while selecting sample for the study it has been distributed over six agro-climatic zones so that the sample represents the total population.

Population of Assam comprises of people from different cultural background. As cultural background influences consumption behavior, attempt was made to draw the sample from the major social groups present in the State. The different communities have

been distinguished on the basis of their mother-tongue. The major communities that have been identified from the Economic Survey, Assam (2010-11, 11) were Assamese, Bengali, Nepali and North Indian (mother-tongue Hindi) based on the distribution of population by scheduled language (mother language) and their percentage to the total population. According to Population Census, 2001, out of total population in the State 53.08% were Assamese, 29.96% were Bengali, 6.4% were North Indian, 5.29% Bodo and 2.30% Nepali. The remaining 2.97% consisted of Oriya, Santali, Manipuri and others. Bodo is not taken as separate community in the present study as they are considered as part and parcel of the Assamese people.

3.3 Sources of data:

Secondary data

The general information including spatial distribution of fisheries resources, fisheries production, fish consumption, commercial activities related to fish, and infrastructural facilities relating to pisciculture sector were obtained from various authentic sources such as NSSO (National Sample Survey organization), Ministry of Statistics and Programme Implementation, Government of India;The State of World Fisheries and Aquaculture published by FAO; National Council of Applied Economic Research (NCAER), India; Economic Survey, Government of Assam; Directorates of Fisheries, Government of Assam; District Fishery Office; various journals; Websites; relevant literature, brochures, and leaflets.

Primary data

The pertinent data relating to the objectives of the study were collected from selected sample respondents.

3.4 Sample Design

Population:

Fish farmers of the State of Assam constituted the population for collection of information about constraints of production of fish. Since majority of fish farmers in the State are adopting carp culture technology, it was decided to interview carp culturists. From each of the selected blocks a list of fish farmers involved in cultivating carps has been prepared in consultation with fishery officials of the respective blocks.

Channel members of various stages in fish distribution network such as wholesalers, retailers and vendors/village traders were interviewed. No defined sampling frame was available for this population.

All eating joints dealing in non-vegetarian food constituted the population for selecting sample to gather information related to introduction of value added fish products. In this respect also no sampling frame was available.

All non-vegetarian population of State of Assam made up the population for selecting sample for the consumer survey.

Sample size:

Consumers	660
Fish farmers	240
Marketing intermediaries	245
Eating joints	300

The detailed sample break-up is given in Table 3.1 and 3.2 and Fig.3.3

Questionnaire Design:

Different sets of structured questionnaire were developed and finalized after pilot survey to collect data from respondents. The questionnaires used as survey instrument are given in Annexure –1, 2, 3, 4, 5, and 6.

3.5 Sampling technique:

Quota sampling technique was used for selection of consumer samples since there is no precise sampling frame indicating exact number of households of different communities with respect to village and wards. Randomness was maintained while selecting samples. Geographic profile/Place of residence (Rural and Urban) and demographic profile (community based on scheduled mother tongue) were taken as control characteristics of the quota sampling. A multi-stage sampling design with agro-climatic zone as first stage units, district as the second stage, blocks and municipality board/corporation/town committees as third stage, villages and wards as fourth stage and households as the fifth stage units was adopted to reduce biasness in sample selection.

The 27 districts of Assam are distributed over the six agro-climatic zones, as has been mentioned earlier. One district from each of the agro-climatic zone was selected using judgment sampling. The basis of judgment is the urbanization and fish production potential. Thus, six districts- Sonitpur district from the North Bank Plain zone, Nagaon district from the Central Brahmaputra valley zone, Dibrugarh from the upper Brahmaputra valley zone, Metro Kamrup from the lower Brahmaputra valley zone, Cachar from the Barak valley zone, and Karbi Anglong from the Hill zone were selected for the present study (Fig. 3.1).

Fig. 3.2 Map of Assam showing the study area
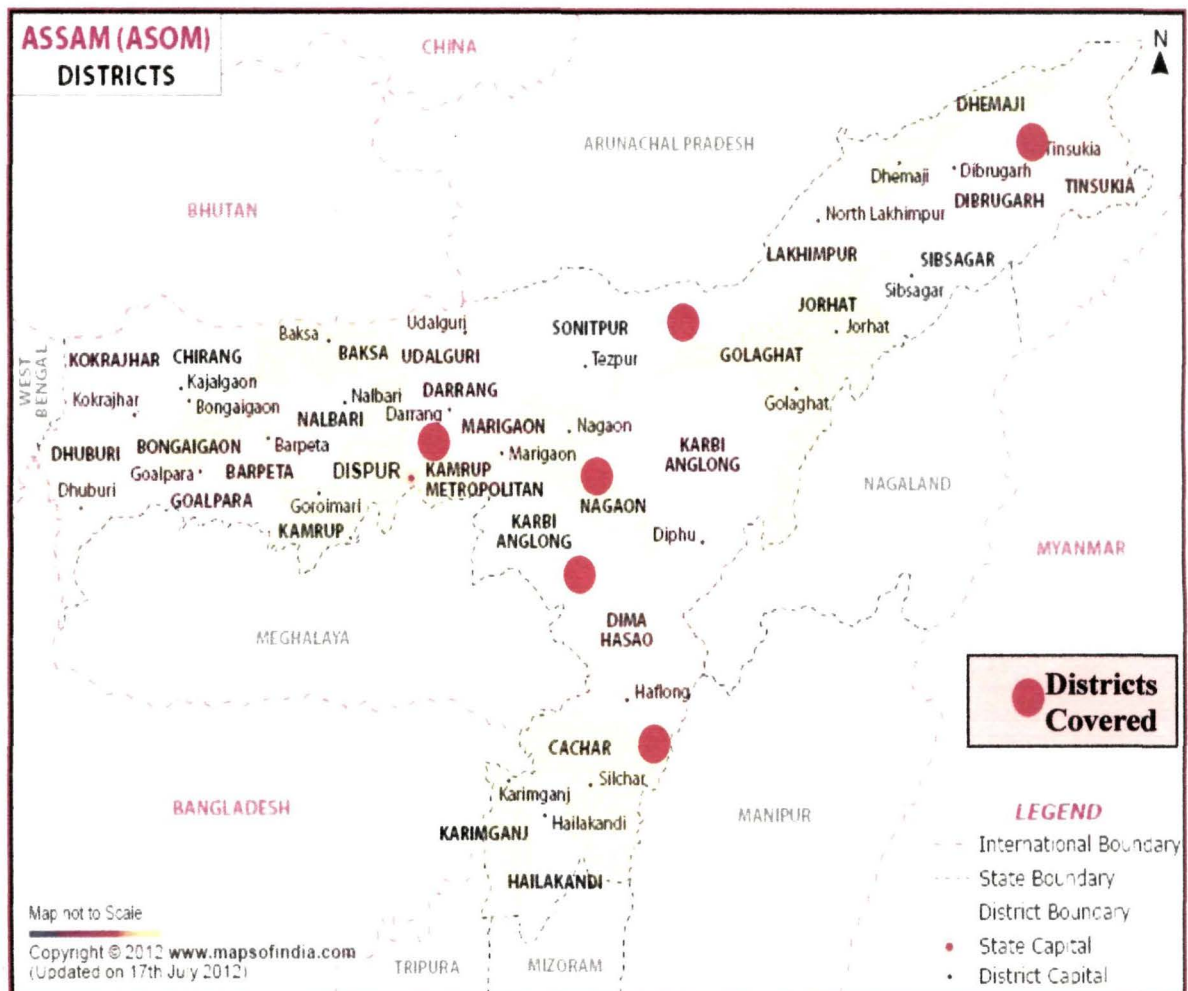
Source of map: www.mapsofindia.com

For selection of rural consumers, one Community Development Block from each of the selected districts has been selected randomly. Blocks of the districts were arranged alphabetically, assigned serial number and one block from each district selected using the random number table. The information regarding names of the villages under selected blocks and the population patterns were collected from the respective blocks. The next step was to categorize the villages under each block on the basis of majority of different communities in the population based on the language spoken (Assamese, Bengali, Nepali and Hindi) in consultation with block officials. Then villages under each category were arranged alphabetically, assigned serial number and one village from each category was selected using the random number table. Again, from each of the selected villages 20 households of Assamese, 15 households of Bengali, 10 households of Nepali, 10 households of Hindi speaking communities (North Indian) have been selected by using the right hand rule (random walk method).

For selection of urban consumers, the demographic profile of different wards of Municipal Corporation, Municipal Boards, Town Committee and census town have been collected from respective departmental officials and categorized the wards on the basis of majority of different communities based on four mother languages as has been selected for urban area. Then one ward from each of the category was randomly selected. Out of the total households in selected wards 20 households of Assamese, 15 households of Bengali, 10 households of Nepali, 10 households of North Indian were selected by using the right hand rule. Selection of respondents by using right hand rule was also used for fish consumer survey in the study of Bay of Bengal Programme (BOBP) under the Post-Harvest Fisheries Project in 1992, in coordination with the Marketing and Research Group (MARG), Chennai, India (BOBP 6). The detailed list of selected districts, blocks, villages and wards is given in Annexure 7.

The sample size for consumer survey was 660, of which 330 were from urban and 330 from rural and this sample size was considered based on sample size in similar social science researches. A study carried out by Sumedhan (44-59) had taken a total sample size of 600 in the study. The study collected primary data from 600 households, 300 each from rural and urban population of Kerala. Multistage sampling technique was adopted in that study for selecting the sample unit. In the first stage, three towns were selected from

southern, central and northern parts of Kerela to represent the entire State. In the second stage, one ward from each town and panchayat was selected. Then 100 households from each of these selected wards were selected, thus 300 households from rural and 300 from urban area were selected. The towns, villages and wards were selected on the basis of systematic random sampling. The respondents were selected from the voter list using Lottery method. Israel (4) stated that for use of descriptive statistics (e.g., mean, frequencies, percentage etc.) nearly any sample size would suffice but a sample size of 200-500 is needed for multiple regression, analysis of covariance, or log-linear analysis, which might be performed for more rigorous state impact evaluations. It is expressed that a minimum of 100 elements is needed for each major group or subgroup in the sample and for each minor subgroup, a sample of 20 to 50 elements is necessary. A total of 666 respondents were used as sample size by Hulya and Aliye (87) for studying fish consumption behaviour pattern of Tukish people. Bhatt (2000, 182) in his study on fish consumption behaviour had taken a total of 60 producers and 60 consumers as final sample size. The study was carried out in purposively selected two districts of Karnataka-Mysore and Raichur. Both the districts were drawn from different agro-climatic zones. From each of the district two blocks were selected based on the list of farmers and production data supplied by the Fish Farmers Development Agency. Thirty producers from each of the selected block and 30 consumers from selected district headquarters were selected. Pavithra had taken a sample size of 135 consumers of which 45 located in urban, 45 in semi urban and 45 in rural areas and analyzed the food consumption pattern in Karnataka with special reference to Mysore district. A total of 549 interviews were conducted by Jamdade et al. (143-44) across the entire Kolhapur city through personal interviews and respondents were selected using the Right Hand Rule.

Before initializing the main study, a preliminary study using observation and unstructured interview methods was carried out in Sonitpur and Nagaon districts of Assam. Rural and urban households were visited to find out the different variables influencing fish consumption and to identify the variables to be incorporated in the questionnaire used in the main survey. The total sample size for this preliminary study was 132 from the two districts mentioned above.

A structured questionnaire was developed to collect information from the consumers. The questionnaire concentrated on finding out the psychological factors of consumers affecting consumption behaviour with respect to either raw fish or fish products. It also emphasized on finding out consumers' acceptance level of and willingness to pay for value addition in the selling process of fish and introduction of new products. For this, 5 point Likert scales have been used. Reliability test for interval scaled measured statements in the questionnaire for consumer survey was carried out after the pilot survey to test the internal consistency of the results. Cronbach's Alpha value was found 0.731 indicating a good scale and internal consistency of results. Reliability test was also done after completion of data entry and Cronbach's Alpha value was found 0.700 which also indicates good internal consistency of interval-itemed questionnaire (Nargundkar 64). The data pertaining to fish consumption and other household expenditures and its market value were collected for the year 2010-11. Since, most of the families do not maintain any record of household expenditures, it was dependent solely on their memory. However, information so obtained was checked by cross examination. A household was adopted as the unit of investigation in this study. The head of the family was taken as the respondent from whom the relevant data were collected. During the interview some stimuli such as photographs of different types of fish and value added fish products (PLATE I to V in Annexure 26) were also shown for better interaction with fish consumers. This method was used in the Bay of Bengal Programme (BOBP 1992, 6) study and Upadhyay and Pandey (2009, 194).The questionnaire contained maximum close ended questions and it took 15-20 minutes to fill in for each respondent.

Fig. 3.2 depicts the research design. Sample break-up of consumers is depicted in Table 3.1 and 3.2. Overall sample break up is shown in Fig. 3.3.

METHODOLOGY

| SURVEY OF CONSUMERS | → | IDENTIFICATION OF FISH CONSUMPTION BEHAVIOUR | → | FULFILMENT OF OBJECTIVE -1 |

SURVEY OF FISH FARMERS

SURVEY OF MARKETING INTERMEDIARIES

SURVEY OF EATING JOINTS

IDENTIFICATION OF PRODUCTION CONSTRAINTS, DISTRIBUTION CONSTRAINTS, AND DEVELOPING NEW PRODUCT CONCEPTS

FULFILMENT OF OBJECTIVE -2

EXPERT OPINION

FULFILMENT OF OBJECTIVE -3

Fig. 3.2 Research Design

Table 3.1 Breakup of consumer sample

Communities	No. of Rural consumers	No. of Urban consumers	Community wise total no. of consumers
Assamese	120	120	240
Bengali	90	90	180
Nepali	60	60	120
North Indian	60	60	120
Total	**330**	**330**	**660**
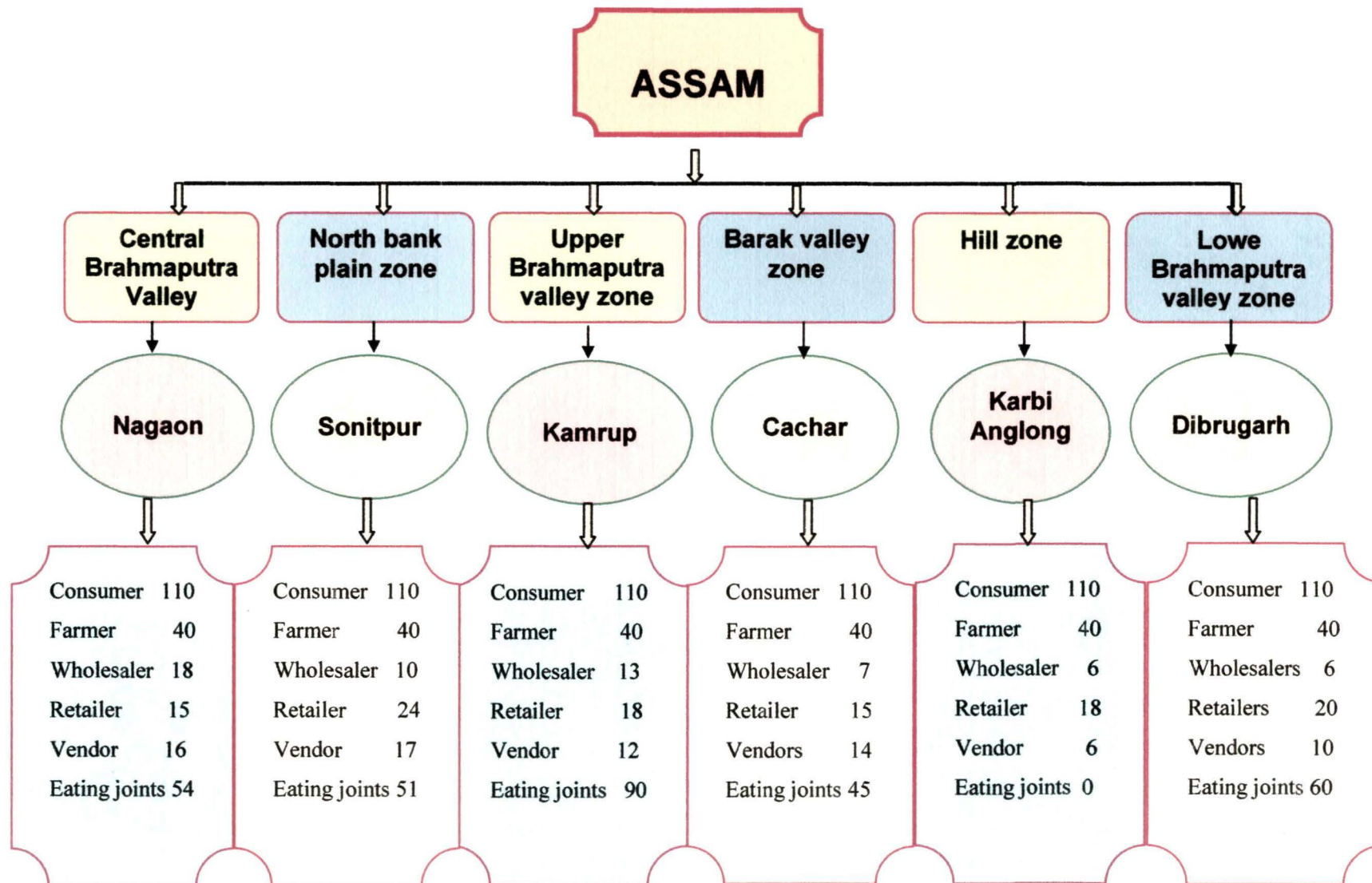
Fig. 3.3 Overall Sample Break-up

Table 3.2 Breakup of consumer sample in details

Name of selected districts under each agro-climatic zones	Community-wise Respondents in Rural Area					Community-wise Respondents in Urban Area				
	Assamese	Bengali	Nepali	North Indian	Total	Assamese	Bengali	Nepali	North Indian	Total
Dibrugarh (Upper Brahmaputra Valley zone)	20	15	10	10	55	20	15	10	10	55
Sonitpur (North Bank Plains)	20	15	10	10	55	20	15	10	10	55
Nagaon (Central Brahmaputra Valley)	20	15	10	10	55	20	15	10	10	55
Karbi Anglong (Hills zone)	20	15	10	10	55	20	15	10	10	55
Cachar (Barak Valley)	20	15	10	10	55	20	15	10	10	55
Kamrup Metro (Lower Brahmaputra Valley)	20	15	10	10	55	20	15	10	10	55
Total	120	90	60	60	330	120	90	60	60	330

For the second phase of the study i.e., to identify the constraints related to fish production and exploring possibilities of marketing consumer preferred fish and fish products, fish farmers, marketing intermediaries and marketers of fastfood eating joints were interviewed.

Since majority of fish farmers in the State are adopting carp culture technology, it was decided to interview carp culturists. From each of the selected blocks a list of fish farmers involved in cultivating carps has been prepared in consultation with fishery officials of those respective blocks.

Out of the prepared list, 40 farmers from each of the selected blocks have been finally selected through simple random sampling. The names of the farmers have been arranged alphabetically and a serial number has been assigned to each name. The farmers were selected using the random number generator. Altogether 240 carp farmers have been selected as sample from all the six agro climatic zones. The sample size was fixed at 240 considering similar studies carried out by different authors. Bhaumik et al. (348-59) conducted a study in 4 districts of West Bengal to identify perceived problems of composite fish culture. The study collected data through two stage random sampling. In the first stage 10 blocks from each district were selected at random and a list of fish farmers was prepared. From the prepared list, taking 10 farmers from each block, a total of 400 fish farmers were finally selected which constituted the sample of the study. Sarkar, Chowdhury and Itohara (69) had taken a representative sample of 90 fish farmers from two villages under Mymensing district of Bangladesh. They arranged a Focus Group Discussion (FGD) to identify potential entrepreneurship barriers of pond fish culture.

A pilot survey was also conducted among 60 farmers following judgment sampling with an open ended questionnaire to identify their constraints of carp culture so that selected constraints could be incorporated into the final questionnaire for knowing their degree of seriousness. A structured questionnaire was designed after identifying probable constraints as perceived by the farmers and finally 32 constraints were considered following a Focus Group Discussion (FGD) among fisheries officials of Department of Fisheries, scientists, academicians and fish farmers. The degree of seriousness of each constraint in adoption of composite fish culture was measured by using a 5-point Likert scale with responses Strongly Agree (SA), Agree (A), Neither agree nor disagree (NAND), Disagree (D) and Strongly Disagree (SD) and value assigned to each of these responses were 2, 1, 0, -1 and -2 respectively. The

reliability test of the questionnaire containing questions in interval scale was carried out by applying Cronbach's Alpha method using SPSS software. The Cronbach's Alpha value of 32 interval scaled measured statements relating to constraints of production and marketing of fish as perceived by the farmers was 0.884 indicating a good internal consistency of results. After collecting the perceived seriousness of the constraints from the fish farmers, the data was put through factor analysis to club similar constraints and reduce their number.

The record of farmers cultivating consumer preferred indigenous varieties of fish other than carps was not found in the selected districts. During the survey, only a few farmers were found among the selected respondents who cultivated *Notopterous chitala* (locally known as *'chital'*) and *Clarias batrachus* (locally known as *'magur'*) along with carps and hence, no separate interview was conducted for these farmers.

To examine the marketing constraints, different markets of the study area were purposefully selected as these markets had large volume of fish transacted through large numbers of wholesalers, retailers and village traders/vendors. During the period of investigation, 60 wholesalers, 110 retailers and 75 vendors/village traders were interviewed with the pretested interview schedule and thus 245 marketing intermediaries were interviewed covering all the selected districts. Direct observations method was also used while collecting primary data related to marketing aspects of fish. While selecting the middlemen, judgment sampling method was used. Judgment was on the basis of volume of trade and varieties of fish dealt in by the intermediaries. To measure the degree of seriousness of problems as perceived by the middlemen during marketing of fish a 5 point Likert scale was used in the interview schedule. The reliability test of the questionnaires for wholesalers, retailers and village traders/vendors, containing questions in interval scale was carried out by applying Cronbach's Alpha method using SPSS software. Cronbach's Alpha value was also found suitable (i.e. more than 7.0) for these questionnaires. The sample of wholesalers and retailers drawn from different markets are given in Annexure 8 and 9.

All five sets of questionnaires (for consumers, farmers, wholesalers, retailers and vendors) were developed in English and translated into Assamese as it is the language understood by all categories of respondents.

The possibility of marketing of value added fish and fish products were examined in different eating joints of the study area. The different eating joints considered for the study were Fastfood restaurants, Restaurants (Rice as core item),

Bar-cum-restaurants, Dhabas, and road-side Chaat houses. The eating joints were selected from town/city area of each district (except Karbi Anglong district where preferences for fish and fish products were found to be very poor and urbanization is also less) through judgment and snowball sampling. The judgment was based on popularity of the eating joints (according to local populace) and coverage area. All together 300 eating joints comprising of 71 fast-food restaurants, 57 restaurants, 59 bar-cum-restaurants, 57 dhabas and 56 chaat houses were surveyed in the study area. The managers/owners of the eating joints were interviewed with a semi-structured interview schedule. Break-up of samples of eating joints surveyed in selected districts is given in Annexure 10.

Data collection was carried out during February, 2011 to March, 2012.

Based on the findings of Objective 1 and Objective 2, and review of some relevant literatures, certain measures have been formulated and finalized after taking into account expert opinion. The expert panel comprised fisheries scientists, academicians, Officers of Department of Fisheries (Government of Assam), Managing Director of Assam Apex Co-operative Fish Marketing and Processing Federation Ltd. (FISHFED), and entrepreneurs. Experts were selected on the basis of their contribution/experience in fisheries development in the State. Interview with the experts were conducted in two rounds.

3.6 Analytical tools /Statistical tools

Different descriptive statistics, parametric test (t- test and ANOVA) and non-parametric test (Chi-square test) were applied as statistical tools on the basis of necessity. Descriptive statistics used were frequency, percentages, mean and standard deviation. Tables and bar charts were also used. Software package, Statistical Package for Social Science (SPSS) version 16 was used for data entry and analysis. SPSS is one of the most widely used statistical software packages which covers a broad range of statistical procedures that allows summarizing data, determining whether the differences between groups are statistical significant or not. SPSS also contains several tools for analyzing data, including functions for recording data and computing new variable as well as merging and aggregating data files.

Likert's Scale Technique

It is a psychometric response scale primarily used in questionnaires to obtain participant's preferences or degree of agreement with a statement or set of statements. It is developed by Dr. Rensis Likert. In a Likert scale, respondents are asked to indicate their level of agreement with a given statement by way of an ordinal scale. Generally, a 5- point scale ranging from "Strongly Agree" on one end to "Strongly Disagree" on the other end. Each level on the scale is assigned a numerical value or coding, usually starting at 1 and incremented by one for each level. The scores are totaled to measure the respondent's attitude (Bertram). The 5 –point Likert scale, ranging from"Strongly Agree", "Agree", "Neither Agree nor Disagree", "Disagree", and "Strongly Disagree" was applied in the present study to measure the perceptions of respondents on different aspects of fish consumption patterns and constraints of production of fish and value added fish and value assigned to each of the level were 2, 1, 0, -1, and -2 respectively.

Chi-Square Test

The chi-square test ($\chi 2$-test) is used to determine whether there is a relationship between two nominal variables. Karl Pearson in 1900 developed a non-parametric test for testing the significance of the discrepancy between experimental (observed) frequencies and the theoretical frequencies (expected) obtained under some theory or hypothesis. Chi-square test is applied in order to test the goodness of fit or to test the significance of association between attributes or to test the homogeneity or the significance of population variance. In order to apply the Chi-square test either as a test of goodness of fit or as a test to judge the significance of association between attributes, it is necessary that the observed as well as theoretical or expected frequencies must be grouped in the same way and the theoretical distribution must be adjusted to give the same total frequency as it is found in case of observed distribution. The calculated value of χ^2 is compared with its critical value (probability) at a particular level of significance and degree of freedom (Kothari 233-38). Chi-square test was used in the study to know the relationship between income and frequency of fish consumption, income and average quantity of fish consumption, and community and frequency of fish consumption.

Independent sample t- test

Independent sample t- test is used to test the difference between the means of two groups. To find out the difference in mean consumption of fish/mean

consumption expenditure between rural and urban consumers Independent sample t-test was carried out.

Analysis of Variance (ANOVA)

This statistical technique is used for examining the difference among means of more than two groups. It is the generic name given to a set of techniques which is used to study the casuse-and-effect of one or more factors on a single dependent variable. ANOVA is used when the independent variables are of nominal scale (categorical) and the dependent variable is metric (continuous), or at least interval scaled. Completely Randomized Design in a One-way ANOVA is used when there is one categorical independent variable, and one dependent (metric) variable. One-way ANOVA is applied when there is only one factor. One drawback of ANOVA is that it does not indicate which groups are significantly different from each other. In such cases, Post-hoc analysis can be used to measure the significant difference between means of two or more groups (Nagundkar 327-34).

One way analysis of variance (ANOVA) was carried out to find out the difference in mean consumption of fish/mean consumption expenditure among different communities/income groups. Post-hoc analysis was performed to ascertain pair-wise significant difference among different communities/income groups.The assumption regading form of population distribution has been tested and found to be normally distributed. The data has also been tested for equality of variance ('p' < 0.000) and found to be suitable for conducting ANOVA. This implies that data set does not violate any of the assumption of conducting ANOVA.

Factor analysis

It is used for data reduction by reducing the number of variables being studied. In marketing research, there may be large number of variables, most of which are correlated and which must be reduced to a manageable level. There are two stages in factor analysis. Stage-I (which is called as Factor extraction process) helps to identify how many factors will be extracted from the data. Principal Component Analysis (PCA) is the most popular method for this. The simple rule-of-thumb normally used says that all factors with an Eigen value of 1 or more should be extracted. The higher the Eigen value of a factor, the higher is the amount of variance explained by the factor. Stage II is called as Rotation of Principal components. This is used to interpret and name the factors. In stage-II, either the Unrotated or Rotated factor matrix is referred to assign variables to factors and to interpret factors. The original factor

matrix is unrotated, and is a part of the output from stage-I.The factor matrix (whether unrotated or rotated) gives us the loading of each variable on each of the extracted factors.This is similar to correlation matrix, with 'loadings' having values between 0 and 1. Values close to ¶ represent high loadings and those close to 0, low loadings. For each column (factor), the variables which have a high (close to 1) loading should be identified and a combined meaning for the factor found (Nagundkar 327-34). In factor analysis, adequacy of data should be tested on the basis of results of the Kasier-Meyer-Olkin (KMO) measures of sampling adequacy and Bartlett's test of sphericity (homogeneity of variance). The KMO measure of sampling adequacy should be more than 0.50 for acceptability of data for factor analysis. This is a goodness of fit coefficient whose value varies between 0 and 1. Bartlett's test of sphericity should also be checked for existence of sufficient correlation between the variables to proceed with the analysis (Lahiri and Samanta 79).

Factor analysis was applied after testing adequacy of data using KMO and Bartlett's test of sphericity (homogeneity of variance) for analyzing the constraints faced by the fish farmers/producers to reduce the number of variables (constraints). To identify the respondent's (farmers/producers) perception towards different statements related to constraints of production and marketing of fish so as to group them into specific factors, factor analysis was done using principal component analysis of SPSS. During the preliminary study 32 variables have been identified as constraints of production of fish. As it is difficult to address 32 varaables independently, they were put through factor analysis to group variables having internal consistency together so that the number can be reduced. Rotated component matrix has been observed to get the factors that can be named specifically and interpreted.

Hulya and Aliye (87-91) applied the Kaiser-Meyer Olkin (KMO) test, Bartlett's test and factor analysis to examine consumer's attitudes toward consumption of fish and fish product. Arvanitoyannis et al. (266-68) applied principal component analysis (PCA) to test the hypothesis that fish preference is multi-dimensional parameter. PCA with varimax rotation identified four factors with eigenvalues greater than 1.

SPSS version 16 was used for data entry and analysis.

CHAPTER: IV

RESULTS AND DISCUSSION

CHAPTER-IV
RESULTS AND DISCUSSION

4.1 Demographic Profile of the Consumer Respondents

The profile of the respondents after data collection is discussed in the following section. The detailed demographic profile of the consumer respondents is presented in Tables 4.1 and 4.2, and Fig.4.1 to 4.5.

Majority of the respondents were within the age category 25-45 years. This accounts for 57.8% of the total sample, followed by the age category 45 years and above (40.2%), and 15-25 years (2.0%). In all the four communities, majority of respondents belonged to the age group of 25-45 years. Of the total respondents, 79.5% were male and 20.5% were female. Majority of respondents (52.4%) belonged to general caste, followed by respondents belonging to Other Backward Caste (OBC 29.5%), Scheduled Caste (SC 13.9%) and Scheduled Tribes (ST 4.2%). In urban area 60.3 % of respondents belonged to general caste, 27.3 % OBC, 8.8% SC and 3.6% ST whereas percentage composition of caste in rural area were General 44.5%, OBC 31.8%, SC 19.1%, and ST 4.5%. Majority of respondents of all the communities belonged to general caste. 45.4% among Assamese, 48.9% among Bengali, 53.3% among Nepali, and 70% among North Indian.
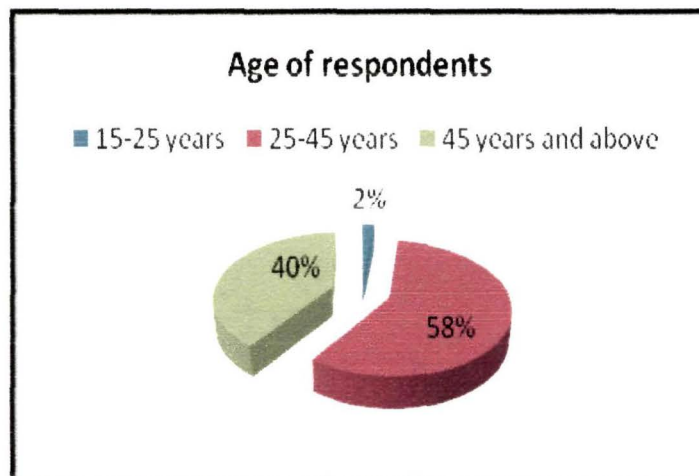
Fig.4.1 Age of the Respondents
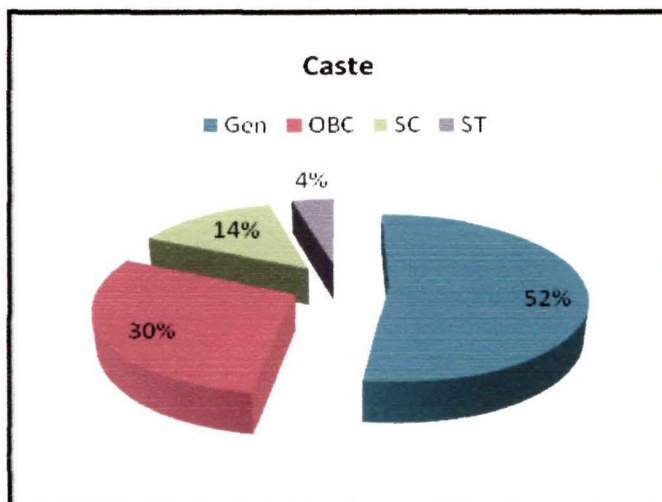
Fig.4.2. Caste of the Respondents

Overall, a higher percentage of the respondents (46.1%) had education below 10th standard, followed by upto 10th standard (24.8%), graduates (20.8%), and post-graduate or above (8.3%). Majority of respondents in both rural and urban areas received education below 10th standard and percentage wise it was higher in rural area (57.9 %) compared to urban area (34.2%). In rural area 3.9% of respondents had education up to post-graduate level or above and it was more in urban areas (12.7%). In urban area 28.5% and in rural area 13% respondents were graduates. Among all the communities, the educational status below 10th standard was the highest among the North Indian (82.5%) followed by the Bengali (51.1%), the Nepali (43.3%) and the Assamese (25.4%). The percentage of graduate respondents was 30.4% among Assamese communities, 21.7% among Bengalis, 15.0% among the Nepalis and 5.8% among North Indian.
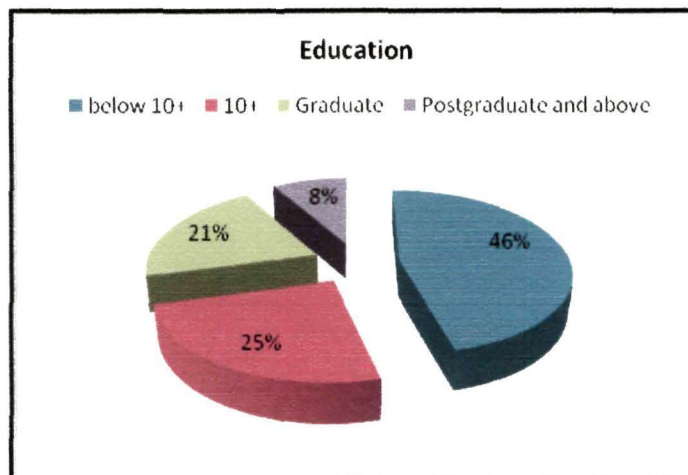
Fig.4.3. Education of the Respondents

On an average 68.0 % of respondents had nuclear type of family system and the rest (32%) had joint family in the study area. The percentage of nuclear family is comparatively more in urban area (72.4%) than in rural area (63.6%).The nuclear family system was more prevalent among all the communities. The average family size of the total consumer sample in the study area was 5.40. However it was 5.67 in the rural and 5.13 in the urban areas.

With regards to occupational status, a higher percentage of respondents (33%) was engaged in business, followed by government service (31.5%), cultivation (18%), private service (9.2%), and labour (8.2%). Majority of respondents (33.3%) in rural area were engaged in farming followed by business (27.3%), government service (20%), labour (12%) and private service (6.7%). In urban area a higher percentage of respondents was engaged in government service (43%) followed by business (38.8%) and other occupations. With respect to different communities, government service holders were 47.5% among the Assamese, 32.5% among the Nepalese, 23.3% among the Bengalis and 10.8% among the North Indians.
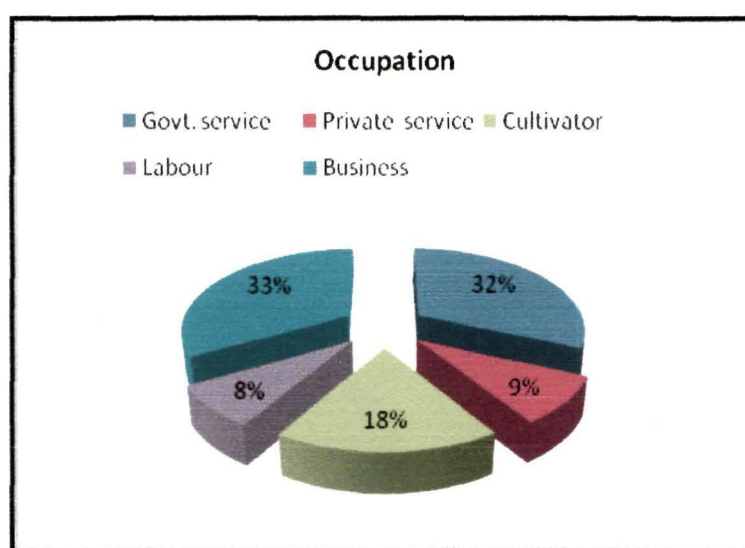
Fig.4.4. Occupation of Respondents

On an average, majority of consumers (27.6%) have monthly average household income less than Rs.5000.00 in the study area. Again, 24.4%, 20.6 %, 16.7% and 10.7% of respondents have monthly average household income Rs.5000-10000, Rs.10000.00-Rs.20000.00, Rs.20000.00-Rs.40000.00 and above Rs.40000.00, respectively. Respondents having monthly income less than Rs.5000.00 were more among rural households (42.1%) than urban households (13%). A higher percentage of urban households (17.3 %) had monthly income above Rs.40000.00 as compared to

rural households (4.2%). The detailed monthly income of respondents in rural and urban area is given in Table 4.2.

Respondents having monthly average household income less than Rs.10000.00 was found highest among the North Indian (40.8%) followed by the Bengali (30%), Nepali (25.8%) and the Assamese (20%). The percentage of respondents having income more than Rs.40000.00 was found highest among the Assamese (19.2%) and lowest among the North Indian (0.8%). The monthly family incomes across four communities have been presented in Table 4. 2.
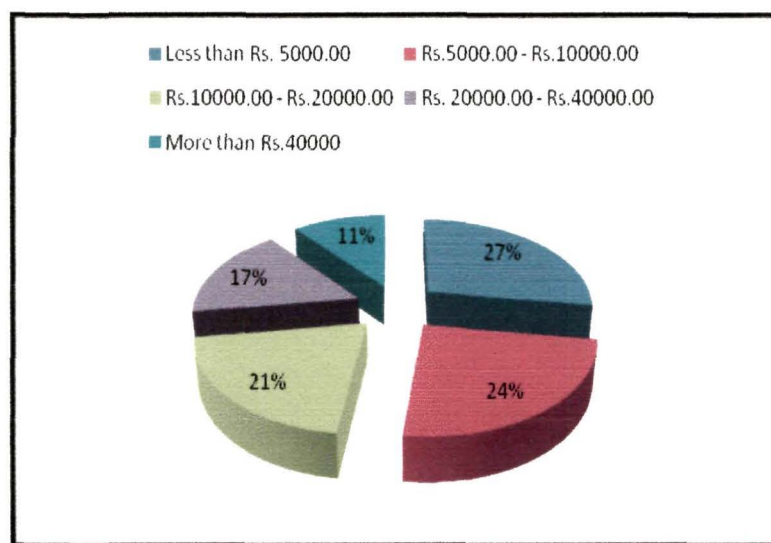
Fig. 4.5. Monthly Average Income of Households

Table 4.1 Rural and Urban area-wise Demographic Profile of the Respondents

Sl. No.	Variables	Specification	Rural		Urban		Overall	
			Frequency	%	Frequency	%	Frequency	%
1	Age of the respondents (in years)	15 -25 years	6	1.8	7	2.1	13	2.0
		25 - 45 years	189	57.3	193	58.5	382	57.8
		45 & above years	135	40.9	130	39.4	265	40.2
		Total	330	100	330	100	660	100
2	Gender	Male	277	83.9	248	75.2	525	79.5
		Female	53	16.1	82	24.8	135	20.5
		Total	330	100	330	100	660	100
3	Caste	General	147	44.5	199	60.3	346	52.4
		OBC	105	31.8	90	27.3	195	29.5
		SC	63	19.1	29	8.8	92	13.9
		ST	15	4.5	12	3.6	27	4.2
		Total	330		330		660	100.0
5	Education	Below 10+	191	57.9	113	34.2	304	46.1
		10+	83	25.2	81	24.5	164	24.8
		Graduate	43	13	94	28.5	137	20.8
		Post-Graduate or above	13	3.9	42	12.7	55	8.3
		Total	330	100	330	100	660	100.0
6	Type of family	Nuclear	210	63.6	239	72.4	449	68.0
		Joint	120	36.4	91	27.6	211	32.0
		Total	330	100	330	100	660	100.0
7	Occupation	Govt. service	66	20.0	142	43.0	208	31.5
		Private sevice	22	6.7	39	11.8	61	9.2
		Cultivator	110	33.3	9	2.7	119	18.0
		Business	90	27.3	128	38.8	218	33.0
		Labour	42	12.7	12	3.6	54	8.2
		Total	330	100	330	100	660	100.0
8	Monthly family income in rupees	Less than 5000	139	42.1	43	13	182	27.6
		5000 - 10000	84	25.5	77	23.3	161	24.4
		10000-20000	55	16.7	81	24.5	136	20.6
		20000 - 40000	38	11.5	72	21.8	110	16.7
		More than 40000	14	4.2	57	17.3	73	10.7
		Total	330	100	330	100	660	100

Table 4.2 Community-wise Demographic Profile of the Respondents

Sl.No	Respondent's profiles	Specification	Assamese	Bengali	Nepali	North Indian
1	Age (in years)	15 -25 years	3.3	1.1	1.7	0.8
		25 - 45 years	58.8	57.2	55.8	59.2
		45 & above years	37.9	42.7	42.5	40.0
2	Gender	Male	78.8	77.2	77.5	86.7
		Female	21.2	22.8	22.5	13.3
3	Caste	General	45.4	48.9	53.3	70.8
		OBC	33.8	23.9	46.7	12.5
		SC	10.0	26.7	-	16.7
		ST	10.8	0.6	-	-
4	Education	Below 10+	25.4	51.1	43.3	82.5
		10+	27.5	22.2	36.7	11.7
		Graduate	30.4	21.7	15	5.8
		Post-Graduate and above	16.7	5.0	5.0	-
5	Family type	Nuclear	73.3	61.7	68.3	66.7
		Joint	26.7	38.3	31.7	33.3
6	Family size		5.17	5.48	5.68	5.45
7	Occupation	Govt. service	47.5	23.3	32.5	10.8
		Private sevice	8.3	13.3	12.5	1.7
		Cultivator	22.9	11.7	23.3	12.5
		Business	18.8	41.1	28.3	54.2
		Labour	2.5	10.6	3.3	20.8
8	Monthly family income (in Rupees)	Less than 5000	20.0	30.0	25.8	40.8
		5000 - 10000	18.3	25.6	25.8	33.3
		10000- 20000	20.8	20.6	22.5	18.3
		20000- 40000	21.7	16.7	16.7	6.7
		More than 40000	19.2	7.2	9.2	0.8

(N.B. Figures in percentage except family size)

4.2 Fish Consumption Patterns

4.2.1 Per Capita Consumption of Fish

The annual per capita fish consumption in the study area was found 14.27 kg. The monthly average quantity of fish consumed in each household was 5.94 kg and monthly per capita consumption of fish is 1.19 kg. The annual per capita consumption of fish in the study area is higher than meat (8.28 kg) as the later is considered as substitute of fish. Monthly per capita consumption of fish in rural area was 1.21 kg in rural area and 1.17 kg in urban area. Per capita consumption of fish in rural and urban area, and across the communities is presented in Table 4.3. It is observed that standard deviations in mean fish consumption for different groups are high which may be due to inter-family variation in fish consumption. The findings of

the study revealed that per capita fish consumption is more in rural area than in urban area which may be due to availability aquatic resources and fish in rural area. Bhatta (2003, 17-42) reported that fish consumption is higher among rural consumers as compared to urban consumers. This finding also matches with earlier findings of Bhatta (2001, 182-83) and Dey et al. (2005, 89).

Table 4.3 Quantum of Fish Consumption in the Study Area

Respondent's profile	Average monthly total consumption of fish per household (Kg)	Monthly per capita consumpti on of fish (Kg)	Daily per capita consumption of fish (kg)	Annual per capita consumption of fish (Kg)
Geographic				
Rural	6.59 ± 4.95(SD)	1.21	0.04	14.54 ± 10.26(SD)
Urban	5.28 ± 3.51(SD)	1.17	0.03	13.99 ± 10.46(SD)
Demographic				
Assamese	7.73 ± 4.69(SD)	1.59	0.05	19.11 ± 10.72(SD)
Bengali	6.32 ± 3.98(SD)	1.28	0.04	15.41 ± 10.77(SD)
Nepali	4.00 ± 3.35(SD)	0.74	0.02	8.83 ± 7.08 (SD)
North Indian	3.72 ± 3.09(SD)	0.69	0.02	8.31 ± 4.92 (SD)
Overall	5.94 ± 4.34(SD)	1.19	0.04	14.27 ± 10.36(SD)

The estimated annual per capita consumption of fish (14.27 kg) irrespective of rural or urban area obtained from household survey was found higher than the national average (9.8 kg). It may be due to the fact that the estimates of national statistics on per capita fish consumption, commonly based on the total availability of fish in the country which often do not include consumption of many small and non-commercial fish species obtained from artisanal and subsistence fisheries, and the national average is an average figure for both vegetarian and non-vegetarian populations, while the survey data covered only the non-vegetarian population (Dey et al.99).

The annual per capita consumption of fish is highest among the Assamese (19.11 kg), followed by the Bengali (15.41 kg), the Nepali (8.83 kg) and North Indian (8.31kg). Average monthly household consumption of fish among different communities varies from 3.72 kg (among North Indian) to 7.73 kg (among Assamese). The monthly per capita consumption of fish is 1.59 kg, 1.28 kg, 0.74 kg and 0.69 kg among Assamese, Bengali, Nepali and the North Indians respectively.

Independent sample 't' test was carried out to find out the statistical significance on the difference in per capita fish consumption between rural and urban consumers with the following Hypotheses -

H_0: $\mu_1 = \mu_2$

H_1: $\mu_1 \neq \mu_2$

Where,

μ_1 = mean fish consumption of rural consumers

μ_2 = mean fish consumption of urban consumers

Table 4.4 Independent Samples Test for Annual Per Capita Consumption of Fish in Rural and Urban Area

		Levene's Test for Equality of Variances					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Annual per capita consumption of fish in kg	Equal variances assumed	0.41	0.53	0.68	658.00	0.49	0.55
	Equal variances not assumed			0.68	657.76	0.49	0.55

Table 4.4 indicates that sig. value (p) for the Levene's Test for Equality of Variances is 0.53 which is greater than 0.05 (p> 0.05). Sig. (2-tailed) value was 0.49, which is greater than 0.05 indicating no significant difference in per capita consumption of fish between consumers of rural and urban area. Hence null hypothesis cannot be rejected. It implies that the difference in consumption quantity between rural and urban consumers is not significant.

The study tried to find out whether quantity of fish consumption is significantly different among the different communities. ANOVA was carried out to

check statistical significance in the difference in per capita fish consumption among different communities. The hypothesis is

H_0: $\mu_1=\mu_2=\mu_3=\mu_4$

H_1:$\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4$

Where, μ_1 = mean fish consumption of Assamese

μ_2= mean fish consumption of Bengali

μ_3= mean fish consumption of Nepali

μ_4= mean fish consumption of North Indian

Statistical analysis indicates 'p' value (0.000) < level of significance (alpha) at 95% level of confidence (0.05), rejecting the null hypothesis (Table 4.5). It implies that there is difference in mean consumption of fish among different communities. To determine the existence of significant difference of per capita consumption of fish among different communities, Post- hoc analysis (Fisher's LSD) was carried out. The result indicated significant difference between Assamese and Nepali, Assamese and North Indian, Assamese and Bengali, Bengali and Nepali, and Bengali and North Indian (Table 4.6).

Table 4.5 ANOVA test results of Per Capita Consumption of Fish among Different Communities

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13670.594	3	4556.865	52.389	0.000
Within Groups	57060.283	656	86.982		
Total	70730.877	659			

Table 4.6 Multiple Comparisons of per capita consumption of fish (kg) among different communities with using Post-hoc test Least Significant Difference (LSD) method

Community of the respondent (I)	Community of the respondent (J)	Mean Difference (I-J)	Std. Error	Sig.
Assamese	Bengali	3.69*	0.92	.000
	Nepali	10.28*	1.04	.000
	North Indian	10.80*	1.04	.000
Bengali	Assamese	-3.69*	0.92	.000
	Nepali	6.58*	1.09	.000
	North Indian	7.11*	1.09	.000
Nepali	Assamese	-10.28*	1.04	.000
	Bengali	-6.58*	1.09	.000
	North Indian	0.52	1.20	.664
North Indian	Assamese	-10.80*	1.04	.000
	Bengali	-7.11*	1.09	.000
	Nepali	-0.52	1.20	.664

*. The mean difference is significant at the 0.05 level.

Descriptive statistics (Table 4.7) revealed that per capita consumption of fish is the highest among the Assamese (19.12 kg) followed by the Bengali (15.41 kg), Nepali (8.83 kg) and the North Indian (8.31 kg).

Table 4.7 Annual per capita consumption of fish across the communities

Communities	N	Mean	Std. Deviation	Minimum	Maximum
Assamese	240	19.12	10.72	1.50	60.00
Bengali	180	15.41	10.77	1.00	72.00
Nepali	120	8.83	7.08	.20	32.00
North Indian	120	8.30	4.92	1.00	24.00
Total	660	14.27	10.36	.20	72.00

N.B. Annual per capita consumption of fish in kg

The monthly average quantity of fish consumed per household varies from 4.2 kg (in the lowest income group i.e., less than Rs. 5000) to 8.31 kg (highest income group i.e., more than Rs. 40,000). The annual per capita consumption is estimated at 10.20 kg., 12.80 kg, 15.76 kg 16.78 kg and 21.21 kg respectively in Category-I (Less than Rs.5000), Category-II (Rs.5000 to Rs.10000), Category-III (Rs. 10000.00 to Rs.20000.00) , Category-IV (Rs.20000 to 40000.00) and Category-V (More than Rs. 40000.00). Table 4.8 clearly indicates that fish consumption increases with increase of family income. This finding was found similar with the findings of Bhatta (2001, 182-

83); Dey et al.(2005,89), P.Kumar, G. Kumar (22-23), Belton et al.(53), Burger et al.(2003,254); Sekar, Randhir, and Meenhakshi (56-60); and the report of FAO(2001,v).

Table 4.8 Quantum of fish consumption across different income groups

Income group categories	Average monthly total consumption of fish per household (Kg)	Per capita monthly consumption of fish (Kg)	Annual per capita consumption of fish (Kg)
Category-I (Less than Rs.5000)	4.20	0.85	10.20
Category-II (Rs.5000 to Rs.10000)	5.46	1.07	12.80
Category-III (Rs. 10000.00 to Rs.20000.00)	6.48	1.31	15.76
Category-IV (Rs.20000 to 40000.00)	7.31	1.40	16.78
Category-V (More than Rs. 40000.00)	8.31	1.77	21.21

The difference in per capita fish consumption among different income group categories has been tested by using one way ANOVA

$$H_0: \mu_1=\mu_2=\mu_3=\mu_4=\mu_5$$

$$H_1: \mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq \mu_5$$

Where,

μ_1 = mean fish consumption of category-I

μ_2 = mean fish consumption of category-II

μ_3 = mean fish consumption of category-III

μ_4 = mean fish consumption of Category-IV

μ_5 = mean fish consumption of Category-V

Results of the ANOVA test (Annexure 11) revealed that 'p' value is 0.000, which is less than the level of significance. Therefore null hypothesis is rejected which implies there is significant difference in per capita consumption of fish across different income groups. The post- hoc analysis (Annexure 12) indicates that there is significant difference in fish consumption among income Category-I, Category-II and Category-V, but no significant difference is seen between Category-III and Category-IV. The descriptive statistics (Annexure 13) revealed that per capita fish consumption is highest in Category-V (21.21 kg) and lowest in Category-I (10.20 kg).

The above findings regarding quantity of fish consumption reveals that quantities consumed by people from both rural and urban area are almost same. The Assamese and the Bengali communities consume more fish than other communities and the per capita consumption of fish is maximum among the highest income group. The estimated annual per capita consumption of fish obtained from household survey (14.72 kg) is higher than those of the state (Assam) average (8.3 kg) and the national average (9.8 kg). The reason for this may as explained by Dey et al. (99) is that estimate of national statistics on per capita fish consumption commonly basd on the total availability of fish in the state/country, often do not include consumption of many small and non-commercial fish species obtained from artisanal and subsistence fisheries, and it is generally believed that the actual per capita fish consumption in many developing countries is higher than the national average reported in official databases. It is also reported that difference between the estimated per capita fish consumption in India derived from the survey data and the national average is due to the fact that the national average is an average figure for both vegetarian and non-vegetarian population, while the survey data covered only the non-vegetarian population.

4.2.2 Expenditure on Fish over Total Expenditure of Food items

The average monthly expenditure on fish per family in the study area was Rs.662.42, which constituted 14.56% of monthly household expenditure on food. The monthly average expenditure on fish in rural area was Rs.580.15 and in urban area Rs.744.70. The percentage of monthly expenditure on fish with respect to total monthly household expenditure on food items was slightly more in urban area (14.69%) than in rural area (14.41%). Table 4.9 shows the average monthly expenditure on food items in the study area.

The monthly per capita expenditure on food among rural consumers of study area was Rs.710.00 whereas in case of urban consumers it was Rs. 988.00 (Table 4.10). According to the 66th round consumer expenditure survey of National Sample Survey Organization (NSSO 1-7), average monthly per capita food expenditure in rural areas of India (All India level) was Rs.600.00 and in Assam it was Rs.646 during 2009-10, whereas in case of urban consumers of India it was Rs.881.00 and for Assam it was Rs.929.00 during the same period. The findings of the present study are found in conformity with this NSSO report to certain extent.

Table 4.9 Average monthly household expenditure on food items/fish

Categories of respondents	Monthly expenditure on food per household (in Rs.)	Monthly expenditure on fish per household (in Rs.)	Percentage of expenditure on fish over total expenditure on food
Geographic profile			
Rural	4026.68	580.15	14.41
Urban	5070.30	744.70	14.69
Communities			
Assamese	4953.17	849.58	17.15
Bengali	4254.81	705.56	16.58
Nepali	4928.29	472.67	9.59
North Indian	3799.83	413.17	10.87
Income groups			
Category-I (Less than Rs.5000.00)	2988.20	349.06	11.68
Category-II (Rs. 5000.00-10000.00)	4025.60	541.17	13.44
Category-III (Rs.10000.00-20000.00)	4885.82	673.97	13.79
Category -IV (Rs.20000-40000.00)	5866.28	898.09	15.31
Category -V (Rs.40000.00 and above)	7031.35	1350.70	19.21
Overall	4548.49	662.42	14.56

Table 4.10 Comparison of Monthly Per Capita Food Expenditure (Rs) with 66th round of NSSO Report

	Rural	Urban
All India (NSSO report)	600	881
Assam (NSSO report)	646	929
Study area (Present study finding)	710	988

A comparison of average monthly expenditure on fish with other food items is presented in Table 4.11 and 4.12. Percentage share of monthly expenditure on fish over total food expenditure was highest (14.56%) followed by meat (13.22%), milk (7.4%) and egg (2.5%) which is evident from Table 4.11. Share of monthly expenditure in animal protein food items (fish, meat, egg and milk) over total expenditure on food is estimated at 37.67%. Overall, the proportion of monthly

household expenditure on staple food in the study area is 62.33%. The proportion of household expenditure on staple food in rural area (62.79%) is slightly higher than the urban area (61.96%). The daily per capita food expenditure is found more in urban area (Rs.32.94) than the rural area (Rs.23.67).

Table 4.11 Average monthly expenditure (in Rs.) on fish and other food items per household

Respondent's profile	Fish	Staple food	Meat	Egg	Milk	Total
Geographic						
Rural	580.15	2547.60	551.67	98.29	268.08	4026.68
Urban	744.70	3162.18	651.04	129.18	403.92	5070.30
Communities						
Assamese	849.58	2953.25	721.63	128.20	314.77	4953.17
Bengali	705.56	2730.03	433.37	106.26	293.14	4254.81
Nepali	472.67	3111.46	727.73	100.18	530.17	4928.29
North Indian	413.17	2588.92	484.83	109.07	234.71	3799.83
Overall	662.42	2854.59	601.20	113.74	336.11	4548.49

N.B. All figures in Rupees

Table 4.12 Monthly expenditure share over different food items

Categories	Percentage of monthly expenditure on				
	Staple food	Fish	Meat	Egg	Milk
Geographic					
Rural	62.79	14.41	13.70	2.40	6.60
Urban	61.96	14.69	12.84	2.55	7.97
Demographic					
Assamese	59.62	17.15	14.57	2.59	6.35
Bengali	64.16	16.58	10.19	2.5	6.89
Nepali	63.13	9.59	14.77	2.03	10.76
North Indian	68.13	10.87	12.76	2.87	6.18
Overall	62.33	14.56	13.22	2.50	7.4

Independent sample 't' test was carried out to assess the significance in monthly average household expenditure on fish between rural and urban consumers. Results of Independent sample 't' test (Annexure 14) indicate that significant value (p) for the Levene's test for Equality of Variances is 0.001 which is less than 0.05 (p< 0.05). Significant (2-tailed) value was also less than 0.05. This implies that the expenditure of urban consumers on fish is significantly higher than that of rural consumers.

The monthly average expenditure on fish was highest among the Assamese (Rs.849.58) and lowest among North Indians (Rs.413.17). The monthly average

expenditure on fish was Rs.705.56 and Rs.472.67 respectively among the Bengali and the Nepali community. The Assamese consumers spend 17.15% on fish with respect to monthly total expenditure on food items followed by Bengali (16.58%), North Indian (10.87%) and Nepali (9.59%).

The significance level of difference in monthly average expenditure on fish among different communities has been tested by using one way ANOVA (Annexure 15). In the analysis 'p' value was found 0.000 which is less than the level of significance (alpha) at 95% level of confidence. It indicates that monthly average expenditure on fish among different communities have significant differences. Post-hoc analysis revealed that there exist significant difference in monthly average expenditure on fish between Assamese and Nepali, Assamese and North Indian, Assamese and Bengali, Bengali and Nepali, and Bengali and North Indian (Annexure 16). Descriptive statistics (Annexure 17) of average monthly expenditure on fish among the Assamese, Bengali, Nepali and North Indian communities reveals that monthly average expenditure on fish is the highest among the Assamese followed by the Bengali, Nepali and the North Indians.

The monthly average expenditure on fish among different income groups were Rs.349.06, Rs.541.17, Rs.673.97, Rs.898.09 and Rs.1350.70 in Category-I, Category-II, Category-III, Category-IV and Category-V respectively. The percentage of expenditure on fish with respect to total household expenditure was 11.68%, 13.44%, 13.79%, 15.31% and 19.21% in category-I, Category-II, Category-III, Category-IV and Category-V respectively. It indicates that the monthly average expenditure on fish and the percentage of expenditure on fish with respect to total household expenditure increases with increase of income and the fact is in line with those of Bhatta (2001, 147-90), Sekar and Senthilnathan (27-30) and Gopal and Nair (140) who reported that average fish consumption expenditure increases with increase in income. Sekar, Randhir and Meenhakshi (56-60) also reported that the average expenditure share of fish across different income groups increased from the lowest to the highest income groups. The percentage share of monthly expenditure on staple food was highest in low income group i.e., Category-I (68.80) and lowest in the high income group i.e., Category –V (55.66). The percentage share of monthly expenditure on other animal sourced food also increased with income.

4.2.3 Frequency of Fish Consumption

Overall, 53.7% of respondents eat fish twice a week, 25.2% daily, and 13.0% once a week. The average frequency of fish consumption in the study area is twice a week. Tables 4.13 and 4.14, and Fig.4.6 and 4.7 illustrate the findings of frequency of eating fish.

The majority of consumers in both rural and urban areas consume fish at least twice a week. In the rural area 54.5% of consumers and in urban area 52.7% of consumers ate fish at least 2 days in a week. The frequency of eating fish daily is more (26.1%) in rural area than in urban area (24.2%). In rural area 13.3% consumers and in urban area 12.7% eat fish once in a week. Findings of Sekar also indicated that majority of consumers ate fish twice a week.

Table 4.13 Frequency of eating fish in rural and urban area

Frequency	Rural		Urban		Total/Overall	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Daily	86	26.1	80	24.2	166	25.2
Twice a week	180	54.5	174	52.7	354	53.7
Once a week	44	13.3	42	12.7	86	13.0
Fortnightly	11	3.3	17	5.2	28	4.2
Once in a month	9	2.7	17	5.2	26	3.9
Total	**330**	**100.0**	**330**	**100.0**	**660**	**100.0**
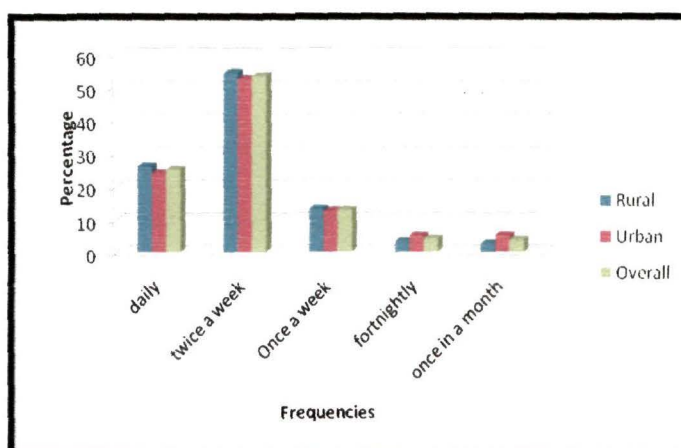
Fig. 4.6. Frequency of eating fish in rural and urban area

Most of the consumers (more than 40%) of different communities eat fish at least twice a week (Table 4.13). The frequency of eating fish daily is highest among the Bengali (41.1%) followed by the Assamese (33.3%). The frequency of eating fish

twice a week is maximum among the Assamese (58.8%) followed by North Indians (57.5%), the Bengali (52.3%) and the Nepali (41.7%).

Table 4.14 Frequency of eating fish across the communities

Frequency	Assamese		Bengali		Nepali		North Indian	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Daily	80	33.3	74	41.1	6	5.0	6	5.0
Twice a week	141	58.8	94	52.3	50	41.7	69	57.5
Once a week	13	5.4	10	5.6	33	27.5	30	25.0
Fortnightly	3	1.2	1	.6	13	10.8	11	9.2
Once in a month	3	1.2	1	.6	18	15.0	4	3.3
Total	240	100.0	180	100.0	120	100.0	120	100.0
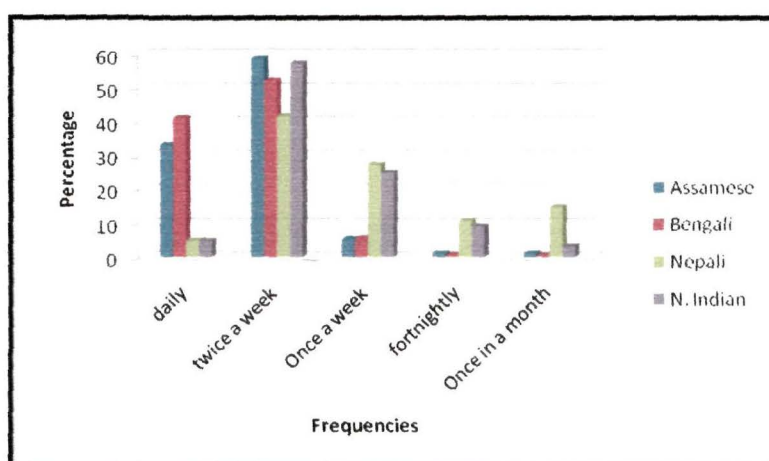
Fig. 4.7. Frequency of consumption of fish across the communities

The frequency of eating fish daily was maximum among the consumers of income group Category-V (43.5%) and lowest among the consumers of category-I (15.5%). Major percentage of consumers of all the income categories (47-56.1%) consumed fish twice a week. The percentages of consumers eating fish twice a week are 54.1%, 56.1%, 47.0%, 60.9% and 47.9% in the income groups Category-I, Category-II, Category-III, Category-IV and Category-V respectively (Table 4.15).

Table 4.15 Frequency of eating fish among different income groups

Frequencies	Category-I	Category-II	Category-III	Category-IV	Category-V
Daily	15.5	21.0	33.1	25.5	43.7
Twice a week	54.1	56.1	47.0	60.9	47.9
Once a week	17.7	16.0	11.8	9.1	2.8
Fortnightly	7.7	4.3	3.7	-	2.8
Once a month	5.0	2.5	4.4	4.5	2.6

N.B. Figures in percentage of respondents

By using chi-square analysis (Pearson coefficient) the relationship between frequency of fish consumption and income of the respondents was tested. The result revealed that there is relationship between frequency of fish consumption and income of the respondents since 'p' (0.000) value was found less than 0.05 (Table 4.16).

Table 4.16 Chi-square test result on frequency of fish consumption and income of respondents

	Degree of Freedom (df)	Asymp.Sig. (2-sided)
Pearson Chi-square	20	.000

Chi-square test was also carried out to determine the relationship between frequency of fish consumption and community of respondents. In the result of chi-square test, 'p' (Asymp. Significant) value was found 0.000 which is less than 0.05. Hence, it can be inferred that there is relationship between the frequency of fish consumption and community of respondents.

4.2.4 Average Quantity of Fish Purchased

The majority of respondents irrespective of geographic and demographic profile purchased an average quantity of 500gms fish at a time. Overall, 48.3% of the respondents purchased 500gms fish at a time, while 19.5% of respondents bought 250 gm fish, 18.5% of respondents bought 1 kg, and 5.5% bought more than 1.0 kg.

Data presented in Table 4.17 indicate that 48.5% respondents of urban area and 48.2% of rural area purchase 500gm of fish at a time. 20.3% respondents in rural area and 18.8% in urban area procured an average quantity of 250 gm fish. Similarly 20.6% of urban and 16.4% of rural respondents procured an average quantity of 1.0 kg at a time, and 6.7% of urban and 4.2% of rural respondents purchased more than a kg at a time. The average quantity of fish purchased at a time in rural and urban areas is depicted in Fig.4.8.

Table 4.17 Average quantity of fish purchased at a time in rural and urban area

Quantity purchased at a time	Rural		Urban		Overall/Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
250 gm	67	20.3	62	18.8	129	19.5
500 gm	159	48.2	160	48.5	319	48.3
1.0 kg	54	16.4	68	20.6	122	18.5
more than a kg	14	4.2	22	6.7	36	5.5
unspecified	36	10.9	18	5.5	54	8.2
Total	**330**	**100.0**	**330**	**100.0**	**660**	**100.0**
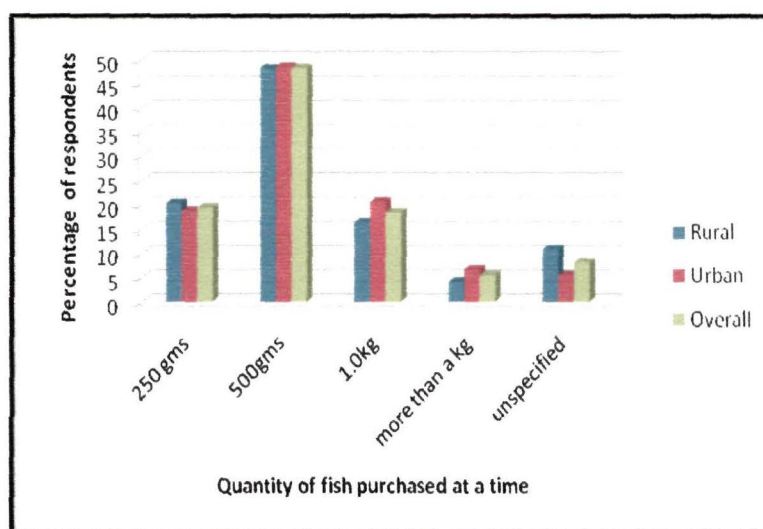
Fig. 4.8. Average quantity of fish purchased at a time in rural and urban area

Majority of respondents of all the communities purchased an average quantity of 500gm fish at a time (Table 4.18). An average quantity of 250gms of fish was purchased at a time by majority of North Indian (33.3%), followed by Bengalis (30%), Nepali (10%) and Assamese (9.6%). 11.2% of respondents of the Assamese community purchased more than 1 kg fish at a time. The highest percentage (25%) of respondents of the Nepali community purchased 1 kg of fish at a time followed by the Assamese (22.9%), North Indian (16.7%), and the Bengali (9.4%). Community-wise average quantity of fish purchased at a time is presented in Fig.4.9.

Table 4.18 Average quantity of fish purchased at a time by different communities

Average quantity of fish purchased at a time	Assamese		Bengali		Nepali		North Indian	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
250 gm	23	9.6	54	30.0	12	10.0	40	33.3
500 gm	105	43.8	97	53.9	70	58.3	47	39.2
1.0 kg	55	22.9	17	9.4	30	25.0	20	16.7
more than a kg	27	11.2	2	1.1	5	4.2	2	1.7
unspecified	30	12.5	10	5.6	3	2.5	11	9.2
Total	240	100.0	180	100.0	120	100.0	120	100.0
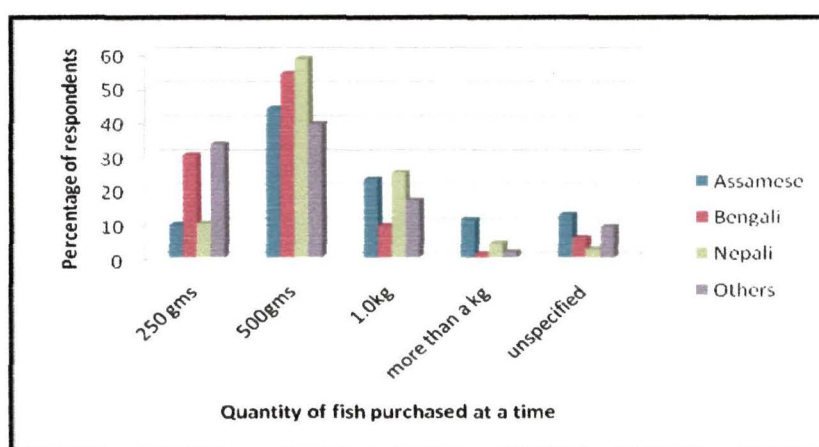
Fig. 4.9. Average quantity of fish purchased among different communities
Note: 'others' indicate North Indians

Table-4.19 presents the average quantity of fish purchased at a time by different income groups. It reveals that an average quantity of 250 gm fish purchased at a time was highest among the consumers of lowest income group (Category-I) and lowest in the Category-V. Procurement of 500 gm fish at a time was highest among all the income groups and it varies from 36.6% to 55.9%. An average quantity of 1.0 kg fish purchased at a time by highest percentage of consumers of the income group Category-V (35.2%). The percentage of consumers purchasing more than 1.0 kg fish at a time was maximum among Category- V (11.3%) and minimum among Category-I (1.7%).

Table 4.19Average quantity of fish purchased at a time by different income groups

Average quantity of fish purchased at a time	Category-I	Category-II	Category-III	Category-IV	Category-V
250 gm	36.5	20.4	.12.5	10.0	2.8
500 gm	47.0	53.7	55.9	40.9	36.6
1.0kg	7.7	16.7	16.2	30.9	35.2
More than 1.0kg	1.7	3.7	5.9	10.0	11.3
Unspecified	7.2	5.6	9.6	8.2	14.1

N.B. Figures in percentage of consumers in that category

The trend indicates a relationship between income and quantity of fish purchased at a time. To check this chi-square test was carried out. Chi-square test revealed that there is significant relationship between income and average quantity of fish purchased.

The results clearly indicate a large percentage of consumers (48.3%) prefer to buy an average quantity of 500 gm at a time compared to other size categories. Again, the frequency of eating fish by majority of consumers (53.7%) is twice a week. This information would help the marketers to concentrate on preparation of 500 gm size pack and sell at the required frequency.

4.2.5 Form of Fish Preferred

Overall, 93.9% respondents prefer to purchase local fish and only 6.1% purchase imported (locally known as *chalani*) fish. About 93% of respondents of rural area consumed *local* (fish produced in local water bodies of Assam) fish and 23% consumed *chalani* fish but in urban area 94.8% of respondents preferred local fish and 5.2% *chalani* fish. This finding reveals that there exists a tremendous demand for local fish in the study area. Respondents of all categories preferred local fish in live and fresh condition than frozen/iced fish.

4.2.6 Species of Fish Preferred

The respondents were asked to give their priority of consumption of different species of fish in order of preference starting from 1 as the highest preference. Rank analysis (weighted value) was carried out to know the consumer preference. Rank order. is given according to rank score. The species of fish ranked 1, 2, and 3 were given weight (scores) as 3, 2, and 1 respectively. The total rank score was obtained by

multiplying the frequency of showing preference as first, second and third, with the respective weightage to add them up. The preferences then arranged in descending order of preferences on the basis of their total rank score and finally ranked. Same procedure has been followed in calculation of preferences and rank order.

The common name (English name), local name and scientific name of different species of fish is given in Annexure 18.

Indian Major Carps (IMC):

Majority of respondents (72.1%) have shown their first preference for rohu, second preference for catla (67.3%), and 35.5% respondents have shown third preference for mrigal. In order of rank, rohu was given as first rank, catla second and mrigal third (Table 4.20).

Table 4.20 Consumer preferences for IMC in rural and urban area

IMC	Total Rank score	Rank order
Rohu	1786	I
Catla	1440	II
Mrigal	373	III

Similar findings were also reported by Dey et al. (107) where consumers of India and Bangladesh ranked rohu, catla and mrigal as first, second and third preferred species. Bhatt (2001,182-83) in a study conducted in Karnataka also found that rohu and catla was the most preferred species and mrigal was the least preferred species in both rural and urban areas.

Exotic carps:

Common carp was given 1st rank followed by Grass carp and Silver carp (Table 4.21). Dey et al.(107) also revealed that common carp was the most preferred species followed by grass carp and silver carp.Upadhya and Panday (193-96) revealed that silver carp was the most preferred fish in Trpura among these exotic carps.

Table 4.21 Consumer preferences for Exotic carps in rural and urban area

Exotic carp	Total Rank score	Rank order
Common carp	1219	I
Grass carp	586	II
Silver carp	526	III

Minor carps

The consumer preference patterns for three different minor carps- *bhangon,* *kurhi* and *koilajara* were obtained from the respondents. Among these *bhangon* was given first rank in order of preference by all respondents followed by *kurhi* and *koliajara.*

Live fish:

Among different live fishes respondents were asked to show their preferences for magur, singi, koi, *sol and goroi.* Out of these the highest preferred live fish was magur, followed by koi, *sol,* singi, and *goroi.* Overall 63.9%, 20.2%, 12.9%, 9.5% and 5.4% of the respondents gave first preference to magur, koi, singi, *sol* and *goroi* respectively. Magur, *sol,* koi, singi and *goroi* were ranked as 1st, 2nd, 3rd, 4th and 5th respectively.

Big varieties of fish:

Consumer preferences for three big varieties of fish- *Arii, Chital* and *Borali* were also obtained and analysed. The respondents had shown first, second and third priority to *Chital, Arri* and *Borali,* respectively in order of rank. *Chital* is the highest preferred fish both in rural and urban areas. Next to *Chital* the rural respondents preferred *Borali* whereas the urban respondents preferred *Arri.* Among the four communities the Assamese, the Bengali and the North Indian had shown first preferences for *Chital* whereas *Borali* was the first choice of the Nepali community. The Assamese and Bengali respondents expressed preferences for *Arii* and *Borali* as second and third option.

Preferences for *Pabha, Kandhuli* and *Singorah:*

Among these three varieties, the highest percentage of respondents (66.1%) indicated *Pabha* as their first choice. Only 35.2% and 22.7% of respondents had shown first preferences for *Singorah* and *Kandhuli* respectively. Both rural and urban respondents expressed first preference to *Pabha,* second to *Singorah* and third to *Kandhuli. Pabha* was the most preferred fish among all the communities.

Small varieties of fish:

With regards to preferences for smaller varieties of fishes, majority of respondents in the study area, irrespective of rural/urban and communities, expressed their preferences for *moa* (32.9%), followed by *puthi* (22.9%), *boliora* (10.3%), *dorikona, prawn,* and *kholihona.*

The preferences expressed for different varieties of fish ascertained that apart from carps there exist good preferences for indigenous varieties of fishes such as magur, singi, koi, *sol, arri, chital, borali,* and *pabha* in different strata of the population. Sugunan (7) also found that the consumer preferrence for *moa, puthi* and *pabha* were more and fetched more prices in Assam.

4.2.7 Preferred Size of Carps:

The highest percentage of respondents (31.7%) preferred 1.0 -2.0 kg size of carps. Carps weighing 2.0–3.0 kg are preferred by 21.5 % of respondents. Majority of respondents in both rural (33.9%) and urban area (29.4%) preferred the size of 1.0 - 2.0 kg. In urban area 29.4 % of respondents have preferred the size of 2.0-3.0 kg while in rural area 16.1% preferred this size group.

Majority of respondents (more than 30%) of all the four communities have shown their preferences for 1.0-2.0 kg size fish. The average size of 2.0-3.0 kg has the highest preference of the Assamese (26.2%) followed by the North Indian (20%). Information on preferred size of carps shall benefit fish farmers and marketeers in taking decision in their production and marketing process. Farmers should concentrate more in production of 1.0-2.0 kg size carp fish than other size categories.

4.2.8 Preferences for Fish compared to other Animal Protein

The preference for fish compared to other animal protein has been analysed. In general, majority of the respondents (60.3%) in the study area have the first preference for fish. The percentage of respondents preferring fish as first choice is 61.8 in rural area and 58.8 in urban area. The analysis indicates that both rural and urban respondents have the highest preferences for fish followed by chicken, mutton, beef, pork and eggs.

4.2.9 Preferences for Different Form of Cooking/Preparation

Overall, majority of respondents (69.8%) have preferred curry followed by fried (26.7%), steamed (2.7%) and roasted (0.8%) form of fish preperation. Among different communities, irrespective of rural and urban area, majority of respondents also preferred curry followed by fried, steamed and roasted forms of cooking (Table 4.22). From the table it can be inferred that majority of the respondents preferred curry. The study conducted by the BOBP (13) among the consumers of Chennai also revealed that curry and fried form were the preferred preparations.

Table 4.22 Preferences for different form of cooking/preparation

Respondents profile	Percentage of consumers showing first preferences for			
	Fried	Curry	Steamed	Roasted
Geographic				
Rural	32.7	63.9	2.4	1.2
Urban	20.6	75.8	3.0	0.3
Communities				
Assamese	29.6	66.7	1.7	2.1
Bengali	13.9	78.3	7.8	1.1
Nepali	37.5	62.5	-	-
North Indian	29.2	70.8	-	-
Overall	26.7	69.8	2.7	0.8

4.2.10 Methods of Preparation depending on Species of Fish

Depending on species of fish, method of preparation varies. For preparation of different varieties of carps, majority of respondents (70.8%) preferred curry followed by fried (27.7%). Live fish was preferred as curry by majority (86.5%) of the respondents. Small fishes were preferred as fried by majority of respondents (58.2%), followed by curry (25.8%). Dried fish was prepared as curry by majority (73.8%) of respondents (Table 4.23).

Such informations could help in the decision making process of preparation of different fish reciepies in different eating joints.

Table 4.23 Preparation of different species of fish

Form of preparation depending on varieties of fish	Response of consumers in percentage
Carps	
Fried	27.7
Curry	70.8
Steamed	1.1
Roasted	0.5
Live fish	
Fried	7.4
Curry	86.5
Steamed	5.3
Roasted	0.8
Small fish	
Fried	58.2
Curry	25.8
Steamed	10.6
Roasted	5.5
Dry fish	
Fried	8.4
Curry	73.8
Steamed	0.7
Roasted	7.5
Chutney	9.6

4.2.11 Reasons /Factors Influencing Fish Consumption

To assess the most preferable factors influencing fish consumption, respondents were asked to rank the given list of factors according to their judgment starting with 1 as the highest score. Table 4.24 represents the information about reasons /factors influencing fish consumption. It is observed that palatable taste, high nutrition value, habit, easy digestibility, affordable price of fish in comparison to meat, easy availability, less fat content, status symbol are ranked by the respondents as 1st, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th, respectively as the reasons/factors influencing fish consumption. It is assessed that among different factors influencing fish consumption 'palatable taste' occupied the top rank and "status symbol" as the last rank. The various reasons indicated by respondents for preferring fish as first choice were largely in conformity with the findings of Santhakumar and Sanjeevraj (51- 53).This finding also confirmed earlier findings of Verbeke and Vackier (67) that the most important driver for eating fish was taste followed by nutritional value.

According to Jamdade et al. (143), the most important reason for eating fish was the nutritional aspect of fish among the more educated group whereas less educated people consumed fish especially due to the taste of fish.

Table 4.24 Reasons /factors influencing fish consumption (Overall)

Reasons/factors affecting fish consumption	Total rank score	Rank order
Palatable taste	4621	1
High nutrition value	4509	2
Habit	3714	3
Easily digestible	2753	4
Price of fish is affordable in comparison to meat	2128	5
Easily available	1899	6
Less fat content	1700	7
Status symbol	555	8

During the survey it was observed that majority of consumers were unaware about benefits of fish consumption to human health. In such situation, health benefit of fish consumption with scientific evidence should be communicated to the people which shall increase fish consumption even among the non-eaters of fish.

4.2.12 Reasons for Not Preferring Fish

In order to identify the most important reason for not preferring fish among the low users, respondents were asked to rank a list factors according to their judgment starting 1 as the highest negative score and the results are presented in Table 4.25. Overall, the respondents in the study area ranked 'price of good quality fish is unaffordable' as first important reason for not preferring fish followed by 'presence of intramuscular bones', 'tradition', ' religious reason', 'difficult to clean', 'bad smell', 'difficult to prepare', 'do not like the taste' and 'lack of status benefit'. The 'price of good quality fish is unaffordable' is the single largest known factor responsible for low consumption of fish. Many people do not consume fish because it has a bad odour. The results were found somewhat similar with the findings of Sabat, Sharma and Salim (19) where they reported that price and presence of bones in fish were the problems in fish consumption along with irregular supply and lack of fresh fish.

The reasons for not preferring fish prioritized by the respondents shall provide solutions to the producers and marketers for producing and supplying fish which are preferred by the consumers. According to Rao and Raju (1-14) the bad odour can be removed by better processing methods of fish with some other food items.

Table 4.25 Reasons for not preferring fish

Reasons for less preference for fish	Total rank score	Rank order
Price of good quality fish is unaffordable	1187	1
Presence of intramuscular bones	939	2
Tradition	617	3
Difficult to clean	403	4
Bad smell	266	5
Difficult to prepare	263	6
Do not like the taste	42	7
Lack of status benefit	42	7
Religious reason	40	8

4.2.13 Place of Purchasing Fish

Majority of respondents (52%) in the study area purchase fish from the local market followed by town market (33%) and at place of residence (from vendors 15%).

Fig. 4.10 depicts the place of purchasing fish in rural and urban areas. In rural area, 80.3% consumers purchase fish from local market, 6.4% from town market and 13.3% from vendors/fish peddlers. On the other hand, 59.7% consumers of urban area purchase fish from town market, 23.6% from local market and 16.7% at place of residence i.e. from vendors/fish peddlers. Chi-square test was carried out to know the relationship of place of residence (Rural and Urban) with respect to place of purchasing fish. The result indicated that p (.000) < 0.5. Hence, there is relationship between place of residence (Rural and Urban) and place of purchasing.

Fig.4.10. Place of purchasing in the study area

Information on these aspects will be helpful for the stakeholders to strengthen their distribution network. Fish vending could be a lucrative business if proper

segmentation strategy is followed (Malhotra and Sinha 318). The high-income groups of fish eaters would pay for the services of vendors if good quality fish were made available. Cleanliness, good packaging and proper containers to keep fish fresh would be some of the requirements of fish vending.

4.2.14 Need for Value Addition

In the study area, 98.9% of respondents have shown their need to purchase fish as dressed and chopped, 46.5% as ready to eat fish other than fried fish, 11.2% as iced fish, and 8.5% as fried fish (Table 4.26).The reason cited by the respondents is that the value addition save time and they can opt for a slice of larger fish. In urban area almost all the respondents (99.7%) wanted chopped and cleaned fish and in rural area it is opted by 98.2% of respondents. The percentage of respondents opting for ready to eat fish is more in urban area (55.2) than in rural area (37.9). 11.5% respondents of urban area and 10.9% of rural area want to purchase iced fish, and 9.4% and 7.6% of respondents of rural and urban area respectively want fried fish.

Table 4.26 Need for value addition in fish (in percentage of respondents)

Respondents profile	Value addition as			
	Dressed and chopped	Fried	Iced/Frozen	Ready to eat
Geographic				
Rural	98.2	9.4	10.9	37.9
Urban	99.7	7.6	11.5	55.2
Income groups				
Category-I (Less than Rs.5000)	97.8	8.3	8.3	24.9
Category-II (Rs.5000 - 10,000)	99.4	10.5	11.1	40.1
Category-III (Rs.10,000 – 20,000)	98.5	8.8	10.3	58.1
Category-IV (Rs.20,000 – 40,000)	100	9.1	10.9	63.6
Category-V(More than Rs.40,000)	100	12.7	21.1	67.6
Overall	**98.9**	**8.5**	**11.2**	**46.5**

The percentage of respondents showing willingness for value addition in fish as ready to eat fish is 24.9% among income group Category-I, 40.1% among Category-II, 58.1% among Category-III, 63.6% among Category-IV and 67.6 % among Category-V (Fig.1). Willingness for value addition as iced /frozen was found maximum among income group category-V (21.1%) and lowest among income group category-I (8.3%).

4.2.15 Willingness to pay extra amount for value addition

Table 4.27 represents the respondents' willingness to pay extra for different types of value addition in fish. The study showed that majority of respondents (87.9%) were willing to pay 5% extra for value addition as cleaning and chopping and only 8.2% and 0.6% respondents were willing to pay 5-10% and more than 10%, respectively. In urban area, 91.8% respondents and in rural area 83.9% have the willingness to pay up to 5% extra for cleaning and chopping. Willingness to pay extra for ready to eat fish (except fried fish) up to 20%, 20-30% and more than 30% were shown by 40.8%, 5.9% and 0.3% of consumers respectively. Only 10% of the respondents were willing to pay up to 10% extra for frozen and iced fish.

Table 4.27 Willingness to pay extra for different value addition in fish

Value addition	Willingness to pay extra	Rural	Urban	Overall
Dressed and chopped fish	Upto 5%	83.9	91.8	87.9
	5-10%	8.8	7.6	8.2
	More than 10%	1.2	-	0.6
	Do not want to pay extra	6.1	0.6	6.1
Fried fish	Upto 10%	7.0	5.6	6.2
	10-15%	2.1	1.8	2.0
	More than 15%	0.3	0.3	0.3
	Do not want to pay extra	90.6	92.4	91.5
Frozen fish/Iced fish	Upto 10%	10.6	9.4	10.0
	10-15%	0.6	0.9	0.8
	More than 15%	-	-	-
	Do not want to pay extra	88.8	89.7	89.2
Ready to eat fish (Except fried fish)	Upto 20%	34.5	47.0	40.8
	20-30%	3.9	7.9	5.9
	More than 30%	0.3	0.3	0.3
	Do not want to pay extra	61.2	44.8	53.0

N.B. Figures indicate percentage of respondents

4.2.16 Consumer awareness about and willingness for different value added fish products

The study of awareness of respondents about different value added products related to fish is essential so that producers and marketers can plan their production and marketing activities. In this section, awareness regarding value added fish products, such as fish cutlet, fish finger, fish ball, and fish pickle (other than cleaned and chopped fish, iced/frozen fish, and dry fish which were considered as value

addition to fish) was studied and results presented in Table 4.28. Out of the total respondents, 95 respondents (14.41%) were aware of and purchased different value added fish products. 73 respondents (22.1%) of urban area and 22 respondents (6.7%) of rural area were aware of and purchased different value added fish products. Awareness and consumption of different value added fish products were found highest among the respondents of income Category-V (39.4%) followed by that of Category-IV (24.5%). Fish cutlet, fish finger, fish ball, fish pokoura and fish pickle were the ready to eat value added fish products which were found to be consumed by a small section of the respondents. Overall, the highest percentage of consumers consumed fish finger (10.2%) followed by fish cutlet (8.6%). The result of Chi-square test showed a significant relationship between respondents' income and awareness/purchase intention of value added fish products as 'p' value (o.ooo) is found to be less than 0.05 at 95% level of confidence. This indicates a pattern of increase in acceptance level of value added fish products with increase in income.

Table 4.28 Value added fish products purchased by consumers (Figures in percentage)

Respondents profile	Fish cutlet	Fish finger	Fish ball	Fish pokoura	Fish pickle
Geographic profile					
Rural	3.60	2.40	0.90	0.90	0.60
Urban	13.60	17.90	1.20	2.40	nil
Income groups					
Category-I (Less than Rs.5000)	3.30	2.20	0.60	1.10	nil
Category-II (Rs.5000 - 10,000)	2.50	5.60	nil	1.20	nil
Category-III (Rs.10,000 – 20,000)	7.40	7.40	1.50	2.90	nil
Category-IV (Rs.20,000 – 40,000)	10.90	19.10	1.90	2.70	nil
Category-V (More than Rs.40,000)	35.20	32.40	4.20	nil	0.90
Overall	**8.6**	**10.2**	**1.1**	**1.7**	**0.3**

The results of the present study support earlier findings of Sabat, Sharma and Salim (19-27) where they reportd that about 10% respondents had consumed value added products of fish out of which maximum were from urban and minimum were from rural area. From the findings it can be inferred that majority of consumers are willing for value addition in the form of dressed and chopped fish followed by ready to eat fish. The present results show that there is a good scope for niche marketing of

value addition as ready to eat products in uban areas. It could be a guide to both producers and marketers to produce products of desired quality and price which can satisfy consumers.

4.2.17 Constraints of consumption of ready to eat fish/ value added fish products

Fish curry and fish fry are two traditional value added fish products in Assam which are widely prepared and consumed, and these are commonly available in eating joints. Value added fish products, such as fish cutlet, fish finger, fish ball, fish pickle etc. are not traditionally prepared. These value added products have become popular in some other parts of the country. In order to identify the most important reason for non/less consumption of these products (fish cutlet, fish finger, fish ball, fish pickle etc.) consumers were interviewed with both closed and open ended questions and asked to tick one and/or more than one options.

'Not easily available', 'lack of awareness', 'have not tasted the product yet', 'do not like the taste' and 'presence of intramuscular bones' were stated as the reasons for non/less consumption of ready to eat fish products by 99.7 %, 88.0 %, 84.5 %, 8.9 % and 3.2 % respondents respectively in the study area. Among other variables of non/less consumption of ready to eat fish were price of these products and health consciousness which were reported by 16.06 % and 23.57 % of respondents respectively. According to Sabat, Sharma and Salim (19) the major barriers for consumption of value-added fish and fish products were lack of awareness, unavailability, no preference and unacceptable taste. North Indian respondents were ready to pay a reasonable amount for value-added fish and fish products, but no such product is available in the market.

Understanding such constraints is of great importane for marketers who want to satisfy unmet needs through their product offering by improving product quality, distribution and communication. Promotional campaign can play an important role in creation of awareness and popularity of different value added fish products. Since 23.57% of respondents showed their reluctance to take value added fish products due to health consciousness, there is a need of quality certification of these products so that consumers can accept these without hesitation.

4.2.18 Constraints faced during purchasing fish

Consumers were asked to give their response against constraints facing during purchasing of fish. The constraints presented to them for responding were 'difficulties of ascertaining quality', 'dirty and unhygienic market area', 'chances of getting cheated', 'irregularity of supply', and 'non-availability of preferred fish'. The degree of seriousness of each constraint was measured using a 5-point Likert scale with response of Strongly Agree (SA), Agree (A), Neither agree nor disagree (NAND), Disagree (D) and Strongly Disagree (SD) and value assigned to each of the response were 2, 1, 0, -1, and -2 respectively. The responses from the consumers are summarized in Table 4.29 and depicted in Fig.4.11.

Table 4.29 Constraints faced during purchase of fish in rural and urban area

Difficulties faced during purchasing of fish	Mean value of responses in 5 point Likert scale in relation to the problems		
	Rural area	Urban area	Overall
Quality difficult to ascertain	-0.05	0.14	0.04
Dirty and unhygienic market area	0.55	0.69	0.62
Chances of getting cheated	0.44	0.65	0.54
Irregularity of supply	0.44	0.40	0.42
Unavailability of preferred fish	0.64	0.37	0.50
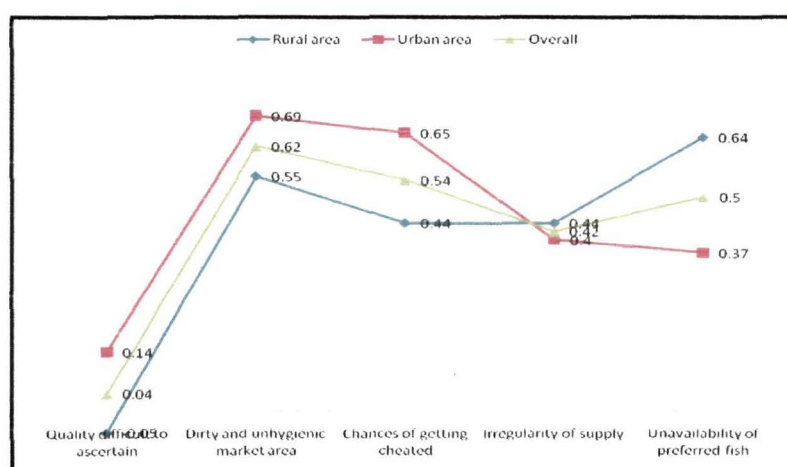
Fig. 4.11. Overall perception of consumers about constraints faced during purchasing of fish

The mean value of each problem statement indicated that the respondents of the study area largely agreed to the statement 'dirty and unhygienic market area', followed by 'chances of getting cheated', 'unavailability of preferred fish', 'irregularity of supply', and 'quality difficult to ascertain'. Respondents in rural area largely agreed to the statement 'unavailability of preferred fish' followed by 'dirty and unhygienic market area' but in urban area, majority of respondents largely agreed to 'dirty and unhygienic market area' followed by 'chances of getting cheated.' During the investigation it was reported by a section of respondents that they relied on fish eyes and appearance of gills to evaluate freshness of fish.

4.2.19 Willingness to pay extra for better shopping environment

The respondents were asked to express their willingness to pay extra in relation to three statements, i.e., 'I will pay extra if quality and weight of fish is certified', 'I will pay extra if market infrastructure is improved' and 'I will pay extra for regular availability of preferred fish' in a 5 point scale as 'Strongly Agree', 'Agree', 'Neither agree nor disagree', 'Disagree' and 'Strongly Disagree.'

The mean values of responses are presented in Table 4.30 and Fig.4.12.

Table 4.30 Willingness to pay extra for better shopping environment

Willingness to pay extra for	Mean value of responses in 5 point Likert scale in relation to better marketing of fish		
	Rural area	Urban area	Overall
If quality and weight of fish is certified	0.91	0.95	0.93
If market infrastructure is improved	0.36	0.58	0.47
If preferred fish are found on regular basis	0.42	0.55	0.48
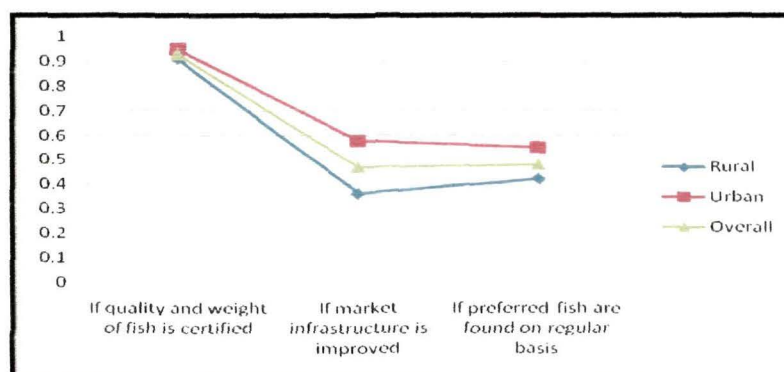
Fig.4.12. Overall willingness of consumers to pay extra for better shopping environment

Majority of respondents (59.7%) in the study area agreed to pay extra if quality and weight of fish is certified. Only 7.3% respondents disagreed to pay extra even if quality and weight of fish is certified. In rural and urban area, 63.0% and 56.4% of respondents respectively agreed to pay extra if quality and weight of fish is certified.

Out of the total respondents 48.8% agreed to pay extra for better market infrastructure. Only 18.6% respondents disagreed to pay extra if market infrastructure is improved. 50.3% of respondents of urban area and 47.3% respondents in rural area agreed to pay extra if market infrastructure is improved. 49.1% respondents agreed to pay extra for regular supply of preferred fish.

Table 4.30 indicates that respondents were highly agreed to pay extra if quality and weight of fish is certified.

4.2.20 Decision making and activities performed in the household with respect to fish consumption

The decision about the type of fish to buy, frequency of eating, type of preparation and activities of purchasing, scaling and cleaning, and preparation of fish are influenced by different members of the family in the households. The marketers have to ascertain which members in the family play active role as a decider of fish consumption in the family in order to develop effective promotional strategies. The result presented in the Table 4.30 indicates that decision on the type of fish to buy and frequency of eating fish were mainly taken by the family head/ husband, which accounts 43.9% and 47.9% respectively. Next to family head/ husband, decision on the type of fish to buy and frequency of eating fish were taken jointly which accounts for 37.7% and 34.4% respectively. The decision about preparation of fish was taken mainly by the housewife (71.7%). Purchasing of fish was mainly performed by husbands (71.5%) and scaling and cleaning of fish was mainly carried out by the housewife (80.9%). The responsibility of cooking of fish was mainly of the wife (87.6%). Since woman is the queen of the kitchen and decision maker in the household management in many Indian homes, they should be motivated to eat fish (P. S. Rao 3) and they should be targeted for promotional campaign through different electronic and print media about preparation of different fish recipies.

Table 4.31 Activities performed in the household

Activities performed in the family	Family head/Husband	Wife	Children	Joint	Household helper
Deciding type of fish to buy	290 (43.9)	58 (8.8)	63 (9.5)	249 (37.7)	-
Deciding frequency of eating fish	316 (47.9)	57 (8.6)	60 (9.1)	227 (34.4)	-
Purchase of fish	472 (71.5)	37 (5.6)	11 (1.7)	134 (20.3)	6 (0.9)
Scaling and cleaning of fish	34 (5.2)	534 (80.9)	7 (1.1)	50 (7.6)	35(5.3)
Deciding the preparation	39 (5.9)	473 (71.7)	11 (1.7)	134 (20.3)	3 (0.5)
Preparation of fish	10 (1.5)	578 (87.6)	8 (1.2)	59 (8.9)	5 (0.8)

N. B Figures in bracket indicate the percentage of respondents under the category

The decision on the type of fish to buy both in rural and urban areas was taken by husbands in equal percentage (43.9%). Decision regarding frequency of eating fish was also taken by family head/husbands in equal percentage (47.9%) in both in rural and urban areas. No significant differences have been seen in purchase of fish, scaling and cleaning, deciding the preparation and preparation of fish in rural and urban area (Table 4.32).

Table 4.32 Activities performed in rural and urban households

Activities performed in the family	Rural					Urban				
	Husband	Wife	Children	Joint	Household helper	Husband	Wife	Children	Joint	Household helper
Deciding what fish to buy	145 (43.9)	25 (7.6)	31 (9.4)	129 (39.1)	-	145 (43.9)	33 (10.0)	32 (9.7)	120 (36.4)	-
Deciding frequency of eating fish	158 (47.9)	23 (7.0)	34 (10.3)	115 (34.8)	-	158 (47.9)	34 (10.3)	26 (7.9)	112 (33.9)	-
Purchase of fish	235 (71.2)	13 (3.9)	7 (2.1)	23 (22.1)	2 (0.6)	237 (71.8)	24 (7.3)	4 (1.2)	61 (18.5)	4 (1.2)
Scaling and cleaning of fish	17 (5.2)	275 (83.3)	4 (1.2)	26 (7.9)	8 (2.4)	17 (5.2)	259 (78.5)	3 (0.9)	24 (7.3)	27 (8.2)
Deciding the preparation	16 (4.8)	241 (73)	4 (1.2)	66 (20.0)	3 (0.9)	23 (7.0)	232 (70.3)	7 (2.1)	68 (20.6)	-
Preparation of fish	6 (1.8)	293 (88.8)	1 (0.3)	28 (8.5)	2 (0.6)	4 (1.2)	285 (86.4)	7 (2.1)	31 (9.4)	3 (0.9)

N. B Figures in bracket indicate the percentage of respondents under the category

4.2.21 Habit of taking food outside

Eating out habit of the people of the study area is a recent phenomenon and observation reveals that it is mostly popular among the high income group. This study tried to look into the patterns of eating out habit of the population of the study area so that proper marketing strategies could be developed.

4.2.21.1 Frequency of going to restaurant for meals

The results presented in Table 4.33 indicate that frequency of going to restaurant for meals in the study area is very low. Only 2.7% of respondents go once a week, 3.5% twice a week and 11.1% once in a month to restaurants for meals. 3.6% respondents in urban area and 1.8% respondents in rural area go to restaurants for their meals. Again, 3.9% and 3.0% respondents of both urban and local area, respectively, go to restaurants for meals twice a week.

Table 4.33 Frequency of going to restaurant for meals

Respondents profile	Frequency of going to restaurant for meals			
	Once a week	Twice a week	Once in a month	Rare
Geographic profile				
Rural	1.8	3.0	7.0	88.2
Urban	3.6	3.9	15.2	77.3
Income groups				
Category-I	1.7	2.2	3.9	92.3
Category-II	3.1	3.1	6.8	87.0
Category-III	2.9	2.9	10.3	83.8
Category-IV	0.9	6.4	16.4	76.4
Category-V	7.0	4.2	32.4	56.3
Overall	**2.7**	**3.5**	**11.1**	**82.7**

N. B Figures in bracket indicate the percentage of respondents under the category

The frequency of going to restaurant for meals once per month was more among all the income groups in comparison to the frequency 'once a week' and 'twice a week.' The percentage of respondents going to restaurants once a month was found to be 3.9% , 6.8%, 10.3%, 16.4% and 32.4%, among income group Category-I, II, III, IV and V respectively. Chi-square test revealed that frequency of going to restaurant for meals increases with increase in income since 'p' value was 0.000.

4.2.21.2 Frequency of taking snacks in eating joints

To know the pattern and frequency of taking snacks in eating joints, the respondents were asked a question on the frequency with options as 'Everyday', 'Once a week', 'Twice a week', and 'Unspecified'. The result is presented in Table 4.34. Overall, majority of respondents (87.3%) reported that frequency of taking snacks in eating joints is not specified. Of the total respondents, 5.8% have taken every day, 3.8% once a week and 3.2% twice a week. 7.3% of respondents of urban and 4.2% rural areas have taken snacks every day in eating joints.

The frequency of taking snacks outside home was also 'unspecified' (74.6% to 91.2%) among all the income groups in comparisons to the frequency of 'Everyday' (2.8% to 11.3%), 'Once a week' (1.2% to 8.5%), 'Twice a week (0.9% to 5.6%).'

Table 4.34 Frequency of taking snacks outside home

Respondents profile	Frequency of taking snacks outside home			
	Everyday	Once a week	Twice a week	Unspecified
Geographic profile				
Rural	4.2	4.2	2.1	89.4
Urban	7.3	3.3	4.2	85.2
Income groups				
Category-I	2.8	3.3	2.8	91.2
Category-II	7.4	1.2	3.1	88.3
Category-III	5.1	2.2	4.4	88.2
Category-IV	5.5	7.3	0.9	86.4
Category-V	11.3	8.5	5.6	74.6
Overall	5.8	3.8	3.2	87.3

N. B Figures in bracket indicate the percentage of respondents under the category

4.2.21.3 Frequency of choosing fish items while eating out

The frequency of choosing fish items while eating out was analysed. It was found that 35.9% of respondents in the study area took fish sometimes while eating out whereas 8.0% respondents invariably and 32.9% rarely ate fish items. 23.2% respondents reported that they never took fish while eating out. There was no significant difference ('p' value from chi-square test was 0.882) in frequency of choosing fish items while eating out in both rural and urban area.

The study also revealed that majority of the respondents (65.8%) never buy cooked items for lunch/dinner, 28.5% very rarely, 3.6% once in a month, 1.2% once a week and 0.9% fortnightly.

4.2.21.4 Frequency of choosing fish items while buying outside food

The frequency of choosing fish items while buying outside food is analysed and presented in Fig.4.13. 36.1% of respondents chose fish items sometimes and 35% chose rarely while buying prepared food from outside. Of the total respondents, 24.1% of them never chose fish items while buying from outside. There is no major difference in the frequency of choosing fish items while procuring such items from outside in rural and urban areas. It implies that fish is not a popular item with respect to prepared items purchased to be consumed at home.
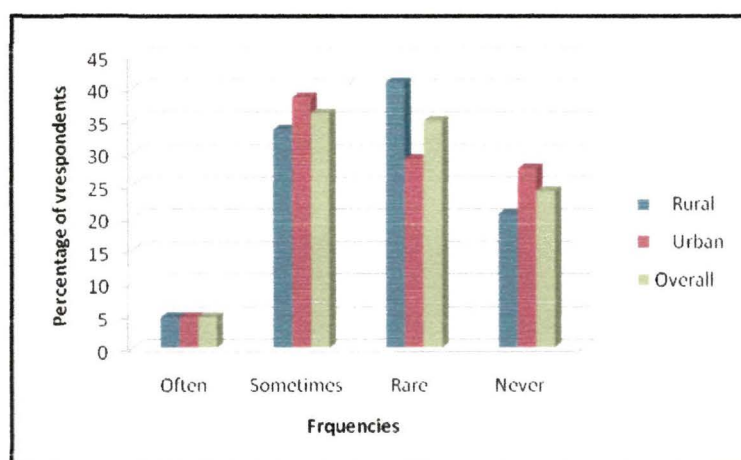
Fig.4.13. Frequency of choosing fish items while buying outside food in rural and urban area

4.2.22 Consumers' perceptions on choosing ready to eat fish

Consumers' perception on choosing ready to eat fish was evaluated with a statement 'I will increase choosing ready to eat fish if different delicacies are available' using 5 point Likert scale. The results presented in Table 4.35 indicated that 39.8% of respondents in the study area irrespective of geographic and demographic profile had agreed and 8.9% strongly agreed to the statement which shows a good possibility of production and marketing of ready to eat fish. In urban area 41.8% respondents agreed and 10.3% strongly agreed to increase choosing ready to eat fish if different delicacies are available.

The percentage of respondents who agreed to increase choosing fish if different delicacies are available was 47.1% among Assamese, 41.1% among Bengalis, 31.7% among Nepali and 31.7% among North Indian. From the mean value, it is ascertained that though willingness to choose ready to eat fish is maximum among Assamese, it is almost universally accepted by all the different communities.

The percentage of respondents who agreed to choose ready to eat fish if different delicacies are available were 19.3%, 39.5%, 51.5%, 55.5% and 46.5% among the income group category-I , II, III, IV and V respectively. Willingness for choosing ready to eat fish increases from lower income groups to higher income groups if different delicacies are available. The mean value of the table also indicates that the degree of response to the statement 'I will increase choosing ready to eat fish if different delicacies are available' increases from lower income groups to higher income groups. The result of chi-square test shows that 'p' value is less than 0.05 indicating significant relationship between incomes of respondents and choosing ready to eat fish if different delicacies are available.

Table 4.35 Consumer's perceptions on choosing ready to eat fish

Respondents profile	I will increase choosing ready to eat fish if different delicacies are available					
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Mean
Geographic profile						
Rural	7.6	37.9	36.7	16.4	1.5	0.34
Urban	10.3	41.8	34.2	11.2	2.4	0.46
Communities						
Assamese	15.8	47.1	27.9	7.1	2.1	0.68
Bengali	8.3	41.1	32.2	16.1	2.2	0.37
Nepali	3.3	31.7	44.2	18.3	2.5	0.15
North Indian	1.7	31.7	46.7	19.2	0.8	0.14
Income groups						
Category-I	3.9	19.3	48.6	26	2.2	0.03
Category-II	6.2	39.5	40.7	12.3	1.2	0.37
Category-III	10.3	51.5	30.1	5.9	2.2	0.62
Category-IV	10.9	55.5	20.9	10.0	2.7	0.62
Category-V	22.5	46.5	22.5	7.0	1.4	0.82
Overall	**8.9**	**39.8**	**35.5**	**13.8**	**2.0**	**0.40**

Note: All figures are in percentage in the category

4.3 Constraints and Possibilities of Production and Marketing of Fish and Value added fish

4.3.1 General Profile of the Sample Fish Farmers

The general profile of the farmers is presented in Table 4.36. The average age of respondents was 39.1 years. Out of the total respondents, the majority (35.4%) belonged to General caste, followed by Scheduled Tribes (24.2%), Other Backward Caste (22.5%) and Scheduled Caste (17.9%). As regards educational status, 46.2% of

respondents have qualification up to 10+ standards, 17.5% graduates, 31.7% below 10+, and 4.6% up to primary level. The nuclear type of family system exists among 58.8% respondents. The average size of the family was 6.18. Out of total respondents, 27.5% have taken fish culture as their primary occupation while 72.5% have taken it as secondary source of occupation.

Table 4.36 General Profile of the farmers

Sl. No.	Variables	Specification	Frequency	Percent
1	Caste	General	85	35.4
		OBC	54	22.5
		SC	43	17.9
		ST	58	24.2
2	Education	Illiterate	2	0.8
		Primary	9	3.8
		Below 10+	76	31.7
		10+	111	46.2
		Graduate	42	17.5
3	Type of family	Nuclear	141	58.8
		Joint	99	41.2

4.3.2 General information about fish culture practices among respondent farmers

As regards operational holding, the fish farm area varies from 0.02 ha to 4.0 ha and the average was estimated at 0.55 ha. The number of fish ponds owned by each farmer ranges from 1 to 27 of different sizes. The majority of the farmers (55.8%) own only one pond. Average annual fish production ranges from 500 to 7500 kg/ha/year and average was estimated at 2050 kg/ha/year. Among the respondent farmers, 57.1% have taken training on fish culture. Majority of respondents (27.5%) have undergone training programme of 3-7 days duration. 15% and 7.9% of respondents have taken training programme of duration less than 2 days and 8-15 days respectively. Only 6.7% of respondents have taken training programme for duration of more than 15 days. The highest percentages of farmers (52.5%) have adopted Single Stocking Single Harvesting followed by Multiple Stocking Multiple Harvesting (27.5%), and Single Stocking and Multiple Harvesting (20%) type of semi-intensive composite fish culture.

All the respondents (100%) in the study area cultivate Indian Major Carps and 94.6% of farmers culture exotic carps in composite fish culture system. Other minor carps such as *Kurhi*, *Bhangon*, *Koliajara* and *Java puthi* are also cultured along with

major carps and exotic carps by 41.2%, 29.2% and 11.7% respondents respectively. 16.7% and 1.7% of respondents cultivated *Chital* and magur respectively.

Most of the farmer respondents (95%) procure fish seed from private farm and only 5% of respondents have taken seed from the Government farm. About 72% of the respondents took the seed at pond site from hawkers (vendors) and 28% respondents carried the seed from seed production centre on their own. Fish feeds (mainly, rice bran and mustard oil cake) and fertilizers were procured by respondents from local markets (more than 85%). Only 28 farmers (11.7%) received fund from different banks, NGOs and Department of Fisheries.

As regards selling of fish, the respondents sold fish through different marketing channels. Majority of farmers (55.8%) sold their produce through the marketing channel Producer →Village trader/Retailer →Consumer, followed by Producer →Wholesaler →Village trader/Retailer →Consumer (43.8%), Producer →Village Trader →Wholesaler →Village trader/Retailer →Consumer (43.8%), and Producer →Consumer (11.2%).

4.3.3 Constraints of fish production as perceived by the farmer respondents

The data collected from farmers during the preliminary survey through the open ended questionnaire were analysed by descriptive statistics. It was found that lack of good quality fish seeds (fry/fingerlings) of required size and number at the time of stocking was perceived as the most serious problem by all the respondents followed by high cost of inputs like feed, inorganic fertilizer, and medicine. Various other constraints were perceived by the respondents. A total of 32 constraints have been identified. In the final survey respondents were asked to express their level of agreement in relation to the identified constraints in adoption of fish culture using 5 point Likert scale and the respondents were asked to indicate their perceived seriousness of the constraints. The result is presented in Table 4.37.

The mean value of the statements indicate that lack of standardized technology for indigenous fish species (1.52) is the biggest problem followed by lack of good quality fish seeds of required size and number at the time of stock (1.40), high initial cost of digging out new pond (1.38), difficulties in getting institutional credit (1.35), lack of facilities for soil and water testing (1.31), high cost of medicine (1.31), difficulties and expensiveness of carrying fish to sell in distant market (1.28), high cost of fingerlings/carried over seeds (1.21), difficulties of identifying good quality

fish seed (1.20), lack of fund (1.20), non-availability of formulated feed (1.10), lack of proper knowledge on pond management (1.03), and inadequate training programme on fish culture (1.02). The findings of the study were found similar to certain extent with the findings of the studies carried out by Bhaumik and Saha 348-59; Selvaraj 25-30; V. Kumar and Selvaraj 63-69; Padhy 9-10; Srivastava 310; Abraham et al. 41-48; Sasmal et al. 134-42; Mohanty et al. 139-45; Chattopaddhyay et al. 20-23; and Munilkumar and Nandeesha 399-412 in different parts of the country.

Table 4.37 Farmers perception on constraints of fish culture

Sl. No	Constraints	SA	A	NAN D	D	SD	Mean
1	Lack of good quality fish seeds of required size and number at the time of stock	58.3	32.9	1.2	6.2	1.3	1.40
2	Difficult to identify good quality fish seed	42.1	46.2	2.1	8.8	0.8	1.20
3	Unavailability of formulated feed	38.3	47.1	2.1	11.2	1.2	1.10
4	Difficult to get good brooders during breeding	29.0	45.1	19.1	6.2	0.6	0.96
5	Initial cost of digging out new pond is high	45.4	50	2.1	2.1	0.4	1.38
6	Lack of fishery input supplier in the locality	22.2	58.2		17.6	1.3	0.82
7	Lack of facilities for soil and water testing	53.3	35.4	1.7	7.9	1.7	1.31
8	Growth of fish is less	26.2	52.1	5.0	14.6	2.1	0.86
9	Cost of fingerlings/carried over seeds is high	36.4	54.4	2.5	6.7	-	1.21
10	Cost of fish medicine is high	43.5	4..99	7.5	1.7	0.4	1.31
11	Cost of fishing net is more	21.2	56.2	13.8	8.8	-	0.90
12	Selling price at farm front is low	22.9	50	11.7	14.2	1.2	0.79
13	Lack of fund	40	50		7.9	1.2	1.20
14	Difficult to get institutional credit	54	34.3	5.4	5.0	1.3	0.35
15	Lack of proper distribution channel	17.6	45.8	3.8	30.3	2.5	0.46
16	Exploitation by middlemen	25	46.7	10.8	16.2	1.2	0.78
17	Difficult and expensive to carry fish for selling to the distant market where price of fish is more	38.8	54.9	3.0	3.0	0.4	1.28

18	Inadequate training programme on fish culture	32.5	53.3	0.4	11.7	2.1	1.02
19	Inadequate visit of extension personnel to farm site	25.4	5.1	4.6	17.1	0.8	0.84
20	Lack of follow up action by extension workers	27.6	56.1	5.0	10.5	0.8	0.99
21	Lack of expected result from fish culture	20.9	30.1	5.9	35.1	7.9	0.21
22	Lack of proper knowledge on pond management	37.7	44.8	1.7	14.6	1.3	1.03
23	Lack of technological knowhow	24.8	53.4	2.9	18.5	0.4	0.84
24	Lack of standardized technology for indigenous fish species	59.6	36.7	1.7	0.8	1.2	1.52
25	Lack of suitable temperature for growth of fish throughout the year	21.8	41.8	13.8	20.9	1.7	0.61
26	High acidity of soil	10.9	28.2	35.7	22.3	2.9	0.22
27	Water retention capacity of soil is low	13.8	30	3.8	42.1	10.4	- 0.05
28	Monsoon is irregular	10.5	43.5	11.8	29.1	5.1	0.25
29	Occurrence of flood	14.6	15.5	1.3	51.5	17.2	- 0.41
30	Outbreak of disease	32.1	53.8	1.2	12.5	0.4	1.05
31	Poaching of fish	2.5	17.5	5.0	56.7	18.3	- 0.71
32	Poisoning the water body.	1.7	14.3	3.8	56.3	23.9	- 0.87

(Note: A= Strongly Agree, A= Agree, NAND = Neither Agree Nor Disagree,

D=Disagree, SD=Strongly Disagree. All the figures are percentage of

responsiveness against the statement except the mean value).

Factor analysis:

Since there was large number of variables (constraints), factor analysis was carried out to reduce the number of variables. Adequacy of data was tested on the basis of results of the Kasier-Meyer-Olkin (KMO) measures of sampling adequacy and Bartlett's test of sphericity (homogeneity of variance). The KMO measure of sampling adequacy is 0.781 indicating the data was suitable for factor analysis. This is a goodness of fit coefficient whose value varies between 0 and 1. For factor analysis, values over 0.5 has been considered (i.e., data reduction is effective). Again, Bartlett's test of sphericity is found significant (p<0.001) which explains existence of sufficient correlation between the variables to proceed with the analysis. The extraction values

from communalities (Annexure 19) were large indicating that all the extracted communalities are acceptable and all variables are fit for the factor solution.

The factor analysis revealed that 9 factors extracted together accounted for 65.7% of the total variance (information contained in the original 32 variables). The Eigen values greater than 1 (Kaiser's criteria) were considered here for retaining the 9 factors. On the basis of factor loading greater than 0.5, 9 factors emerged. A factor loading of 0.5 has been used to determine the cut-off point for assessing variables of factors (Hulya and Aliye 89). From the Total Variance Explained Table given in Annexure 20, it can be inferred that 23.35% variance is explained by Factor-1, 9.20% by Factor-2, 7.16% by Factor-3, 5.72% by Factor-4, 5.17% by Factor-5, 4.32% by Factor-6, 4.09% by Factor -7, 3.48% by Factor-8 and 3.18% by Factor-9. Factor loadings in case of Factor-1 were found more (13 out of 32 variables have factor loading >0.5) in Component Matrix table (Annexure 21). Hence, the rotated component matrix (Annexure 22) has been observed to get the factors that can be named specifically and interpreted. Scree plot of eigen values which is given in Fig.4.14 also indicated that these nine factors should be included in the analysis.
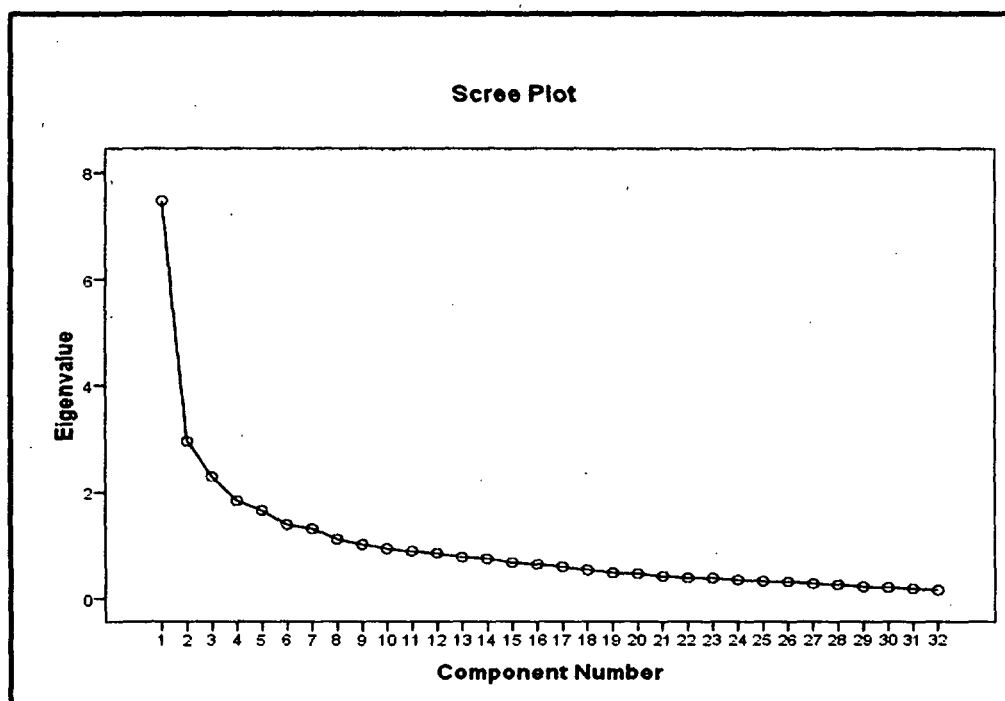
Fig. 4.14 Scree plot

Factor-1: From the rotated component matrix table (Annexure 26) it is found that following variables have factor loading more than 0.5

i.   Inadequate visit of extension personnel to farm site (0.755)

ii.   Lack of follow up action by extension workers (0.711)

iii.   Inadequate training programme on fish culture (0.675)

iv.   Unavailability of formulated feed (0.657)

v.   Lack of expected result from fish culture (0.571)

vi.   Lack of knowledge of soil and water quality management (0.571)

Internal consistency of these 6 constraints has been tested using reliability test. The cronbach's alpha value was found 0.801 which indicates high internal consistency of these constraints. In this case Factor-1 is named as 'Support System Constraint'.

Factor -2: Factor-2 is combination of 5 variables

i.   Difficult to get good brooders during breeding (0.660) ,

ii.   Lack of fishery input supplier in the locality (0.596),

iii.   Cost of fishing net is more (0.588),

iv.   Exploitation by middlemen (0.561) and

v.   Lack of proper distribution channel (0.525).

Cronbach's alpha value of these factor was found 0.726 indicating good internal consistency. Factor-2 is named as 'Infrastructural Constraints.'

Factor-3 Factor -3 is combination of variables

i.   Lack of suitable temperature for growth of fish throughout the year (0.692)

ii.   Monsoon is irregular (0.676)

iii. .   Difficult and expensive to carry fish for selling to the distant market where price of fish is more (0.609)

iv.   Water retention capacity of soil is low (0.519).

The reliability test of these variables indicates lower internal consistency (Cronbach's alpha value 0.605). Hence, these constraints are not considered for strategy formulation.

Factor-4: Factor-4 is combination of variables

i.   Difficult to get institutional credit (0.747)

ii.   Lack of good quality fish seeds of required size and number at the time of stock (0.655)

iii.   Difficult to identify good quality fish seed (0.602)

iv.   Lack of fund (0.589).

Cronbach's alpha value was found 0.700 from reliability test of these variables. These constraints together have been named as 'financial and technical constraint.'

Factor-5: It is the combination of 2 variables

i. Poisoning of pond (0.853) and

ii. Poaching (0.811).

Cronbach's alpha value was found 0.814 from reliability test of these two variables indicating good internal consistency. It is interpreted as 'societal constraints'.

Factor-6: It is a combination of three variables

i. Occurrence of flood (0.786),

ii. High acidity of soil (0.682) and

iii. Selling price at farm front is low (0.545).

Since these constraints show low internal consistency (Cronbach's alpha=0.601) these constraints are not considered for strategy formulation.

Factor-7: It is the combination of two variables

i. Cost of fingerling is high (0.762) and

ii. Lack of technological knowhow (0.666).

These two constraints are also not considered for strategy formulation due to low internal consistency (Cronbach's alpha=0.405)

Factor–8: It consists of only one variable only- lack of standardized technology for indigenous fish species (0.825).

Factor–9: It is also consisted of one variable – occurrence of diseases (0.808).

No specific names are given to Factor- 8 and Factor - 9 as they contain only single variable.

All the 9 factors taken together accounted for 65.7% of total variance. Three factors have been removed due to lack of proper internal consistency. After removal of these 3 factors, the remaining 6 factors accounted for 60.23% of the total variance.

The stratagies formulated based on four major factors (which are named as 'Support System Constraint', 'Infrastructural Constraints', 'Financial and Technical Constraint', and Societal Constraints') are discussed in Chapter-V.

4.3.4 Constraints perceived by different marketing intermediaries

Three different marketing intermediaries are mainly present in the process of marketing of fish in the study area. They are wholesalers, retailers/village traders and vendors/fish peddlers. Varieties of fish in different forms such as live, dead but fresh and iced are sold by these intermediaries. The wholesalers sell only the whole fish but the retailers and vendors sell whole fish as well as the cut fishes. The wholesalers procure fish through village traders or directly from the fish farmers. They sell the fish to the village traders, retailers and vendors. They extend credit to fish farmers for buying feed, fertilizers, seeds etc. in advance with understanding that the fish farmer would sell their entire fish production to them at a negotiated price, which is based on day-to-day market prices. After deducting the advanced money, the wholesalers pay the remaining balance to the framers.

The selling of Indian major carps was dealt in by 98% of the intermediaries and exotic carps were dealt in by 97.4% intermediaries. *Bhangon* and *kurhi* were sold by 7.3% and 1.8% of intermediaries, respectively. Among live fish, magur and singi were sold by 10.9% of intermediaries, and murrels (*sol* and *goroi*) by 8.2% of intermediaries. Small fishes of different varieties (*moa, puthi* etc.) were sold by 3.6% of intermediaries. *Arii, chital* and *kandhuli* were dealt in by1.8%, 1.8% and 0.9% of intermediaries respectively.

Selected intermediaries (wholesalers, retailers/village traders and vendors/fish peddlers) were asked to express their level of agreement in relation to some identified constraints in marketing of fish using 5 point Likert scale.

Wholesalers:

The perceptions of wholesalers towards 15 different constraints are presented in Table 4.38.

Table 4.38 Perceived problems of wholesalers

Sl. No	Problems	SA	A	NAN D	D	SD	Mean
1	Fluctuation of demand and supply affects the earnings	49 (81.7%)	11 (18.3%)	-	-	-	1.82
2	Unavailability of consumer preferred fish	27 (45.0)	26 (43.3%)	-	7 (11.7%)	-	1.22
3	Lack of fund for providing financial assistance to farmers/fishermen/traders	8 (13.3)	40 (66.7%)	4 (6.7%)	8 (13.3%)	-	0.80
4	Inadequate facilities for fish handling and storage	30 (50%)	20 (33.3)	-	10 (16.7)		1.17
5	Lack of sufficient space for auction	10 (16.7)	26 (43.3)	1 (1.7)	23 (38.3)	-	0.38
6	Lack of cold storage	37 (61.7)	21 (35)	1 (1.7)	1 (1.7)		1.57
7	Lack of proper drainage and waste disposal system	31 (51.7)	26 (43.3)	1 (1.7)	2 (3.3)	-	1.43
8	Lack of good provision for water supply	22 (36.7)	31 (51.7)	-	7 (11.7)	-	1.13
9	Inadequate parking space for fish carrying vehicles	21 (35)	29 (48.3)	-	10 (16.7)	-	1.02
10	Lack of adequate provision for ice	17 (28.3)	30 (50)	-	13 (21.7)	-	0.85
11	Insufficient space to accommodate all wholesalers	4 (6.7)	25 (41.7)	1 (1.7)	28 (46.7)	2 (3.3)	0.017
12	No roof in the market	9 (15)	14 (23.3)	-	12 (20)	25 (42.7)	-0.5
13	No cemented floor	11 (18.3)	12 (20)	-	14 (23.3)	23 (38.3)	-0.43
14	Lack of potable water	14 (23.3)	37 (61.7)	-	7 (11.7)	2 (3.3)	0.9
15	Lack of lavatory	18 (30)	35 (58.3)	-	7 (11.7)	-	1.07

(Note: A=Strongly Agree, A=Agree, NAND= Neither Agree Nor Disagree, D=Disagree, SD=Strongly Disagree. All the figures given in brackets are the percentage of responsiveness against the statement).

From the mean value column of the table it is found that majority of respondents highly agreed to the problem 'fluctuation of demand and supply affects the earnings' followed by 'lack of cold storage', 'lack of proper drainage and waste disposal system', 'unavailability of consumer preferred fish', 'inadequate facilities for fish handling and storage', and 'lack of good provision for water supply',

Retailers:

Retailers from different market places were also asked to express their responses on 17 constraints with a separate set of questionnaire using a 5 point Likert scale (Annexure 23). From the mean value of each problem statement, it came to light that 'fluctuations of demand and supply affects the earnings' is perceived as main problem followed by 'unavailability of consumer preferred fish', 'lack of good provision for water supply', 'lack of cold storage', 'lack of proper drainage and waste disposal system', and 'lack of fund for buying fish in bulk.'

Vendors:

The perceived constraints of Hawkers/Vendors are presented in Table 4.39. The mean values of different constraints clearly indicate that 'fluctuation in demand and supply of fish in auction place' is perceived as one of the main constraints by majority of vendors followed by 'unable to purchase fish during April to August due to increase in price of fish', 'no regular supply of fish throughout the year', 'maintenance cost of bicycle is high', 'lack of insulated containers/carriers to carry fish to the door step of consumers', 'lack of fund', 'cannot sell more amount of fish going door to door', 'unavailability of consumer preferred fish', and 'lack of proper fish transportation facility'.

Table 4.39 Perceived constraints of Hawkers/Vendors

Sl. No.	Constraints	SA	A	NAND	D	SD	Mean
1	Lack of fund	23 (30.7)	49 (65.3)	-	3 (4.0)	-	1.23
2	Unavailability of consumer preferred fish	30 (40.0)	31 (41.3)	-	14 (18.7)	-	1.03
3	Unable to purchase fish during April to August due to increase in price of fish	44 (58.7)	29 (38.7)	-	2 (2.7)	-	1.53
4	Lack of proper fish transportation facility	14 (18.7)	47 (62.7)	-	14 (18.7)	-	0.81
5	No regular supply of fish throughout the year	38 (50.7)	37 (49.3)	-	-	-	1.51
6	Fluctuation in demand and supply of fish in auction place	42 (56.0)	33 (44.0)	-	-	-	1.56
7	Lack of insulated containers/carriers to carry fish to the door step of consumers	22 (29.3)	51 (68.0)	-	2 (2.7)	-	1.24

8	Maintenance cost of bicycle is high	24 (32.0)	51 (68.0)	-	-	-	1.32
9	Rude behavior of some customers	1 (1.3)	36 (48.0)	12 (16.0)	26 (34.7)	-	0.16
10	Cannot sell more amount of fish going by door to door	21 (28.0)	48 (64.0)	-	6 (8.0)	-	1.12
11	Exploitation at the time of weighing fish in auction place	8 (10.7)	7 (9.3)	8 (10.7)	52 (69.3)	-	- 0.39

(Note: A=Strongly Agree, A=Agree, NAND= Neither Agree Nor Disagree, D=Disagree, SD=Strongly Disagree. All the figures given in brackets are the percentage of responsiveness against the statement).

Fluctuations of demand and supply of fish is one of the main constraints as perceived by all the wholesalers, retailers and vendors. Others constraints of marketing of fish are mostly related to market infrastructure such as lack of proper fish transportation facility, lack of insulated containers/carriers to carry fish to the door step of consumers, lack of cold storage, inadequate facilities for fish handling and storage, inadequate parking space for fish carrying vehicles, lack of adequate provision for ice, insufficient space to accommodate all wholesalers and retailers, lack of proper drainage and waste disposal system, and lack of good provision for water supply.

4.3.5 Scenario of value added fish/ready to eat fish in different eating joints

To fulfill the second and third objectives of the study, eating joints of different categories (Fast food restaurants/outlets, Restaurants, Bar cum restaurants, Dhaba and Chaat houses) were visited in main towns of selected districts except Karbi Anglong (Under Hill Zone) where urbanization is comparatively less.

4.3.5.1 Demand of fish in eating joints

The average daily requirement of fish is high in restaurants (4.28 kg). The reason for this is that most of these restaurants serve rice as the core item where fish curry and fried fish are on the menu. The demand for fish is less in Fast food restaurants/outlets, Bar cum restaurants, Dhabas and Chaat houses in comparison to meat. The detailed information about average daily requirement of fish and meat in different types of eating joints is presented in Table 4.40. Overall, it reveals that the average daily requirement of fish in eating joints is less (2.39 kg) as compared to meat (5.23 kg).

Table 4.40 Demand of fish and meat in eating joints

Type of eating joints	Average Daily requirement of Fish and Meat in kg	
	Fish	Meat
Fast food restaurant/outlets	1.69	5.77
Restaurant	4.28	3.04
Bar cum restaurant	2.85	9.22
Dhaba	3.18	6.95
Chaat house	0.05	0.80
Overall	2.39	5.23

4.3.5.2 Demand of different varieties of fish in eating joints

Popularity of different species of fish in different types of eating joints was also studied. The different species of fish served in different eating joints are given in Table 4.41. Overall, it was observed that among all the species of fish, the highest served species in eating joints is rohu, followed by catla, prawn, *bhangon*, small variety of fishes (*boriola, singorah, moa, puthi* etc.), *arri, chital, ilish, borali, kurhi, pabha, mrigal,* and koi.

Table 4.41 Varieties of fish species sold in different eating joints (in percentage)

Varieties of fish	Eating joints where different varieties of fish sold					
	Fast food restaurant	Restaurant	Bar cum restaurant	Dhaba	Chaat house	Overall
1. Catla	43.7	87.7	79.7	84.2	1.8	59.0
2. Rohu	43.7	96.5	79.7	89.5	1.8	61.7
3. Mrigal	0	7.0	3.4	7.0	0	3.3
4. Bhangon	19.7	57.9	25.4	71.9	3.6	35.0
5. Kurhi	4.2	12.3	5.1	24.6	1.8	9.3
6. Chital	12.7	40.4	28.8	22.8	-	20.7
7. Arri	14.1	36.8	28.8	31.6	-	22.0
8. Borali	5.6	40.4	20.3	31.6	-	19.0
9. Pabha	2.8	3.5	6.8	7.0	-	4.0
10. Illish	11.3	33.33	28.8	26.3	-	19.7
11. Koi	1.4	5.3	1.7	-	-	1.3
12. Prawn	15.5	8.8	47.5	24.6	-	19.3
13. Smaller varieties	11.3	63.2	18.6	56.1	-	29.0

4.3.5.3 Types of fish items sold in the eating joints

During the survey of the eating joints it was found that altogether 18 (eighteen) fish items were sold in different eating joints. In comparison to different fish recipes, the numbers of meat recipes were more (28 items). The varieties of fish items that were served in eating joints are listed in Table 4.42. Out of these fish curry and fish fry with different ingredients were found to be the highest selling items in eating joints followed by fish fry, steamed fish, fish chilly, fish bhujia, fish finger, fish tikka, fish tandoor, fish cutlet, fish momo etc. Fish curry, fish fry, *sorsori* (fish with mustard and poppy seeds), *tenga jul* (fish sour prepared with tomato/lemon etc.), and *bhapat diya mach* (steamed with mustard paste) were found to be sold by 65.3%, 65.3%, 42.7%, 49.7% and 19.7% of eating joints respectively.

Table 4.42 Value-added/Ready to eat fish items sold in different eating joints

Sl. No	Fish items	Type of eating joints where ready to eat fish items sold					Overall
		Fast food restaurant	Restaurant	Bar cum restaurant	Dhaba	Chaat house	
1	Curry	43.7	100	86.4	100	-	65.3
2	Fry	42.3	98.2	89.8	98.2	1.8	65.3
3	*Sorsori*	31.0	59.6	66.1	57.9	-	42.7
4	*Tenga jhol*	35.2	82.5	42.4	91.2	-	49.7
5	Steamed with mustard seed	16.9	24.6	33.9	22.8	-	19.7
6	*Patat diya* (Fish roasted in banana leaf)	1.4	1.8	-	12.3	-	3.0
7	Goose berry fish curry	1.4	-	-	-	-	0.3
8	Fish in bamboo	1.4	-	-	3.5	-	1.0
9	Fish Chilly	14.1	1.8	42.4	31.6	-	18
10	Fish do-piaza	-	-	10.2	14.0	-	4.7
11	Fish bhujia	-	7.0	10.2	43.	-	11.7
12	Fish toasted	-	3.5	5.1	10.5	-	3.7
13	Fish momo	1.4	-	-	-	-	0.3
14	Fish finger	8.5	1.8	44.1	10.5	1.8	13.3
15	Fish tikka	1.4	-	20.3	1.8	-	4.7
16	Fish tandoor	-	-	8.5	8.8	-	3.3
17	Fish cutlet	-	-	8.5	-	-	1.7
18	Fish pokoura	1.4	-	1.7	3.5	-	1.0

Note: Figures indicate percentage of eating joints in that category

The survey also revealed that 10 fast food restaurants, 6 bar cum restaurants, 5 dhabas, 2 restaurants, and 2 chaat houses showed willingness to introduce fish finger, fish cutlet and fish momo where these items have not already been sold.

4.3.5.4 Perception of eating joints about consumers choosing fish products

The managers/owners of eating joints were asked about their opinion regarding the probability of consumers choosing fish products (other than fish curry and fry) if they are made available. About 55% of fast food restaurants, 68.4% of restaurants, 67.8% of bar cum restaurants, 63.25% dhabas and 46.4% chaat houses expressed the possibility of consumers choosing different fish items if they are made available (Table 4.43). Overall, 60% of eating joints opined that there is a good possibility of consumers choosing fish items if they are made available.

Table 4.43 Perceptions of eating joints about consumers choosing fish products

Sl. No.	Types of eating joints	Probability of consumers choosing fish products if they are made available		
		Yes	No	Cannot say
1	Fast food restaurant	54.9	21.1	23.9
2	Restaurant	68.4	5.3	26.3
3	Bar cum restaurant	67.8	16.9	15.3
4	Dhaba	63.2	10.5	26.3
5	Chat house	46.4	14.3	39.2
	Overall	60.0	14.0	26.0

(N.B.Figure indicates percentage of eating joints in that category)

4.3.5.5 High value products from low value fish

Fish species like Common Carp, Grass Carp, and Silver Carp are not popular among consumers. They also fetch comparatively less price in the market. Hence, it was tried to find out the probability of using these low-valued fish species for the preparation of fish items in the eating joints. About 63.0% Dhabas, 60% restaurants, 59% chaat houses, 46% bar cum restaurants and 45% fast food restaurants have expressed that low- valued fish may be utilized for value added fish products like fish finger, fish ball, fish bhujia, fish pickle etc. The detailed responses of respondents are presented in Table 4.44. On an average, 54.0 % of eating joints opined that there is probability of utilizing low-valued fish for preparation of ready-to-eat fish items.

Table 4.44 Probability of Utilizing Low-valued Fish

Sl. No.	Types of eating joints	Probability of utilizing low-valued fish for preparation of ready-to-eat/value added fish products		
		Yes	No	Cannot say
1	Fast food restaurant	32(45.1%)	18(25.4%)	21(29.6%)
2	Restaurant	34(59.6%)	4(7.0%)	19(33.3%)
3	Bar cum restaurant	27(45.8%)	20(33.9%)	12(20.3%)
4	Dhaba	36(63.2%)	6(10.5%)	14(24.6%)
5	Chat house	33(58.9%)	4(7.1%)	19(33.3%)
	Overall	162(54.0%)	53(17.6%)	85(28.3%)

It has been found that the percentage of respondents opting for ready to eat fish was 46.5% which is more in urban area (55.2%) than in rural area (37.9%). 54.0 % managers/owners of eating joints opined that there is probability of utilizing low-valued fish like grass carp, silver carp, common carp etc. for preparation of value added fish products like fish cutlet, fish ball, fish pickle etc. Sehgal and Sehgal (291-93) also reported that development of value added products from low market valued carps could play significant role in raising the socio-economic condition of carp producers. They prepared three value added de-boned fish products – fish patty, fish finger and fish salad from carps, and found encouraging results. The study concluded that there exists a good scope for the processing of carp flesh into value added products and for boosting the production of these fishes. The present study also reveals that there is a good scope of production and marketing of some selected fish items in the market.

4.3.5.6 Constraints associated with preparation and selling fish items

Respondents were asked to elucidate perceived constraints associated with preparation and selling fish items during the investigation. A total of 15 constraints were identified that are associated with preparation and selling fish items (Table 4.45).

Majority of respondents (91.7%) expressed that the main difficulties associated with preparation and selling fish products is low demand for fast food fish item. Non-availability of suitable varieties for preparation of fish items, irregular supply of suitable variety of fish, high cost of suitable varieties of fish, non-availability of boneless fish like boneless chicken, low demand for value added fish item, and high time consumption for preparation are the problems associated with producing and selling fish products as reported by 50%, 45%, 31%, 20.7%, 19.7% and 18.7% of respondents respectively.

The problems like lack of awareness about fast food fish items by the firm, frequent fluctuation of price of local fish (for which they cannot change the rate in the menu), difficulties in removal of fish bones and lack of expertise for preparation of fast food fish items were reported respectively by 18.7%, 16.3%, 13.3% and 12.3% of respondents.

Other problems like spreading of fish odour to utensils, about 50% loss through removal of fish bones (which cannot be utilized for other items), lack of space to keep, difficult to keep all the consumer preferred fish, and lack of proper cold storage facility to keep marinated fish items were associated with preparation and selling fish items.

Understaning these constraints associated with preparation and selling fish items is of great importance for marketers inorder to satisfy unmet needs of consumers and the findings of the study could be useful for evolving such solutions.

Table 4.45 Perceived Constraints Associated with Producing and Selling Fish Products

Sl. No.	Perceived problems	Fast food restaurant		Restaurant		Bar cum restaurant		Dhaba		Chaat house		Overall	
		F	P	F	P	F	P	F	P	F	P	F	P
1	Demand for value added fish item is less	13	18.3	2	3.5	31	52.5	13	22.8			59	19.7
2	Demand for fast food fish item is less	63	88.7			46	78	54	94.7	55	98.2	275	91.7
3	Availability of suitable varieties for preparation of fish items is less	35	49.3	48	84.2	27	45.8	37	64.9	3	5.4	150	50.0
4	Irregular supply of suitable variety of fish	27	38	49	86	20	33.9	37	64.9	2	3.6	135	45.0
5	More fluctuation of price of local fish but they cannot change the rate in the menu	5	7	16	28.1	7	11.9	21	36.8			49	16.3
6	Lack of awareness about fast food fish items by the firm	10	14.1	9	15.8	1	1.7	15	26.3	22	39.3	56	18.7
7	Cost of suitable varieties of fish is more	17	23.9	30	52.6	12	20.3	30	52.6	4	7.1	93	31.0
8	Difficult to remove fish bones	12	16.9	3	5.3	11	18.6	8	140	6	10.7	40	13.3

No.	Statement	F	P	F	P	F	P	F	P	F	P	F	P
9	Boneless fish are not available like boneless chicken	24	33.8	2	3.5	18	30.5			7	12.5	62	20.7
10	About 50%loss occurs through removal of fish bones which cannot be utilized for other items	11	15.5			6	10.2	5	8.8	3	5.4	25	8.3
11	Preparation is time consuming	19	26.8	1	1.8	13	22	11	19.3	12	21.4	56	18.7
12	Lack of expertise for preparation of fast food fish items	8	11.3	8	14	6	10.2	6	10.5	9	16.1	37	12.3
13	Fish odour may spread to utensils	12	16.9	1	1.8	4	6.8	1	1.8	7	12.5	25	8.3
14	Difficult to keep all the consumer preferred fish	1	1.4			5	8.5			1	1.8	7	2.3
15	No proper cold storage facility to keep marinated fish items	3	4.2			2	3.4	1	1.8	2	3.6	6	2.0
16	Lack of space to keep	8	11.3	1	1.8			12	12.4			21	7.0

(N.B. F= Frequency, and P= Percentage of respondent)

CHAPTER: V
STRATEGIES
&
CONCLUSIONS

CHAPTER- V

STRATEGIES AND CONCLUSIONS

This study was undertaken with the major aim of understanding consumption behavior of the fish consumers and to develop production and marketing strategies to enhance fish demand. A sample of 660 fish consumers was surveyed to fulfill this aim. At the same time, fish producers/farmers and other stakeholders were surveyed to find out constraints and prospects of this sector in the market. Different sampling techniques and statistical tools were applied as and when required.

The major findings derived from analysis of data in the study are presented below, followed by strategies developed for popularizing fish/fish items to reduce/remove the constraints of the stakeholders in fish business.

a) Fish consumption patterns:

- Majority of the consumers (60.3%) in the study area have the highest preference for fish followed by chicken, and mutton. The per capita fish consumption in the study area is estimated at 14.27 kg/year which is higher than the national average (9.8 kg). There is significant difference of per capita consumption of fish between Assamese and Nepali, Assamese and North Indian, Assamese and Bengali, Bengali and Nepali, and Bengali and North Indian. The annual per capita consumption of fish is highest among the Assamese community (19.11 kg), followed by the Bengali (15.41kg), the Nepali (8.83 kg) and the North Indians (8.31 kg). The per capita consumption of fish increases with increase in household income.

- Majority of consumers (53.7%) consume fish twice a week. The average quantity of fish purchased at a time by all types of consumers is 500 gm. The average monthly expenditure on fish per family in the study area is Rs.662.42 which constituted 14.56% of monthly household expenditure on food. The monthly average expenditure on fish in rural area is Rs.580.15 and in urban area Rs.744.70. The percentage of monthly expenditure on fish with respect to total

monthly household expenditure on food items is more in urban area (14.69%) than in rural area (14.41%).

- Consumer preference for different varities of fish varies. Among Indian Major Carps, rohu (*Labeo rohita*) is the highest preferred species followed by catla (*Catla catla*), and mrigal (*Cirrhinus mrigala*). Among exotic carps, common carp (*Cyprinus carpio*) is the highest preferred fish followed by grass carp (*Ctenopharyngodon idella*), and silver carp (*Hyophthalmicthys molitrix*). Bhangon (*Labeo bata*) is the highest preferred fish among minor carps followed by *kurhi* (*Labeo gonius*), and *koliajara* (*Labeo calbasu*). Among different types of live fish the most preferred variety is magur (*Clarias batrachus*) followed by singi (*Heteropneustes fossilis*), koi (*Anabas testudineus*), sol (*Channa striatus*), and goroi (*Channa punctatus*). Among three big varieties of fish chital (*Notopterous chitala*) is highly preferred by consumers followed by arii (*Aorichthys seenghala*) and borali (*Wallago attu*).The consumers also preferred small varieties of fish such as moa (*Amblypharyngodon mola*), puthi (*Puntius spp.*), and boriola (*Aspidoparia spp*).

- Palatable taste, high nutrition value and food habit are the major factors that influence consumption of fish among consumers.

- Majority of consumers (69.8%) prefer curry followed by fried (26.7%), steamed (2.7%) and roasted (0.8%) form of cooking. Depending on species of fish, methods of preparation varies.

- Majority of respondents (93.9%) prefer local fish in live and fresh condition over ice preserved imported (*chalani*) fish. A vast majority of respondents (98.9%) in the study area have shown their willingness to purchase fish as dressed and chopped, and 46.5% as ready to eat fish other than fried fish. The percentage of respondents opting for ready to eat fish is more in urban area (55.2%) than in rural area (37.9%). Majority of respondents (87.9%) are willing to pay 5% extra for value addition as cleaning, dressing and chopping.

- Majority of respondents (59.7%) in the study area agreed to pay extra if quality and weight of fish is certified. A higher percentage of respondents (48.8%) agreed

to pay extra if convenient, clean and hygienic markets are dedeloped and maintained.

- Majority of respondents (52%) in the study area purchase fish from local market.Respondents of the study area, largely agreed to the statement 'dirty and unhygienic market area', followed by 'chances of getting cheated', 'unavailability of preferred fish', 'irregularity of supply', and 'quality difficult to ascertain' as constraints of purchasing fish.

- About 36% of respondents in the study area took fish/fish items sometimes in eating joints and about 40 % of respondents in the study area irrespective of geographic and demographic profile agreed choosing fish items if different delicacies are made available.

- Decision on the type of fish to buy and frequency of eating fish were mainly taken by the family head/ husband. The decision about preparation and cooking of fish was taken mainly by the housewife.

b) Constraints of production and possibilities of marketing of fish and value added fish

- Four major constraints have been identified with respect to production of fish. These are 'support system constraints', 'infrastructural constraints', 'financial and technical constraint', and 'societal constraints'.One of the major problems as perceived by the farmers is lack of standardized technology for indigenous fish species.

- Fluctuations of demand and supply of fish is one of the major constraints as perceived by all the wholesalers, retailers and vendors. Others constraints of marketing of fish are mostly related with market infrastructure such as lack of proper fish transportation facility, lack of insulated containers/carriers to carry fish to the door step of consumers, lack of cold storage, inadequate facilities for fish handling and storage, inadequate parking space for fish carrying vehicles, lack of adequate provision for ice, insufficient space to accommodate all

wholesalers and retailers, lack of proper drainage and waste disposal system, and lack of good provision for water supply.

- The demand for fish is more in those restaurants where rice is the core item to serve.

- The widely used species in eating joints is rohu and it is followed by catla, *bhangon*, small variety of fishes (*borolia, singorah, moa, puthi* etc.), *arri, chital*, illish, prawn, *borali, kurhi, pabha*, mrigal, and koi. In comparision to different fish items, the numbers of meat items were found more in eating joints.

- Overall, 60% of eating joints opined that there is a possibility of consumers choosing fish items if they are made available. On an average, 54.0% managers/owners of eating joints opined that there is probability of utilizing low-valued fish for preparation of value added fish items.

- The main difficulties associated with preparing and selling of value added fish items as perceived by managers/owners of eating joints are less demand for fast food fish item, non-availability of suitable varieties of fish, and lack of awareness about fast food fish items.

The present study tried to evolve some strategies based on findings of the study and reviewing existing strategies adopted for fisheries development in the State so that this sector can become self-sufficient and consumers accept fish as staple food to generate more demand. The proposed strategies were distributed among experts to find out their validity and practicability. Experts were selected based on their contribution/experience in fisheries development in the state. Interview with the experts were conducted in two rounds and the strategies finalized.

Suggested Strategies

The strategies suggested for improvement of production and marketing of fish to cater to the need of the consumers are given below.

A. For More Fish Production

After identifying perceived constraints of fish production and responses on the same by the producers factor analysis was carried out and four significant factors have been identified. These are 'support system constraints', 'infrastructural

constraints', 'financial and technical constraint', and 'societal constraints.' The strategies developed to remove these constraints are given below.

I.   Support System Constraints

The constraints under this included the following variables -

i)   Inadequate visit of extension personnel to farm site

ii)   Lack of follow up action by extension workers

iii) Inadequate training programme on fish culture

iv)   Unavailability of formulated feed

v)   Lack of expected result from fish culture

vi)   Lack of knowledge of soil and water quality management

Strategy-I: Providing more extension support to fish farmers

Methods/Tactics for fulfilling the strategy:

i.   Specialized training and demonstration on various aspects of fish production such as water quality management, fish health management, methods of calculation and application of proper dose/rate of fishery inputs, recent advancement of fish production and marketing systems should be organized for farmers as well as for fishery extension workers by the State Fisheries Department. This will increase the efficiency of farmers, changing the productivity status of fish culture practices in the State. Translocation of proven fish culture technologies to the door steps of farmers alone may cause a paradigm shift in the productivity level of the water bodies under command of fish culture.

ii.   Formulated fish feed should be made available to farmers. This can be done through establishment of Fish Feed Mill with initiation from the government with involvement of entrepreneurs/NGOs/SHGs or on public-private-partnership (PPP) mode.

iii. State Fish Laboratory established at the Directorate Complex, Guwahati for testing of soil and water quality parameters does not have easy access for farmers from remote areas. The provision for testing soil and water quality parameter should be made available at close reach of the farmers to enable them to use proper dose of lime, manures, inorganic fertilizer, medicines etc. in their ponds

based on the result of these tests. Provisions of Fishery Clinic with soil and water testing facilities, disease diagnostic facilities, fish medicines etc. at block level can help the farmers in this regard.

iv. In line with the establishment of Veterinary Hospital in rural areas, the Government of Assam should establish Fishery Extension Unit at least one in each block with necessary infrastructure and manpower.

v. Since the ATMA model has already proven as unique model for dissemination and adoption of technologies, this model should be adopted through proper identification and formation of Farmers Interest Groups (FIGs)/Self Help Groups (SHGs), Farmers field Management Committee (FMCc), and Farmer Advisory Committee (FAC) at Panchayat/block level.

vi. The Department of Fisheries, Government of Assam should have provisions for rewarding efficient Extension Officers and the measures for maintaining accountability should be made stringent. There should be financial and non-financial incentive to extension workers to motivate them to render their sincere service for more diffusion and adoption of fish culture by fish farmers. Necessary facilities to effectively work in remote areas should be provided to the extension workers. Suitable transportation, audio-visual aids and financial provision for demonstration purpose are to be made available at right time.

II. Infrastructural Constraints

This includes the following variables (constraints) –

i) Difficult to get good brooders during breeding

ii) Lack of fishery input supplier in the locality

iii) Cost of fishing net is more

iv) Exploitation by middlemen

v) Lack of proper distribution channel

Strategy-II: Providing infrastructural support to farmers

Methods/Tactics for fulfilling the strategy:

i. To provide a suitable delivery system of fishery inputs to the fish farmers in time as well as participate in the distribution channel by framing fish producers'

consortium at rural areas. This will reduce the cost of production and distribution. This type of organized marketing of fish would be helpful in stabilizing the price which will benefit both producers and the consumers.

ii. 'One stop Aqua Shop'(OAS) as recommended by the DFID (Department for International Development) should be established as single outlet in strategic locations keeping all fishery inputs so that farmers can get all inputs required for fish culture such as fish seed, fish feed, fertilizer, chemicals etc. along with technological information brochures. This OAS can be named as '*Matsy Sewa Kendra.*' OAS with different name has already been started in different parts of the country that provide significant services to the farmers (De and Saha 106).

iii. Provision for icing, packaging, and transporting fish should be provided to rural fish farmers. The Fishery Department should identify the pockets of high fish production potential in the State and build cold storage facilities in these areas. The farmers can be charged at no profit no loss basis to reach the operation cost of such facilities.

III. **Financial and Technical constraint**

The constraints under this included the following variables –

i) Difficult to get institutional credit

ii) Lack of good quality fish seeds of required size and number at the time of stock

iii) Difficult to identify good quality fish seed

iv) Lack of fund

Strategy-III: Providing financial and technical support to the farmers

Methods/Tactics for fulfilling the strategy:

i. Institutional credit package to support growth of culture fisheries in the State should be made available to farmers. Institutional credit should be made available at lower rate of interest and its procedure should be simple for the farmers. Making available of credit package here refers to providing the financial linkage to farmers. After confidence building of the farmers through practical training by the Government, members of the banking sector should be invited to offer a single

window loan provision in the form of loan mela where the less educated farmers be assisted in availing a loan.

ii. Formation of SHG can generate fund by themselves through collection of monthly premium from members and giving it to members at low rate of interest which will ultimately help the farmers to meet the necessary expenses of fish culture to certain extent.

iii. Since lack of quality fish seed at right time of stocking is one of the significant constraints, an attempt should be made to provide quality fish seed at the appropriate time so that productivity status of composite fish culture can increase to a significant extent. To achieve this, following steps may be considered

- The government may make an attempt to provide better quality fish seed at pond site to farmers through judicious carp breeding and hatchery management and proper distribution system.

- As quality of seed is the key element in successful fish farming, it is important to regulate the fish seed market through a mechanism that helps the farmers to get an assured supply of quality seed. Certification of hatcheries could be an option that can be considered to ensure that quality of the seed is regulated at the production stage.

- Attempts for early breeding of important cultured fishes should be taken up at public sector.

- Assam Fish Seed Act, 2005 should be strictly followed which provides guidelines for quality seed production and management.

IV) Societal Constraints

This includes-

i) Poisoning of pond

ii) Poaching

Strategy-IV: Constant monitoring and community based management

Methods/Tactics for fulfilling the strategy:

i. Employing community base watchmen to tackle the problem of poisoning and poaching.

ii. Installing substrates for periphyton growth that in turn work as hurdle to poach inside ponds

iii. Social fencing through community participation will reduce the social constraints

iv. Providing fishery insurance coverage can help mitigating the problem of poaching and poisoning.

One of the major constraints as perceived by the farmers is lack of standardized technology for indigenous fish species which have also more consumer preference.To remove this constraints the suggested strategy is -

Strategy-V: Standardization of breeding and culture technology for high valued indigenous fish

Methods/Tactics for fulfilling the strategy:

i. Package of practices based on location specific standardized breeding and culture technology of magur as well as other indigenous varieties of fish like koi, *sol*, *chital*, *arri*, *pabha*, *moa* etc. should be developed through research in agro-climatic situation of Assam so that farmers can adopt it. Technology of culture of *moa* (*Amblypharyngodon mola*) along with carp species should be explored. In Bangladesh, the government and non-governmental organizations (NGOs) have already begun to promote semi-intensive polyculture in small, seasonal ponds, using the small variety of fish *moa* along with carp. There was no decline in carp production as well as income when the system integrated with *moa* (Roos et al.).

ii. Proper conservation measures against habitat destruction and measures to stop indiscriminate fishing of these species during breeding season should be taken. In this case, Assam Fisheries Rule (1953) which was amended in 2005 should be strictly enforced creating awareness among public.

B. For Marketing intermediaries

Strategy-VI: Development of an elaborate network for handling, transporting, distributing, displaying, and holding facilities to support marketing of fish and value added fish

Methods for fulfilling the strategy:

i. Specially designed or modified tanks and containers, as well as trucks and other transport vehicles equipped with aeration or oxygenation facilities to keep fish alive during transportation should be provided with government initiation and support in initial stage.

ii. Since hygienic fresh fish handling/marketing and post harvest preservation facilities in the State are inadequate and of preliminary nature, such preservation and processing units should be established in selected potential locations by the Department of Fisheries. Both technical and financial assistance such as transportation facilities, establishment of ice plants, landing platforms, weighing sheds, cleaning tables, storage facilities, modern fish selling stalls, retail vending kiosks, etc should be provided to develop handling/ marketing and post harvest infrastructure. More emphasis should be given for provision of running water facilities and proper drainage and waste disposal systems.

iii. Since fish peddlers play an important role in delivering fish at the door steps of consumers, they should be trained in carrying live and fresh fish in keeping them fresh/alive for longer periods. Insulated containers and provision of adequate ice at all stages should be provided. Making available of bi-cycle/motorcycle with built-in insulated fish boxes may serve this purpose. By improving and organizing the services of fish peddlers, it is possible to satisfy consumers through supply of fish of desired quantity/variety in fresh/live condition.

iv. Adoption of Multiple Stocking and Multiple Harvesting of carp culture technology should be encouraged in order to have regular supply of fish though out the year. Since, fluctuations of demand and supply of fish is one of the main constraints as perceived by the wholesalers, and retailers and vendors, adoption of this practice will benefit these marketing intermediaries. Hence, package of

practice of this technology should be developed by the fisheries scientists of the State and transferred to the farmers after standardization of the technology.

v.   Training and demonstration programmes on scientific fish handling, cleaning, dressing and preservation (e.g., icing, refrigeration etc.) may be organized for farmers as well as marketing intermediaries at block level by experts of R & D organizations in Fisheries in the state at specific duration and frequency.

C. Strategy to overcome constraints of preparing and marketing of value added fish

Strategy-VII: Development of hygienic retail outlet, and branding of fish and fish items

Methods/Tactics for fulfilling the strategy:

i.   More retail outlets (fish shops) should be established and operated at consumer-friendly locations in both rural and urban areas so that consumers can get fresh fish easily in a hygienic condition. The Department of Fisheries (Government of Assam), Assam Apex Co-operative Fish Marketing and Processing Federation Ltd. (FISHFED), business firms and SHGs should work together and take pro- active role in opening hygienic fish retail outlets.

ii.   Assam Apex Co-operative Fish Marketing and Processing Federation Ltd. (FISHFED) should be more active in the fish retailing business in line with Tamil Nadu Fish Development Corporation Ltd. (TNFDC), Kerala State Co-operative Federation for Fisheries Development Ltd. (Matsyafed) and West Bengal State Fishermen's Co-Operative Fedaration Ltd. (BENFISH). TNFDC operates fish retail outlets under the name of "*Neidhal*". In Kerala, Matsyafed has started fish retailing outlets under the name of "Fresh Fish Point". These retail outlets purchase fish directly from fishermen/fishermen cooperative societies and sell them to customers at reasonable prices under modern hygienic conditions. These retail outlets aim to replace/remove middlemen involved in fish marketing, thereby ensuring higher returns to fishermen and hygienic fishes to consumers at

affordable prices. Presently, these outlets source their fish from the local wholesale market, but efforts are being made to purchase fish directly from the producer (Kumar et. al 345-54).

Strategy-VIII: Creation of awareness among consumers about nutritional value of fish and different value added fish products

Methods for fulfilling the strategy:

i. Promotional campaign through television and radio commercials, and print media like bulletin, leaflets, news papers and street posters; etc can play an important role in creation of awareness and popularity of different value added fish and fish products. There is need of quality and weight certification for fish and fish products so that consumer can accept these without hesitation. Municipality authority or panchayats can assign these responsibilities to the department of health and to the weights and measures for ascertaining quality and weight of fish in the market.

ii. Promotional campaign about the nutritional value of fish in line with that of egg by National Egg Coordination Committee (NECC). Sales promotion activities should take into consideration the choice and preferences of husbands and wives since in majority of households in the study area husbands made decisions regarding type of fish to buy, frequency of eating fish, and purchase of fish whereas housewives took the decisions about cleaning and types of preparation of fish.

D. Strategies for Marketing of fish in Assam

To develop marketing strategies for fish in the study area, the STP (Segmentation, Targeting and Positioning) approach of marketing has been adopted. After segmenting the market using different demographic and geographic variables, the target market has been identified using the information revealed by the study. The position of fish to be created in the minds of the target segment has also been identified. To create the identified position, the marketing mix has been conceptualized. The following is a discussion on this issue.

a) **SEGMENTATION**

   i.   **Based on geographic profile**

Geographic profile

Rural
- Consumption is more compared to urban
- Frequency is more
- Eating out non existent
- Buys mostly at local market
- Prefers curry
- Prefers value addition in the form of dressing and chopping only
- Wants quality and weight to be certified

Urban
- Consumption is less compared to rural
- Frequency is high
- Eating out is more
- Buys mostly at town market
- Prefers curry
- Prefers valued addition in the form of dressing and chopping, and ready to eat fish items
- Awareness regarding availability of ready to eat fish items is high
- Wants quality and weights to be certified, improvement in market infrastructure, and regularity of supply
- Willing to pay for such value addition

   ii.   **Based on Demographic Profile**

Communities

Assamese
- Consumption is high
- Percentage of expenditure on fish over total food consumption is high
- Frequency is high
- Prefers curry

Bengali
- Consumption is high
- Percentage of expenditure on fish over total food consumption is high
- Frequency is high
- Prefers curry

Nepali
- Consumption is low
- Percentage of expenditure on fish over total food consumption is low
- Frequency is low
- Prefers curry

North Indian
- Consumption is low
- Percentage of expenditure on fish over total food consumption is medium
- Frequency is low
- Prefers curry

Income groups

Category: I	Category: II	Category: III	Category: IV	Category: V
• Fish consumption is less compared to other income groups • Percentage of expenditure on fish over total food consumption is low • Frequency is high • Preference for value addition in the form of dressed and chopped fish is high	• Fish consumption is less compared to other income groups • Percentage of expenditure on fish over total food consumption is low • Frequency is high • Preference for value addition in the form of dressed and chopped fish is high	• Fish consumption is high • Percentage of expenditure on fish over total food consumption is low • Frequency is high • Preference for value addition in the form of dressed and chopped fish is high	• Fish consumption is high • Percentage of expenditure on fish over total food consumption is high • Frequency is high • Preference for value addition in the form of dressed and chopped fish is high • Preference for ready to eat fish is high • Frequency of going to restaurant for meal is high • Awareness regarding availability of ready to eat fish items is high • Willing to pay extra for value addition is high • Willing to increase in choosing value added items if different delicacies are available	• Fish consumption is high • Percentage of expenditure on fish over total food consumption is high • Frequency is high • Preference for value addition in the form of dressed and chopped fish is high • Preference for ready to eat fish is high • Frequency of going to restaurant for meal is high • Awareness regarding availability of ready to eat fish items is high • Willing to pay extra for value addition is high • Willing to increase in choosing value added items if different delicacies are available

b) TARGETING

Target market:

From the above discussion, it is evident that Assamese and Bengali people from urban area whose monthly income is Rs.20000.00 and above can be considered as the target market.

a) POSITION

Hygienic ready to cook or eat tasty fish for nutritional supplement for the whole family.

4 P's:

PRODUCT	PRICE	PLACE	PROMOTION
• Dressed and chopped fish should be marketed in hygienic condition with certification of quality and weight • Preferred varieties of fish should be made available on regular basis • Fish in live and fresh condition should be offered to consumers • Packed and iced fish in different packet size should be made available • Packaging should be of different cuts as done in case of chicken • Introduction of different fish items in restaurants, fast food outlets, and bars visited by the target segment.	• Price should be marginally higher to meet the expense of value addition and at the same time to give the impression of a premium product. • Differential pricing strategy should be followed for different cuts of fish. Heads and tails should be priced lower compared to the other pieces.	• Clean and hygienic retail outlets with refrigeration facility should be established. • Shopping malls will be a very good distribution channel member • Another exclusive distribution channel is provided in a model described latter in this chapter.	• Promotional campaign about nutritional value of fish in line with advertisement of egg and milk should be undertaken using different electronic and print media • Promotional campaign of different fish delicacies of fish should be undertaken • Organizing fish food festivals with good publicity where consumers get exposure to variety of fish and value added fish products • Branding strategy for value added fish and fish products should be formulated

A business model has been designed for marketing of fish and fish products and is presented in Fig.5.1
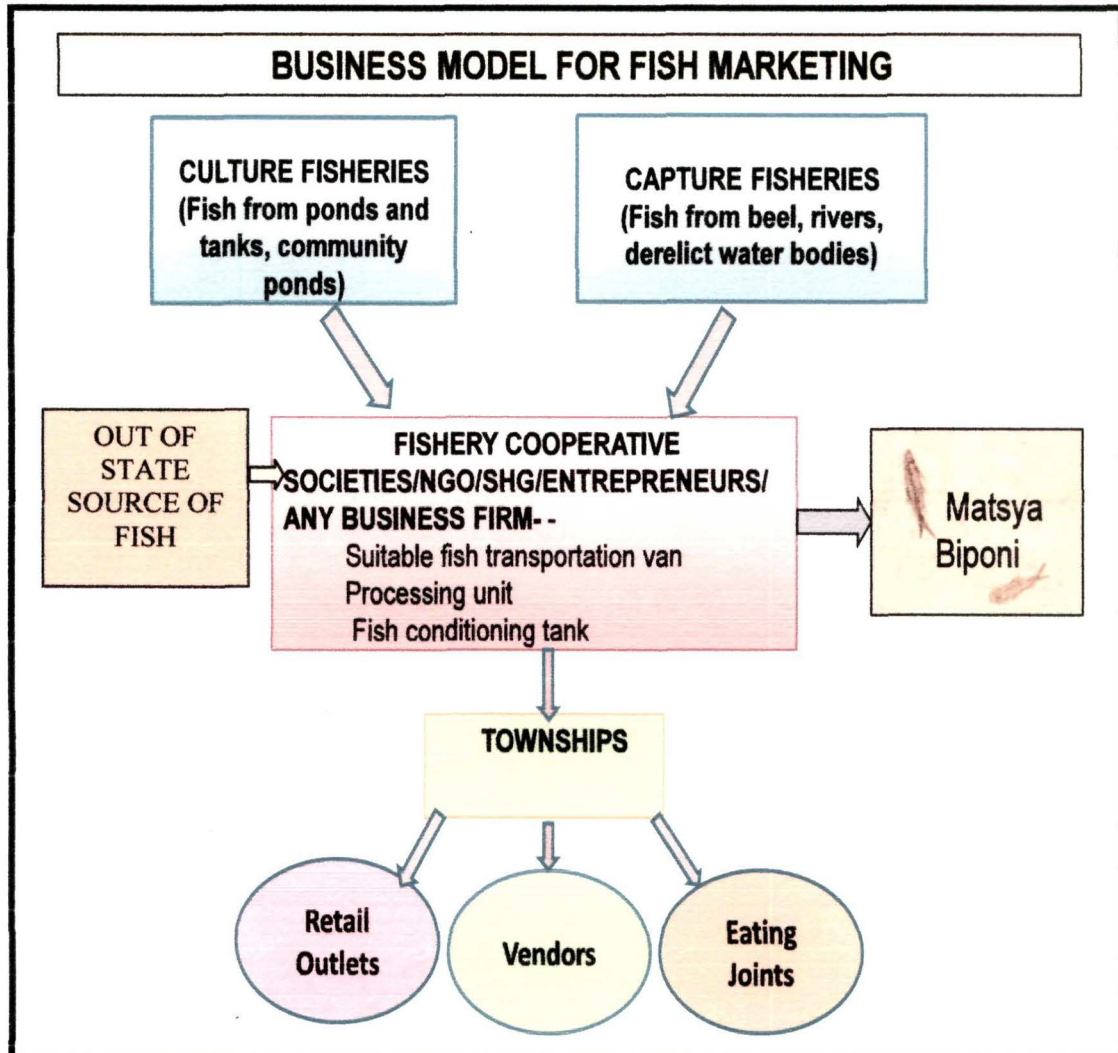
Fig.5.1 District level business model for fish marketing

The business model proposes that a body, whether NGO or SHG or cooperative society, take up the responsibility of collecting and distributing fish, including branded fish items with profit motive in a small geographic area centering a township. This body will take up the activity of collecting fish from the different sources like culture and capture fisheries. This body will act as a wholesaler of fish, as well as provider of ready to eat fish items through the 'Matsya Biponi', which will be discussed subsequently. The ideal infrastructure requirement of this body is described below. But the infrastructure

can be generated in a phased manner depending on priority. A PPP mode of operation can also be considered.

Facilities needed:

- Infrastructure for carrying killed (prior rigor mortis) as well as live fish
- Scaling, grading, chopping, sorting and packaging facilities
- Deboning facility

This cooperative society will act as a feeder to small retail outlets, vendors and eating joints in the township. The facilities required for maintain quality and branding of fish sold through this channel is listed below.

Retail outlets:

- Glass covered
- Use of hand gloves
- Refrigerator
- Provision for storing live fish
- Instant packaging
- Waste disposal system
- Market cleaning system

Vendors:

- Insulated pedal driven closed carts with compartments for carrying chopped iced/frozen fish, half cooked fish
- Container with aeration facility to carry live fish

MATSYA BIPONI

'*Matsya Biponi*' (MB) is proposed to be the provider of ready to eat fish to the general public. MB must be well equipped with cooking facilities and staffed with efficient cooks. The purpose of MB is to provide catering services if the order size is over a predefined size which is to be decided after doing proper costing. This service should be branded on the basis of convenience, hygiene, and taste.

Most of the experts opined that varied consumer preference may be met by development of processed fish products at affordable cost. Such facilities in the region are at an infant stage. Rigorous efforts in this direction will go a long way in making marketing of fish sustainable.

MAJOR POLICY RECOMMENDATIONS (Discussed in detail in the previous section of the current chapter):

Based on the findings of the study following major policy recommendations are suggested-

1. Since most of the fish consumers prefer live and fresh fish, it requires careful post harvest handling for extending its shelf life. Hence, all care should be taken while handling fish so that consumer satisfaction can be given as well as remunerative price can be obtained by the producers and marketing intermediaries. It is recommended to develop an elaborate network for handling, transporting, distributing, displaying, and holding facilities to support marketing of fish in live and fresh. This requires provision for specially designed or modified tanks and containers; transport vehicles equipped with aeration or oxygenation facilities to keep fish alive during transportation with government initiation and support, establishment of hygienic fish market and post harvest preservation facilities in selected potential locations by the Department of Fisheries, providing technical and financial assistance for transportation facilities, establishment of ice plants, landing platforms, weighing sheds, cleaning tables, storage facilities, modern fish selling stalls, and retail vending kiosks; and conducting training and demonstration programmes on scientific fish handling, cleaning, processing and preservation techniques.

2. The Department of Fisheries (Government of Assam), Assam Apex Co-operative Fish Marketing and Processing Federation Ltd. (FISHFED), business firms and SHGs should work together and take pro-active role in opening more hygienic fish retail outlets at consumer-friendly locations.Dressed and chopped fish should be marketed in hygienic condition with certification of quality and weight.

3. Promotional campaign using different mass media to create awareness and popularity of different value added fish and fish products with their nutritional value in line with that of egg by National Egg Coordination Committee (NECC) should be taken in order to increase consumption of fish and value added fish products.

4. The production of consumer preferred carp and non-carp varieties should be increased in order to make them available at affordable price by the consumers. Adoption of Multiple Stocking and Multiple Harvesting of carp culture technology should be encouraged in order to make regular supply of carps throughout the year. In order to achieve this, package of practice of this technology should be developed by the fisheries scientists of the State and transferred to the farmers. Package of practices based on location specific standardized breeding and culture technology of magur as well as other indigenous varieties of fish like *koi, sol, chital, ari, pabda,* and *moa* should be extended through adoptive research in agro-climatic situation of Assam so that farmers can adopt it successfully.

5. Quality fish seed at right time of stocking should be made available among fish farmers through judicious carp breeding and hatchery management and proper distribution system with initiation from Department of Fisheries, Government of Assam. Assam Fish Seed Act, 2005 should be strictly followed which provides guidelines for quality seed production and management.

6. More extension support to fish farmers should be provided. Specialized training and demonstration on varied aspects of fish production for farmers as well as for fishery extension workers, establishment of Fish Feed Mill with initiation from the government with involvement of entrepreneurs/NGOs/SHGs or on public-private-partnership (PPP) to make available formulated feed, establishment of Fishery Clinic and establishment of Fishery Extension Unit at least one in each block with necessary infrastructure and manpower should be done.

FURTHER RESEARCH

The present research is both exploratory and descriptive in nature. This research makes an important contribution to existing knowledge as it provides detailed information on fish consumption patterns depending on geographic and demographic profile. These data provide baseline information for planning consumer oriented production and trading of fish. Most of the existing studies have been concentrating either on the production side of Fish or the consumption aspect. Development of strategies after analyzing both the production and consumption aspects is a major contribution of this study to the existing body of knowledge.

The strategies proposed in the study have the potential of immediate implementation either by the Government through the Department of Fisheries, or by private organizations. The business model proposed can provide guidelines to upcoming entrepreneurs in this segment.

This study restricted itself to the marketing of fish. The production of consumer preferred fish is an area where further research is necessary. Moreover, identifying new products related to fish is another area of research which will need technological investigation and product promotion.

Fish has been an integral part of the dietary habit of the population of the study area. But marketing of fish has never been professionally looked into. This study looked into professional production, distribution, and introduction of new value added fish products. Suggestions have been put forward for professional and efficient marketing of fish and fish products. The proposed strategies can be implemented and implementation of the proposed strategies will go a long way in professional marketing of fish and fish products.

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ANNEXURE

"DEVELOPMENT OF CONSUMER ORIENTED STRATEGIES FOR

MARKETING OF FISH IN ASSAM"

QUESTIONNAIRE FOR CONSUMERS
(The Data will be used for research purpose only)

Dear Sir/ Madam,

A study on consumption and preference patterns of fish is being carried out as a part of my Ph.D research work to develop proper marketing strategies. Your kind cooperation in filling up the questionnaire will go a long way in helping me in this academic endeavor. Thanking you,

P.C.Bhuyan, Research Scholar
Department of Business Administration,
Tezpur University, Napam

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1. Food habit : Vegetarian ☐ Non- vegetarian ☐
2. Household monthly expenditure for food items:

Food items	Quantity required (weekly)	Quantity required (monthly)	Expenditure(Rs.)
Fish			
Meat			
Egg			
Milk and milk product			
Rice			
Wheat			
Dal			
Sugar			
Vegetables			
Edible oil			
Others (Tea, snacks,fruits etc.)			
Non-food items			

Total =

3. How often do you eat fish? Daily/twice a week/weekly /fortnightly/once a month

4. What is the form of fish you generally eat?

a) Local (live and fresh) ☐ b) *Chalani* (imported fish from outside Assam) ☐

5. The variety of fish you generally eat?

    Among carps :

    Live fish   :

    Others   :

6. What is the average quantity of fish purchased at a time?

    a) 250 gm   b) 500 gm   c) 1.0kg   d) More than a kg   e) Unspecified

7. The species of fish preferred (Starting from 1 as the highest preference)

Indian Major Carps	: Catla	☐	Rohu	☐	Mrigal	☐
Exotic carps	: Grass carp	☐	Common carp	☐	Silver carp	☐
Minor carps	: Bhangon	☐	Kurhi	☐	Koliajara	☐
Live fish	: Magur	☐	Singi	☐	Sol	☐
	Goroi	☐	Koi	☐	Others----------	
Big fish	: Ari	☐	Chital	☐	Borali	☐
Preference for-	: Pabha	☐	Kandhuli	☐	Singorah	☐

    Small fish: -------, -----------, ---------, -----------

8. Generally preferred size of carps

    50 – 100 gm ☐   250- 500 gm ☐

    500-1000 gm ☐   1.0- 2.0 kg ☐

    2.0– 3.0 kg ☐   3.0-5.0 kg ☐

    More than 5.0kg ☐

9. Please mention your preference of the following items (starting from 1 as the most preferred)

    a) Fish ☐ b) Chicken ☐ c) Mutton ☐ d) Pork ☐ e) Beef ☐   f) Egg ☐

10. How do you generally prefer to consume fish (starting from 1 as the most preferred)?

    a) Fried (F) ☐   b) Curry(C) ☐   c) Steamed (S) ☐   d) Roasted(R) ☐

11. Do you generally prefer different preparation for different varieties of fish?

    a) Carp   F   C   S   R

    b) Live   F   C   S   R

    c) Small fish F   C   S   R

    d) Dried fish F   C   S   R

12. What is your reason for eating fish? (Please rank starting from 1 as the best reason)

    a) High nutritive value ☐   b) Palatable taste ☐

    c) Less fat content ☐   d) Easily digestible ☐

    e) Habit ☐   f) Status symbol ☐

    g) Easily available ☐

    h) Price of fish is affordable in comparison to meat ☐

13. If fish is not preferred what is your reason for not preferring fish (Please rank starting from 1 as the best reason)

    a) Difficult to clean ☐   b) Difficult to prepare ☐

    c) Price of good quality fish is unaffordable ☐   d) Bad Smell ☐

    e) Presence of intramuscular bones ☐   f) Do not like the taste ☐

    g) Lack of status benefit ☐   h) Tradition ☐

14. Where do you generally buy fish? (Starting 1 as the highest buying place)

    a) Local market ☐   b) Town market ☐   c) Wholesale ☐ d) Vendors ☐

15. Would you like any value addition in the fish you buy? (One can choose more than one)

    a) Cleaned and chopped fish   b) Fried fish

    c) Frozen fish

    d) Stalls of ready to eat fish products (fish cutlet, fish finger, fish balls etc.)

    e) Others (Please specify) –

16. How much extra are you willing to pay for the above value addition?

a) Cleaning and chopping	5%	5-10%	More than 10%
b) Fried	10%	10-15%	More than 15%
c) Frozen	10%	10-15%	More than 15%
d) Ready to eat fish	20%	20-30%	More than 30%

(Fish cutlet, fish finger, fish balls etc)

16. Do you purchase ready- to- eat fish products?   Yes/ No

    If yes, what are those ----------------------, -------------------, -----------------------

    If not, what are the reasons for not taking –

    a) Lack of awareness about the products   b) Not easily available in shop

    c) Do not taste the products till date   d) Do not like the taste

e) May present intramuscular bones   f) Any other (please specify)

17. Do you face any of the following difficulties in purchasing fish?

a) Quality difficult to ascertain
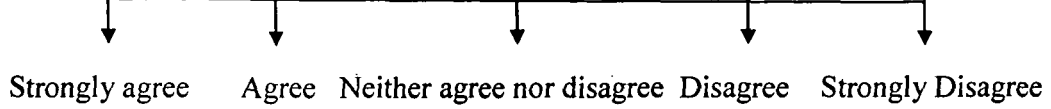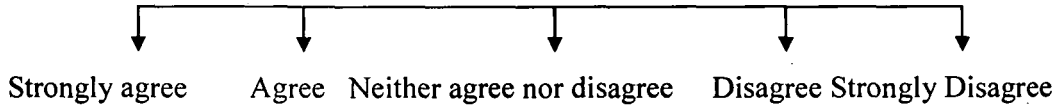
Strongly agree   Agree   Neither agree nor disagree   Disagree   Strongly Disagree

b) Dirty and unhygienic market area

Strongly agree   Agree   Neither agree nor disagree   Disagree Strongly Disagree

c) Chances of getting cheated

Strongly agree   Agree   Neither agree nor disagree   Disagree Strongly Disagree

d) Irregularity of supply

Strongly agree   Agree   Neither agree nor disagree   Disagree Strongly Disagree

e) Unavailability of preferred fish

Strongly agree   Agree   Neither agree nor disagree   Disagree   Strongly Disagree
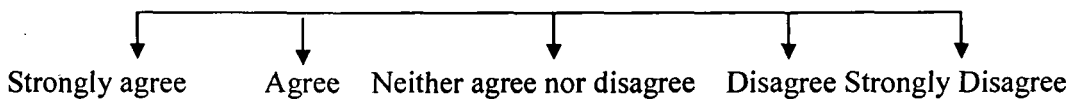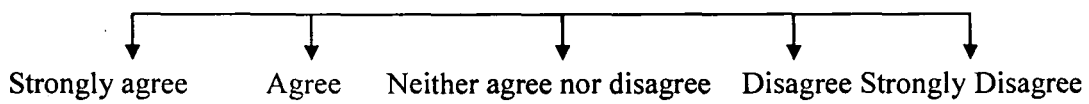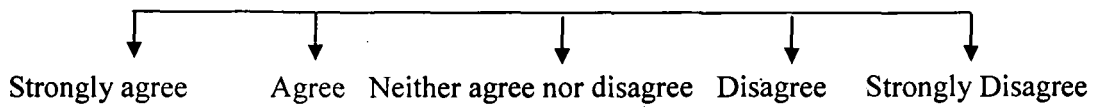
18. Please tick the appropriate response for the following statements –

a) I will pay extra if quality and weight of fish is certified –
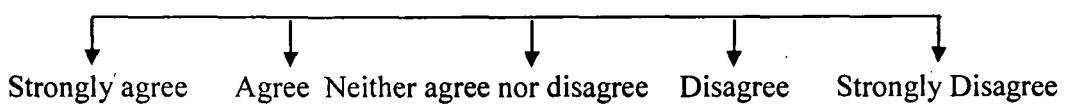
Strongly agree   Agree   Neither agree nor disagree   Disagree   Strongly Disagree

b) I will pay extra if market infrastructure is improved –

Strongly agree   Agree   Neither agree nor disagree Disagree   Strongly Disagree

c) I will pay extra for regular availability of preferred fish -

Strongly agree   Agree   Neither agree nor disagree Disagree   Strongly Disagree
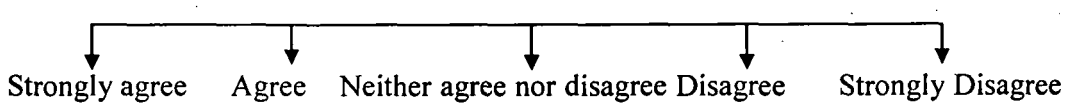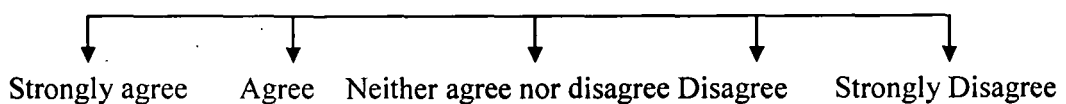
19. Please indicate who undertakes the following tasks in your family

Statement	Husband	Wife	Children	Joint	Household helper
Deciding what fish to eat					
Deciding the frequency of eating fish					
Purchase of fish					
Scaling and cleaning of fish					
Deciding the preparation					
Preparation of fish					

20. What is your frequency of going to restaurant for meals?

    a) Once a week   b) Twice a week   c) Once in a month d) Rare

21. What is your frequency of taking snacks outside the house?

    a) Everyday   b) Once a week   c) Twice a week   d) Unspecified

22. How often do you choose fish items while eating out?

    a) Invariably   b) Sometimes   c) Rare   d) Never

23. How often do you buy cooked food to consume at home for lunch/dinner?

    a) Once a week   b) Once in two week c) Once in a month d) Rare

24. How often do you buy fish items during eating outside food?

    a) Often   b) Sometimes   c) Rare   d) Never

25. Would you increase choosing ready to eat fish items during the above occasions if different delicacies are available

Strongly agree   Agree   Neither agree nor disagree Disagree   Strongly Disagree
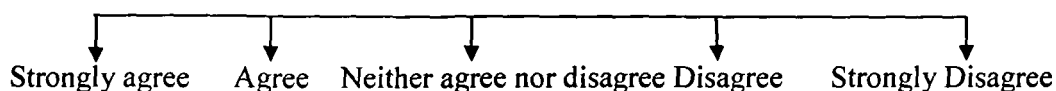
Few words about yourself:

26. Age   : 15-25 yrs /25-45 yrs / 45 yrs and above

27. Gender   : Male   ☐   Female   ☐

28. Educational level   : Below HSLC / 10+ /Graduate /Postgraduate and above

29. Monthly household income   : a) Less than Rs.5,000.   b) Rs.5, 000-Rs.10, 000

    c) Rs.10, 000 – 20,000 d) Rs.20, 000-40,000

    e) More than Rs.40, 000.00

30. Religion   : Hindu/ Muslim/Christian/ Others (   )

31. Community : Assamese/Bengali/ Nepali/Others ( )

32. You belong to : Gen. / OBC / SC / ST

33. Main occupation : Govt. Service ☐ Private Service ☐

Business ☐

Professional ☐ Cultivator ☐ Labour ☐

34. Type of family : Nuclear ☐ Joint ☐

35. Family size: No. of adult = ---------- No. of children = ------- Total = ----

THANK YOU

Name and address of the respondent: **Date of interview**

QUESTIONNAIRE FOR FISH FARMERS

(The Data will be used for research purpose only)

Dear farmers,

A study on constraints of fish culture is being carried out as a part of my Ph.D research work to develop proper production and marketing strategies. Your kind cooperation in filling up the questionnaire will go a long way in helping me in this academic endeavor.

Thanking you,

P.C.Bhuyan, Research Scholar

Department of Business Administration,

Tezpur University, Napam

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1. Varieties of fish produced   :

2. Type of adoption   : Semi-intensive MSMH/SSSH/SSMH

3. No. of fish pond -----   Pond size --   Total area—

4. Annual fish production   :

5. Annual income from fish production:

6. Infrastructures available   :

      No. of hatchery   ---   No. of fishing nets ---

      No. of water pump ---   Others ---

7. Source of raw materials   :   <u>Raw materials</u>   <u>Source</u>

                           Fish seed

                           Feed

                           Fertilizers

                           Others

8. Whether training received?   Yes / No

If yes, for how many days: Less than 2 days/ 3-7 days/ 8-15 days/more than 15 days

9. Source of funding, if availed   :

10. Generally to whom you sell fish?

    a) Producer – Consumer

    b) Producer – Village trader/Retailer – Consumer

    c) Producer – Wholesaler - Village trader/Retailer – Consumer

    d) Producer – Village trader - Wholesaler - Village trader/Retailer – Consumer

11. Please tick in appropriate place against the following statements regarding constraints of fish culture according to its seriousness.

(Note: **SA**= Strongly Agree, **A**= Agree, **NAND**= Neither Agree Nor Disagree, **D**=Disagree, **SD**= Strongly Disagree)

Sl.no	Problems	SA	A	NAND	D	SD
1	Lack of good quality fish seeds of required size and number at the time of stock					
2	Difficult to identify good quality fish seed					
3	Unavailability of formulated feed					
4	Difficult to get good brooders during breeding					
5	Initial cost of digging out new pond is high					
6	Lack of fishery input supplier in the locality					
7	Lack of facilities for soil and water testing					
8	Growth of fish is less					
9	Cost of fingerlings/carried over seeds is high					
10	Cost of fish medicine is high					
11	Selling price at farm front is low					
12	Lack of fund					
13	Difficult to get institutional credit					
14	Lack of proper distribution channel					
15	Exploitation by middlemen					
16	Difficult and expensive to carry fish for selling to the distant market where price of fish is more					
17	Lack of cold storage					
18	Inadequate training programme on fish culture					

19	Inadequate visit of extension personnel to farm site						
20	Lack of follow up action by extension workers						
21	Lack of expected result from fish culture						
22	Lack of proper knowledge on pond management						
23	Lack of technological knowhow						
24	Lack of standardized technology for indigenous fish species						
25	Lack of suitable temperature for growth of fish throughout the year						
26	Soil is Acidic						
27	Water retention capacity of soil is low						
28	Monsoon is irregular						
29	Occurrence of flood						
30	Outbreak of disease						
31	Poaching of fish						
32	Poisoning the water body.						

12. Any other problems (Please specify and rank accordingly as done in the list-

13. Name and address of the Producer   :

14. Age   :   15. Religion:

16. Community   :   17.Caste

18. Educational qualification :   19.Primary occupation:

20. Annual income:

21. Type of family -   Nuclear/Joint   22.No. of family members

Date of interview: **THANK YOU**

QUESTIONNAIRE

(For Wholesalers)

1. Name and address of the Wholesalers :

2. Age : 3. Religion:

4. Community : 5. Caste :

6. Educational qualification : 7. Monthly

income

8. Name of the market :

9. Basic amenities available : Drinking water/Electricity supply/whether

covered with roof/cemented floor

10. Volume of business per day:

(Quantity of fish purchased/sold):

Species of fish   Qn. Auctioned (kg)   Auction price (Rs./kg)

11. Source of collection of fish :

12. Distance between purchase and sale location :

13. Area of distribution :

14. Storage facility : Yes/No,   if yes, whether Owned/Govt.

15. Form of distribution : Live condition/ Dead but fresh/

Frozen/Iced //Whole fish/ Cut fish

16. Mode of transportation:

17. Perceived problems of wholesalers (Please tick in appropriate place against the following statements regarding constraints of marketing according to its seriousness).

Sl. No	Problems	Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
1	Fluctuation of demand and supply affects the earnings					
2	Unavailability of consumer preferred fish					
3	Lack of fund for providing financial assistance to farmers/fishermen/traders					
4	Inadequate facilities for fish handling and storage					
5	Lack of sufficient space for auction					
6	Lack of cold storage					
7	Lack of proper drainage and waste disposal system					
8	Lack of good provision for water supply					
9	Inadequate parking space for fish carrying vehicles					
10	Lack of adequate provision for ice					
11	Insufficient space to accommodate all wholesalers					
12	No roof in the market					
13	No cemented floor					
14	Lack of potable water					
15	Lack of lavatory					

Date of interview: **THANK YOU**

xxx

QUESTIONNAIRE
(For Retailers)

1. Name and address of the Retailer :

2. Age   :   3. Religion:

4. Community   :   5. Cast :

6. Educational qualification :   7. Monthly income

8. Name of the market   :

9. Basic amenities available   : Drinking water/Electricity supply/whether covered with roof/cemented floor

10. Volume of business per day:

    (Quantity of fish purchased/sold):

Species of fish   Qn. Purchased (kg)   Purchase price (Rs./kg)   Sale price (Rs./kg)

11. Source of collection of fish   :

12. Distance between purchase and sale location   :

13. Area of distribution   :

14. Storage facility   : Yes/No,   if yes, whether Owned/Govt.

15. Form of distribution   : Live condition/ Dead but fresh /Frozen Iced/Whole fish/ Cut fish

16. Mode of transportation:

17. Perceived problems of retailers –

Please tick in appropriate place against the problem according to its seriousness.

(Note: **SA**= Strongly Agree, **A**= Agree, **NAND**= Neither Agree Nor Disagree,

D=Disagree, **SD**= Strongly Disagree)

Sl.No.	Problems	SA	A	NAND	D	SD
1	Fluctuations of demand and supply affects the earnings					
2	Unavailability of consumer preferred fish					
3	Lack of fund for buying fish in bulk					
4	Customers' preference for fresh fish make storage in ice non-profitable					
5	Exploitation by middlemen at the time of weighing fish					
6	Insufficient space and seating arrangement for selling fish in the market					
7	Lack of cold storage					
8	Lack of adequate provision for ice					
9	Price of ice is high					
10	Marketing cost is high					
11	Lack of proper drainage and waste disposal system					
12	Lack of good provision for water supply					
13	Lack of proper fish transportation facility					
14	Difficult to transport fish in live condition					
15	Lack of proper shelter to sell fish					
16	Lack of potable water					
17	Lack of lavatory					

Date of interview: **THANK YOU**

QUESTIONNAIRE

(For Hawkers/vendors)

1. Name and address of the vendor :

2. Age :   3. Religion:

4. Community :   5. Cast :

6. Educational qualification :   7. Monthly income

8. Name of the market :

9. Basic amenities available : Drinking water/Electricity supply/whether

       covered with roof/cemented floor

10. Volume of business per day:

     (Quantity of fish purchased/sold):

Species of fish	Qn. Purchased (kg)	Purchase price (Rs./kg)	Sale price (Rs./kg)

11. Source of collection of fish   :

12. Distance between purchase and sale location:

13. Area of distribution   :

14. Storage facility   : Yes/No,   if yes, whether Owned/Govt.

15. Form of distribution   : Live condition/ Dead but fresh /Frozen

       /Whole fish/ Cut fish

16. Mode of transportation:

17. Perceived constraints of Hawkers/Vendors/Fish peddlers

Please tick in appropriate place against the problem according to its seriousness.

Sl. No.	Problems	Strongly Agree	Agree	Neither agree nor Disgree	Disagree	Strongly disagree
1	Lack of fund					
2	Unavailability of consumer preferred fish					
3	Unable to purchase fish during April to August due to increase in price of fish					
4	Lack of proper fish transportation facility					
5	No regular supply of fish throughout the year					
6	Fluctuation in demand and supply of fish in auction place					
7	Lack of insulated containers/carriers to carry fish to the door step of consumers					
8	Maintenance cost of bicycle is high					
9	Rude behavior of some customers					
10	Cannot sell more amount of fish going by door to door					

Date of interview:

THANK YOU

QUESTIONNAIRE FOR EATING JOINTS
(For Dhaba/Restaurants/Bar cum restaurants/Fast food outlets/Chat house)

1. Name and address   :

2. Age -   Religion-   Community -   Caste -

3. Educational qualification   :

4. Monthly income   :

5. Volume of business per day   :

6. What are the items sold   :

         Items

    i.   Fish items   :

    ii.   Chicken items :

    iii.   Mutton items :

    iv.   Veg. items   :

    v.   Others   :

7. No. of persons employed in the firm:

8. What are the different fish items that can be introduced in the menu?

9. What are the difficulties associated with producing and selling fish products?

10. What is the probability of consumers choosing fish products if they are made available?   Yes /No / Cannot say

11. What is the probability of utilizing low-valued fish like grass carp, common carps etc. for value addition as cutlet, finger, chops etc.? Yes /No / Cannot say

Date of interview:

THANK YOU

List of selected districts, blocks, villages and wards

Agro-climatic zone	Selected districts	Rural area		Urban area
		Selected block	Selected villages	Selected wards
Central Brahmaputra valley zone	Nagaon	Juria	Teliabebejia (Assamese) Thiatangni (Bengali) Nepalikhuti (Nepali) Sutirpar (North Indian)	Ward-6 (Assamese) Ward-17 (Bengali) Ward-7 (Nepali) Ward-23 (North Indian)
North Bank plain zone	Sonitpur	Naduar	Barhampur Madhab (Assamese) Panpur malabasti (Bengali) Erabari (Nepali) Mohmara (North Indian)	Ward-17 (Assamese) Ward-16 (Bengali) Ward-19 (Nepali) Ward-12 (North Indian)
Upper Brahmaputra valley zone	Dibrugarh	Tengakhat	Nijtegakhat (Assamese) Tingrai Chariali (Bengali) 1No.Tingrai Nepali (Nepali) Panimudigaon (North Indian)	Ward-5 (Assamese) Ward-12 (Bengali) Ward-6 (Nepali) Ward-8 (North Indian)
Lower Brahmaputra valley zone	Kamrup	Dimoria	Maloibari (Assamese) Pubmaloibari (Bengali) Kosmuri (Nepali) Khetri (North Indian)	Ward-59 (Assamese) Ward-6 (Bengali) Ward-37 (Nepali) Ward-32 (North Indian)
Barak valley zone	Cachar	Borjelenga	Jhapirbond (Assamese) Durgakona (Bengali) Nepali gaon (Nepali) Durgakona (North Indian)	Ward-3 (Assamese) Ward-14 (Bengali) Ward-25 (Nepali) Ward-3 (North Indian)
Hill zone	Karbi Anglong	Howraghat	Borbill gaon (Assamese) Rongkhut Block-1 (Bengali) Rongkhut Tamang gaon (Nepali) Chowhanbasti (North Indian)	Ward-3 (Assamese) Ward-3 (Bengali) Ward-10 (Nepali) Ward-1 (North Indian)

Wholesalers sample drawn from different wholesale markets   n= 60

Sl. No.	Name of district	Name of wholesale market	Sample taken	Total sample
1	Nagaon	Borbazar	6	18
		Sulung	6	
		Juria	6	
2	Sonitpur	Chowkbazar	5	10
		Bhojkhowa	5	
3	Kamrup	Ujanbazar	4	13
		Maligaon	3	
		Paltanbazar	3	
		Kolongpar	3	
4	Cachar	Phatakbazar	7	7
5	Karbi-Anglong	Diphu town market	6	6
6	Dibrugarh	Town Market	6	6

Retailers sample drawn from different markets

n=110

Sl. No.	Name of district	Name of market	Sample taken	Total sample
1	Nagaon	Borbazar	10	15
		Juria	5	
2	Sonitpur	Chowkbazar	11	24
		Gutlung	5	
		Jamuguri	2	
		Mahabhirab	6	
3	Kamrup	Ujanbazar	4	18
		Maligaon	3	
		Paltanbazar	5	
		Lakhitari	3	
		Ganeshguri	3	
4	Cachar	Phatakbazar	10	15
		Vety. Market	3	
		Udarbond	2	
5	Karbi-Anglong	Diphu town market	10	18
		Howraghat	8	
6	Dibrugarh	Town Market	10	20
		Tengakhat	8	
		Tingrai	2	

Break-up of samples of eating joints

n=300

Name of the district	Type of eating joints (Figures in numbers)					Total
	Fast food outlet/restaurant	Restaurant	Bar cum Restaurant	Dhaba	Road side chaat house	
Nagaon	13	10	10	11	10	54
Sonitpur	10	10	10	11	10	51
Kamrup	28	15	18	16	13	90
Cachar	10	10	10	5	10	45
Dibrugarh	10	12	10	15	13	60
Total	71	57	59	57	56	300

ANOVA test results of annual per capita consumption of fish (kg) among different income groups

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7757.45	4	1939.36	20.17	.000
Within Groups	62973.42	655	96.14		
Total	70730.88	659			

Annexure 12

Multiple Comparisons of per capita consumption of fish (kg) among
different income groups with using Post-hoc test Least Significant
Difference (LSD) method

(I) family income per month	(J) family income per month	Mean Difference (I-J)	Std. Error	Sig.
Less than Rs. 5000.00	Rs.5000.00 - Rs.10000.00	-2.60*	1.06	.014
	Rs.10000.00 - Rs.20000.00	-5.56*	1.11	.000
	Rs. 20000.00 - Rs.40000.00	-6.58*	1.19	.000
	More than Rs.40000	-11.01*	1.37	.000
Rs.5000.00 - Rs.10000.00	Less than Rs. 5000.00	2.60*	1.06	.014
	Rs.10000.00 - Rs.20000.00	-2.95*	1.14	.010
	Rs. 20000.00 - Rs.40000.00	-3.98*	1.21	.001
	More than Rs.40000	-8.41*	1.40	.000
Rs.10000.00 - Rs.20000.00	Less than Rs. 5000.00	5.56*	1.11	.000
	Rs.5000.00 - Rs.10000.00	2.96*	1.14	.010
	Rs. 20000.00 - Rs.40000.00	-1.03	1.26	.414
	More than Rs.40000	-5.45*	1.44	.000
Rs. 20000.00 - Rs.40000.00	Less than Rs. 5000.00	6.58*	1.19	.000
	Rs.5000.00 - Rs.10000.00	3.98*	1.21	.001
	Rs.10000.00 - Rs.20000.00	1.03	1.26	.414
	More than Rs.40000	-4.42*	1.49	.003
More than Rs.40000	Less than Rs. 5000.00	11.00*	1.37	.000
	Rs.5000.00 - Rs.10000.00	8.41*	1.40	.000
	Rs.10000.00 - Rs.20000.00	5.45*	1.44	.000
	Rs. 20000.00 - Rs.40000.00	4.42*	1.49	.003

*. The mean difference is significant at the 0.05 level.

Annual per capita consumption of fish among different income groups (Descriptive Statistics)

Income Groups	N	Mean	Std. Deviation	Minimum	Maximum
Less than Rs. 5000.00	181	10.20	7.66	1.00	40.00
Rs.5000.00 - Rs.10000.00	162	12.80	8.92	1.20	60.00
Rs.10000.00 - Rs.20000.00	136	15.76	11.11	0.20	72.00
Rs. 20000.00 - Rs.40000.00	110	16.78	9.90	0.30	48.00
More than Rs.40000	71	21.21	13.23	4.36	60.00
Total	660	14.27	10.36	0.20	72.00

Independent sample 't' test for average monthly household expenditure on fish in rural and urban area

	Rural or Urban	N	Mean	Std. Deviation
Monthly household	Rural	330	580.15	477.37
expenditure on fish	Urban	330	744.70	555.95

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means
		F	Sig.	t
monthly household expenditure on fish	Equal variances assumed	10.66	.001	-4.07
	Equal variances not assumed			-4.07

ANOVA of monthly average expenditure on fish among different communities
Community of the respondents

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	146.193	34	4.300	3.999	.000
Within Groups	671.988	625	1.075		
Total	818.182	659			

Multiple Comparisons of monthly household expenditure on fish among different communities

LSD

(I) community of the respondent	(J) community of the respondent	Mean Difference (I-J)	Std. Error	Sig.
Assamese	Bengali	144.03*	48.79	.003
	Nepali	376.92*	55.32	.000
	North Indian	436.42*	55.32	.000
Bengali	Assamese	-144.03*	48.79	.003
	Nepali	232.89*	58.31	.000
	North Indian	292.39*	58.31	.000
Nepali	Assamese	-376.92*	55.32	.000
	Bengali	-232.89*	58.31	.000
	North Indian	59.50	63.88	.352
North Indian	Assamese	-436.42*	55.32	.000
	Bengali	-292.39*	58.31	.000
	Nepali	-59.50	63.88	.352

*. The mean difference is significant at the 0.05 level.

Average monthly household expenditure on fish (Descriptives Statistics)

Communities	N	Mean	Std. Deviation	Minimum	Maximum
Assamese	240	849.58	587.34	100	4000
Bengali	180	705.56	516.05	50	3000
Nepali	120	472.67	398.95	50	2000
North Indian	120	413.17	311.56	50	2000
Total	660	662.42	524.26	50	2000

Scientific Names of Common Fishes

Sl. No.	Assamese name	English common name	Scientific name
1	Row	Rohu	*Labeo rohita*
2	Bahu/Bhakua	Catla	*Catla catla*
3	Mirika	Mrigala	*Cirrihnus mrigala*
4	Common carp	Common carp	*Cyprinus carpio*
5	Grass carp	Grass carp	*Ctenopharyngodon idella*
6	Silver carp	Silver carp	*Hyophthalmicthys molitrix*
7	Mali/Koliajara	Calbasu/Black rohu	*Labeo calbasu*
8	Bhangone	Bata labeo	*Labeo bata*
9	Laseem Bhangon	Reba	*Cirrhenous reba*
10	Kurhi	Kuria labeo	*Labeo gonius*
11	Magur	Magur	*Clarias batrachus*
12	Singhi	Singhi/ Stinging cat fish	*Heteropneustes fossilis*
13	Kaoi	Climbing perch	*Anabas testudineus*
14	Sol	Stripped murrel	*Channa striatus*
15	Goroi	Murrel/snakehead	*Channa punctatus*
16	Arri	Giant river cat fish	*Aorichthys seenghala*
17	Borali	Freshwater shark	*Wallago attu*
18	Chital	Indian featherback	*Notopterus chitala*
19	Kandhuli	Featherback	*Notopterus notopterus*
20	Pabha	Pabda/Indian butter cat fish	*Ompok bimaculatus*
21	Singorah/ Tingorah	Striped dwarf cat fish	Mystus vittatus
22	Moa	Mola/Minnows/ Indian carplet	*Amblypharyngodon mola*
23	Bariala/Baliara	Aspodiparia	*Aspidoparia spp*
24	Dorikona	Minnows/ Flying barb	*Esomus danricus*
25	Puthi	Barb	*Puntius spp*

Communalities

	Initial	Extraction
Lack of quality fish seed of required size and no. at the time of stock	1.000	.714
Difficult to identify good quality seed	1.000	.756
Unavailability of formulated feed	1.000	.546
Difficult to get suitable brooders during breeding	1.000	.598
Initial cost of digging out new pond is more	1.000	.469
Lack of fishery inputs suppliers in the locality	1.000	.624
Lack of facilities for soil and water testing	1.000	.621
Growth of fish is less	1.000	.500
Cost of fingerling is high	1.000	.654
Cost of medicine is high	1.000	.627
Cost of fishing net is more	1.000	.597
Selling price at farm front is low	1.000	.602
Lack of fund	1.000	.689
lack of institutional credit	1.000	.768
Lack of proper distribution channel	1.000	.742
Exploitation by middleman	1.000	.696
Difficult and expensive to carry fish for selling to the distant market	1.000	.553
Inadequate training programme in fish culture	1.000	.580
Inadequate visit Of extension personnel to farm site	1.000	.620
Lack of follow up action by extension worker	1.000	.667
Lack of expected result from fish culture	1.000	.749
Lack of knowledge of soil and water quality mgt.	1.000	.622
Lack of technological know how	1.000	.600
Lack of standardized technology for indigenous fish spp.	1.000	.747
Lack of suitable temperature for growth of fish	1.000	.593
High acidity of soil	1.000	.764
water retention capacity of soil is low	1.000	.663
Monsoon is irregular	1.000	.730
Regular occurrence of flood	1.000	.720
Occurrence of disease	1.000	.759
Poaching of fish	1.000	.684
Poisoning the water body	1.000	.768

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.473	23.354	23.354	7.473	23.354	23.354	3.954	12.357	12.357
2	2.944	9.200	32.554	2.944	9.200	32.554	2.718	8.493	20.850
3	2.290	7.157	39.711	2.290	7.157	39.711	2.556	7.987	28.838
4	1.832	5.723	45.434	1.832	5.723	45.434	2.422	7.567	36.405
5	1.656	5.173	50.608	1.656	5.173	50.608	2.375	7.421	43.826
6	1.385	4.329	54.937	1.385	4.329	54.937	2.239	6.997	50.823
7	1.312	4.099	59.036	1.312	4.099	59.036	2.006	6.270	57.093
8	1.114	3.481	62.516	1.114	3.481	62.516	1.513	4.727	61.819
9	1.017	3.179	65.696	1.017	3.179	65.696	1.240	3.876	65.696
10	.937	2.928	68.624						
11	.884	2.761	71.385						
12	.850	2.658	74.042						
13	.775	2.421	76.464						
14	.747	2.335	78.799						
15	.674	2.107	80.906						
16	.641	2.005	82.911						
17	.595	1.858	84.769						
18	.530	1.656	86.425						
19	.482	1.507	87.932						
20	.462	1.443	89.375						
21	.416	1.299	90.674						
22	.382	1.193	91.867						
23	.374	1.169	93.036						
24	.345	1.077	94.112						
25	.317	.990	95.102						
26	.308	.964	96.066						
27	.274	.855	96.921						
28	.250	.780	97.700						
29	.214	.670	98.370						
30	.197	.616	98.987						
31	.179	.560	99.547						
32	.145	.453	100.000						

Extraction Method: Principal Component Analysis.

Component Matrix

	Component								
	1	2	3	4	5	6	7	8	9
Lack of quality fish seed of required size and no. at the time of stock	.471	-.181	-.272	.081	-.156	.289	.170	.261	.417
Difficult to identify good quality seed	.542	-.275	-.314	.068	-.445	.255	.136	.003	.045
Unavailability of formulated feed	.536	-.149	-.102	.175	.323	-.023	.179	-.051	-.236
Difficult to get suitable brooders during breeding	.457	-.153	.012	.001	-.465	.157	-.031	-.338	-.097
Initial cost of digging out new pond is more	.409	.102	.478	.083	-.031	.155	.065	.094	.133
Lack of fishery inputs suppliers in the locality	.663	.112	-.065	.045	-.289	-.029	-.222	-.129	-.126
Lack of facilities for soil and water tesing	.379	-.531	.111	.307	.096	.058	-.189	.138	.146
Growth of fish is less	.653	-.210	-.095	-.018	-.048	.003	-.052	-.110	.061
Cost of fingerling is high	.308	-.060	.509	-.302	.193	-.045	.069	.380	-.128
Cost of medicine is high	.443	.040	.563	.198	-.144	.188	-.050	-.091	.079
Cost of fishing net is more	.470	.032	.440	-.236	-.141	.005	-.062	-.312	-.066
Selling price at farm front is low	.571	.279	-.092	.307	-.141	-.124	-.220	-.010	-.104
Lack of fund	.560	.007	-.025	-.236	-.285	-.300	.366	.077	-.088
Lack of institutional credit	.650	.101	-.114	-.082	-.242	-.188	.332	.321	.092
Lack of proper distribution channel	.621	.304	.014	-.334	-.199	.041	-.282	.146	.102
Exploitation by middleman	.456	.300	.241	-.342	-.116	.137	-.407	.116	-.106
Difficult and expensive to carry fish for selling to the distant market	.477	.137	.357	.122	.075	-.132	.348	-.091	-.111
Inadequate training programme in fish cultute	.607	-.299	-.250	.015	.137	-.110	.023	-.162	-.034
Inadequate visit Of extension personnel to farm site	.582	-.387	-.092	.097	.246	.106	.010	-.102	-.175
Lack of follow up action by extension worker	.526	-.419	.095	.132	.277	.282	.053	-.110	-.133
Lack of expected result from fish culture	.713	-.162	-.168	-.116	.126	-.297	-.237	-.113	.019
Lack of knowledge of soil and water quality mgt.	.547	-.360	-.212	-.225	.152	-.205	.083	.159	-.010
Lack of technological know how	.404	-.108	.189	-.402	.336	.122	.012	.250	-.195
Lack of standardized technology for indigenous fish spp.	.159	.020	.017	.586	.046	.429	-.129	.375	-.183
Lack of suitable temperature for growth of fish	.346	.375	.426	.095	.236	.048	.086	-.200	.193
High acidity of soil	.428	.575	-.024	.280	.097	-.183	-.173	.184	.252
water retention capacity of soil is low	.367	.517	-.172	.016	.018	.153	.448	-.035	.066
Monsoon is irregular	.328	.608	-.037	.299	.263	-.060	.219	-.200	-.034
Regular occurrence of flood	.421	.049	-.150	.363	.138	-.528	-.280	.097	.019
Occurrence of disease	.245	-.225	.011	-.247	.378	.085	-.074	-.222	.618
Poaching of fish	.210	.432	-.430	-.323	.298	.249	-.080	-.009	-.080
Poisoning the water body	.283	.463	-.516	-.172	.160	.353	-.099	-.074	-.116

Extraction Method: Principal Component Analysis.

Rotated Component Matrix

	Component								
	1	2	3	4	5	6	7	8	9
Lack of quality fish seed of required size and no. at the time of stock	.224	.071	-.029	.655	.080	.012	-.051	.315	.347
Difficult to identify good quality seed	.366	.404	-.128	.602	.048	-.074	-.193	.189	.004
Unavailability of formulated feed	.657	-.045	.237	.092	.104	.119	.076	.062	-.113
Difficult to get suitable brooders during breeding	.260	.660	.038	.217	-.050	-.094	-.174	-.010	-.066
Initial cost of digging out new pond is more	.025	.264	.446	.138	-.152	.027	.299	.225	.133
Lack of fishery inputs suppliers in the locality	.266	.596	.093	.207	.144	.339	.005	.031	-.097
Lack of facilities for soil and water testing	.484	.090	-.087	.069	-.367	.158	.079	.363	.261
Growth of fish is less	.496	.350	.049	.269	.033	.167	.043	-.011	.161
Cost of fingerling is high	.101	.023	.183	.067	-.152	-.019	.762	.001	-.012
Cost of medicine is high	.076	.473	.467	.019	-.255	.023	.175	.268	.106
Cost of fishing net is more	.156	.588	.323	-.034	-.085	-.040	.259	-.204	.058
Selling price at farm front is low	.184	.358	.210	.139	.151	.545	-.066	.166	-.158
Lack of fund	.223	.222	.165	.589	-.027	.112	.201	-.344	-.211
Lack of institutional credit	.171	.122	.187	.747	.059	.261	.216	-.075	-.085
Lack of proper distribution channel	-.024	.525	.047	.296	.325	.326	.372	-.025	.154
Exploitation by middleman	-.081	.561	.052	-.016	.271	.206	.501	.056	.045
Difficult and expensive to carry fish for selling to the distant market	.251	.116	.609	.154	-.120	.070	.182	-.076	-.155
Inadequate training programme in fish cultute	.675	.148	.004	.203	.069	.185	-.028	-.109	.098
Inadequate visit Of extension personnel to farm site	.755	.135	.046	.064	.030	.028	.088	.120	.047
Lack of follow up action by extension worker	.711	.147	.151	-.001	-.047	-.141	.136	.250	.118
Lack of expected result from fish culture	.571	.291	-.029	.136	.093	.459	.146	-.221	.172
Lack of knowledge of soil and water quality management	.571	-.010	-.150	.354	.021	.165	.276	-.184	.102
Lack of technological know how	.336	.033	.045	.037	.169	-.086	.666	-.011	.054
Lack of standardized technology for indigenous fish spp.	.124	-.025	.073	.010	.032	.108	.006	.825	-.180
Lack of suitable temperature for growth of fish	.003	.147	.692	-.095	.056	.116	.144	.015	.214
High acidity of soil	-.124	.045	.395	.153	.241	.682	.044	.169	.113
water retention capacity of soil is low	-.004	-.010	.519	.408	.466	.005	-.074	-.013	-.070
Monsoon is irregular	.069	-.064	.676	.004	.371	.298	-.152	.004	-.123
Regular occurrence of flood	.295	-.022	.050	.027	-.086	.786	-.042	-.003	-.038
Occurrence of disease	.258	-.013	.080	.002	.043	-.031	.059	-.163	.808
Poaching of fish	.061	-.017	.006	.009	.811	.057	.109	-.050	.071
Poisoning the water body	.090	.112	.021	.065	.853	.071	-.058	.079	.002

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 23 iterations.

Perceived problems of retailers

Sl.No.	Problems	Strongly Agree	Agree	Undecided	Disagree	Strongly disagree	Mean
1	Fluctuations of demand and supply affects the earnings	60 (54.5)	47 (42.7)	1 (0.9)	2 (1.8)	-	1.5
2	Unavailability of consumer preferred fish	52 (47.3)	49 (44.5)	-	9 (8.2)	-	1.31
3	Lack of fund for buying fish in bulk	36 (32.7)	60 (54.5)	2 (1.8)	12 (10.9)	-	1.09
4	Customers' preference for fresh fish make storage in ice non-profitable	33 (30.0)	51 (46.4)	7 (6.4)	19 (17.3)	-	0.89
5	Exploitation by middlemen at the time of weighing fish	4 (3.6)	20 (18.2)	14 (12.7)	72 (65.4)	-	-0.41
6	Insufficient space and seating arrangement for selling fish in the market	20 (18.2)	39 (35.5)	6 (5.5)	45 (40.9)	-	0.31
7	Lack of cold storage	30 (27.3)	78 (70.9)	2 (1.8)	-	-	1.25
8	Lack of adequate provision for ice	13 (11.8)	76 (69.1)	-	21 (19.1)	-	0.74
9	Price of ice is high	7 (6.4)	57 (51.8)	8 (7.3)	38 (34.5)	-	0.30
10	Marketing cost is high	11 (10.0)	73 (67)	8 (7.3)	17 (15.5)	-	0.72
11	Lack of proper drainage and waste disposal system	43 (39.1)	52 (47.3)	1 (0.9)	14 (12.7)	-	1.13

12	Lack of good provision for water supply	37 (36.6)	69 (62.7)	-	4 (3.6)	-	1.26
13	Lack of proper fish transportation facility	23 (20.9)	67 (60.9)	2 (1.8)	18 (16.4)	-	0.86
14	Difficult to transport fish in live condition	15 (13.6)	63 (57.3)	1 (0.9)	31 (28.2)	-	0.56
15	Lack of proper shelter to sell fish	15 (13.6)	63 (57.3)	1 (0.9)	31 (28.2)	-	0.32
16	Lack of potable water	12 (10.9)	83 (75.5)	-	15 (13.6)	-	0.84
17	Lack of lavatory	14 (12.7)	89 (80.9)	-	7 (6.4)	-	1.0

(Note: All the figures given in brackets are the percentage of responsiveness against the statement)

1

Photographs Showing Some Ways of Fish Transportation Prevailing in the Study Area

Photographs Showing Wholesaling and Retailing of fish in some Markets of Study Area

PLATE-I
STIMULI USED DURING CONSUMER SURVEY
Photographs of Indian Major Carps (IMC)

Labeo rohita

Catla catla

IMC

Cirrhinus Mrigala
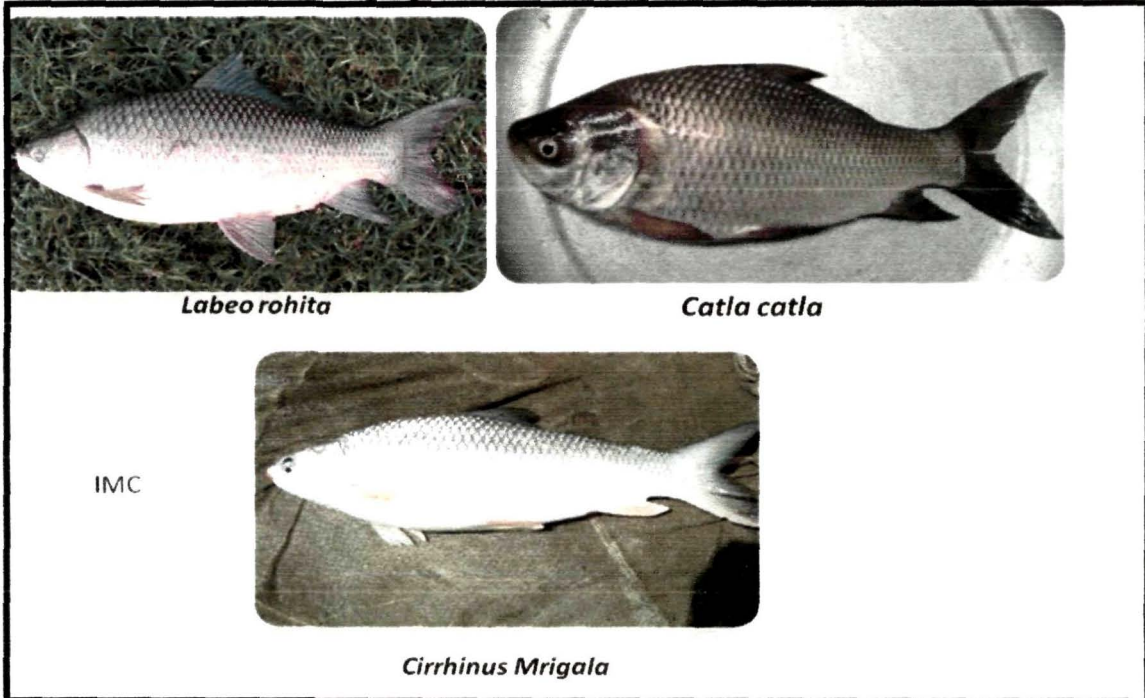
Photographs of Exotic Carps

Common carp (Cyprinus carpio)

Grass carp (Tenophryngodon idella)   *Silver carp (Hypophthalmichthys molitrix)*
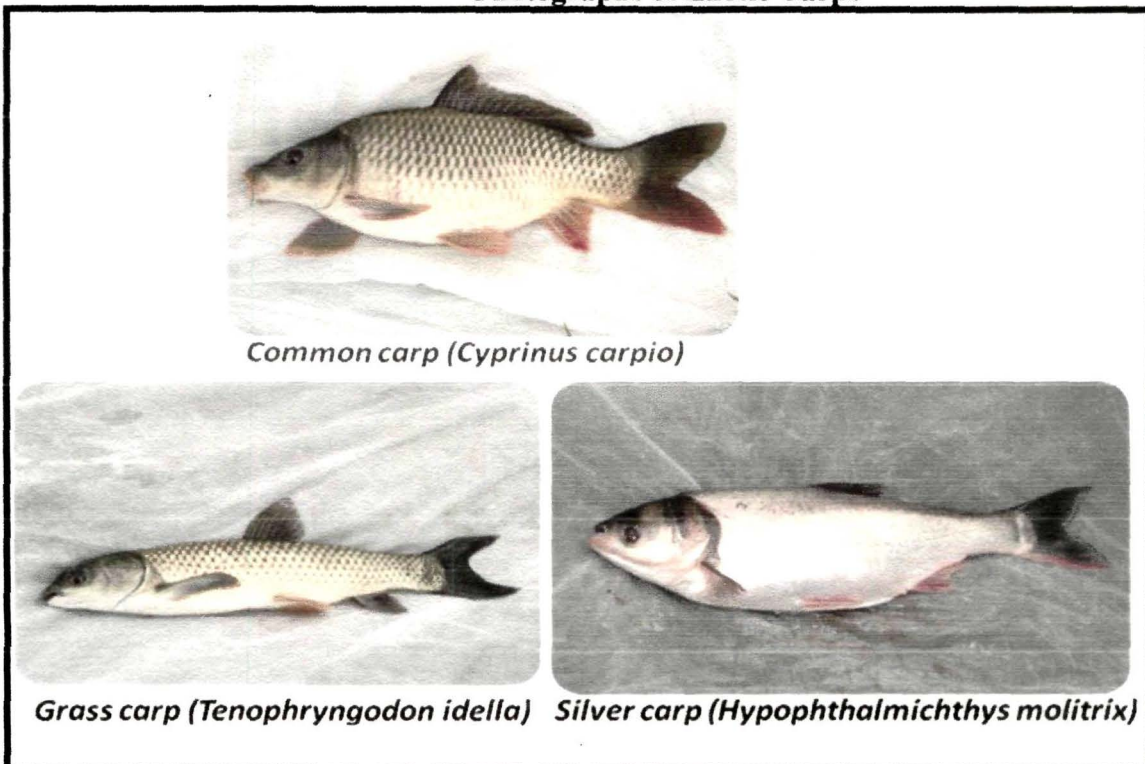
PLATE-II
Photographs of some Minor Carps

Bhangone

kurhi
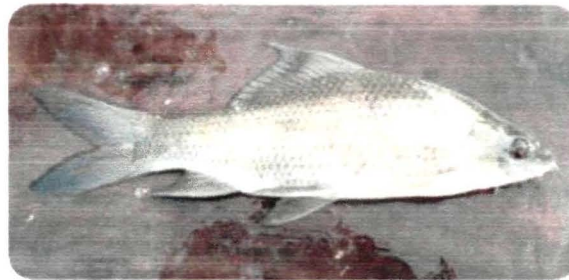
koliajara

Photographs of some live fish and Murrels

Magur

Singi

PLATE-III

Sol

Photographs of some other consumer preferred fish

Chital

iv
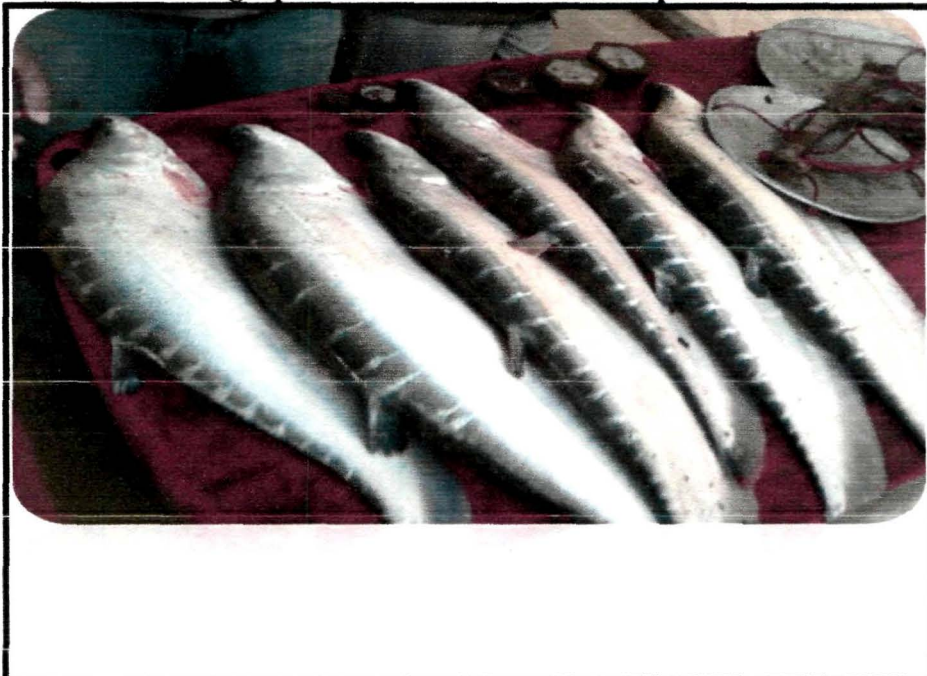
PLATE-IV

Arri and Chital

Pabda
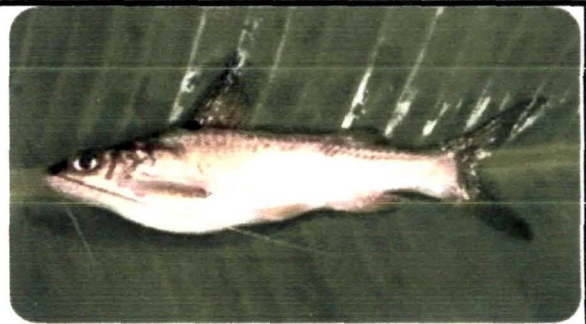
Tengra

Koi

koroti

PLATE-V
SOME VALUE ADDED FISH PRODUCTS

Fish Cutlet

Fish Bali

Fish Finger

Fish Pickle

Fish momo

An entrepreneur of some fish based value added products in Tezpur town
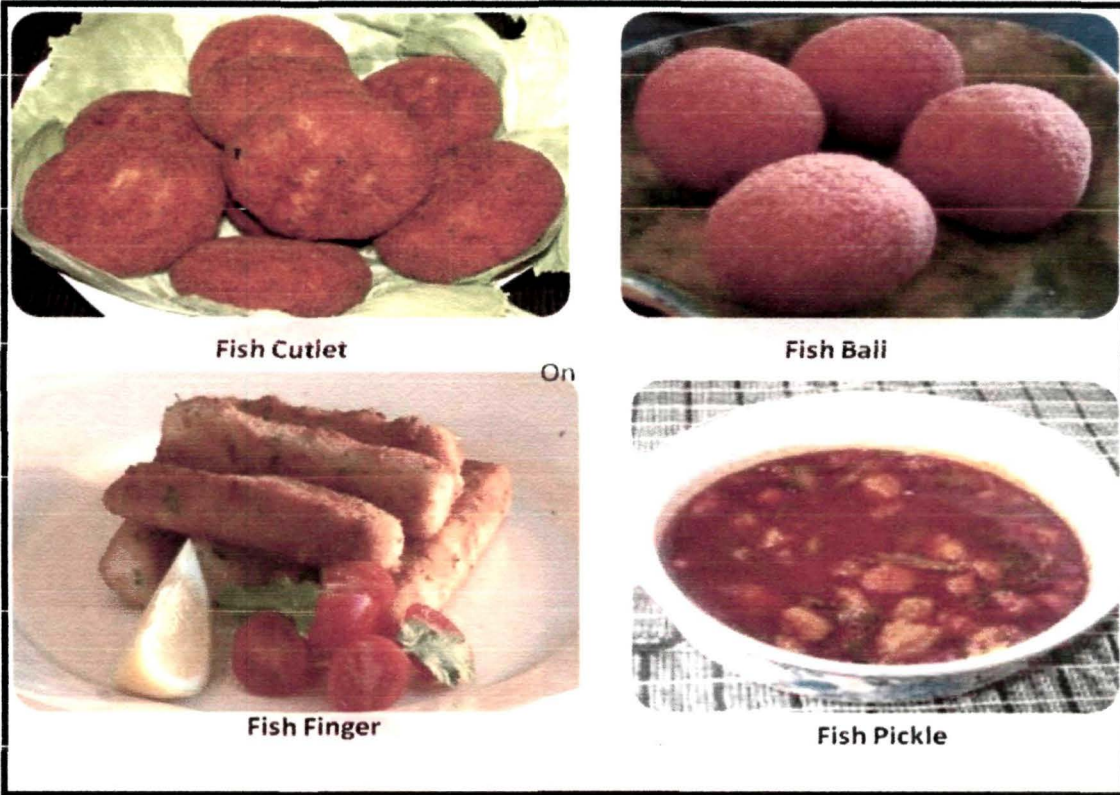
PUBLICATION

Segmental Variations In Fish Consumption Behaviour: A Case Study Of Sonitpur District Of Assam

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** Pradip C. Bhuyan

INTRODUCTION

Fish has a vital role to play in mitigating the protein deficiency in developing countries. Fish has been described as the meat of the third world, and fish makes important contributions to developing and developed countries as a source of employment, income generation and foreign exchange earnings. Dey et al. (2005) studied fish consumption and preference patterns for fish species based on income groups and geographic profile of rural/urban areas in seven countries, viz. , Bangladesh, China, India, Indonesia, the Philippines, Thailand, and Vietnam. The study revealed that freshwater fish species constitute a major share in the total per capita fish consumption in most of these countries and the total intake of fish protein constituted 15% to 53% in these countries. Fish consumption patterns were dependent on the economic conditions of households and per capita fish consumption increased with increase in income. The percentage share of expenditure on fish over total animal protein expenditure is higher for lower income groups, which clearly indicates that the poor people (lower income group) depend more on fish as a source of animal protein than the rich (high income group) . The low-priced fishes were consumed more by the low income groups than by the high income groups, and the high income group spent a significant portion of their budget on expensive fish. The study also revealed that per capita consumption of fish was substantially higher in rural areas than in urban areas.

Statistical information regarding fish consumption patterns in India are limited. Only the National Sample Survey Organization (NSSO) has been conducting household consumer expenditure surveys since 1973-74 and in these surveys, NSSO has collected monthly per capita consumption for a number of commodity groups on a national scale. In India, composite data on consumption of meat, egg and fish are available. But exclusive data on fish consumption are not found. Only rough estimates are generally given about per capita consumption of fish in the country. There is an urgent need to collect reliable statistics on per capita and total fish consumption in India (Malhotra and Sinha, 2007).

According to a study conducted by the National Council for Applied Economic Research (NCAER) in 1976, the proportion of household expenditure on the consumption of fish, out of the total expenditure on food was 7.6% in Bangalore, 14.6% in Kolkata and 6.3% in Delhi and per capita consumption of fish was 9.12 kg, 12.12 kg and 0.56 kg for Bangalore, Kolkata and Delhi respectively. The study revealed that the average expenditure of fish across four income groups increased from 1.49 % to 6.80 % from the lowest to the highest income groups.

Bhatta (2000) in his study *"Production And Consumption Patterns In Karnataka – A Case Study"* reported that fish consumption was higher in the rural areas as compared to the urban consumers. According to this study, the rural consumers consume on an average, 24 kg per annum, irrespective of income classes. However, for urban consumers, the per capita consumption of fish per month increases with the rise in annual income. Again, the study revealed that *rohu* and *catla* were the most preferred species in both the rural and urban areas and gender classes. *Mrigal* was the least preferred fish both in the rural and urban areas.

The result of a study conducted by Nandeesha et al. (2008) revealed that per-capita consumption of fish in Arunachal Pradesh, Tripura, Manipur, Mizoram and Meghalaya was 28.35 kg, 18.14 kg, 17.66 kg, 10.5 kg and 14.27 respectively. The study also revealed that the state of Tripura was consuming more than two times of the locally produced fish based on the estimated level of per-capita consumption of fish of 18.14 kg per annum.

The minimum per capita consumption of fish of an average Indian should be 11.0 kg per annum, as recommended by the ICMR (Indian Council of Medical Research). However, the per-capita consumption of fish in India is only 5.0 kg

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per annum, whereas, per-capita consumption of fish in Japan was 62.6 kg, China - 30 kg, Bangladesh - 35 kg. The average per capita consumption in Asian countries was 23 kg, in USA it was 19 kg, and in the EU, it was 23 kg, while the global average was 17 kg per annum (Das, 2009). Dietary fish consumption patterns are influenced by complex interactions of several factors such as availability, income, prices, tradition and customs, consumer preference as well as demographic and geographic profile. According to Malhotra and Sinha (2007), price does not seem to play a great role in per-capita fish consumption, and at the macro-level, fish consumption does not seem to be linked primarily to income, but rather to consumers' cultural and traditional food habits. They stated that in general, what *"rice and fish"* are to the eastern India, *"bread and butter"* are to the northern and western India.

Rice and fish are the two basic diets of the Assamese people. For 95% of the state's current population, fish is an important protein rich food (Das and Goswami, 2002). But in Assam, having a great potentiality of fisheries resources, the present fish yield was only 1.81 lakh tonnes of fish, against an annual demand of 2.83 lakh tonnes, calculated on the basis of minimum nutritional requirement of 11 kg per capita consumption (Statistical Hand Book of Assam Fisheries, 2004) and the deficit in production is met from import of fish from nearby states. No systematic investigation has been carried out on the consumption pattern of fish by the consumers in Assam. There is a belief that the Assamese and the Bengali communities consume more fish compared to the other communities of the state. As the concept of marketing calls for understanding the needs of the consumers, an attempt was made to carry out a study to find out the consumption patterns with respect to fish in Sonitpur District, Assam with the following objectives:

OBJECTIVES

The objectives of the study are:

1. To examine the segmental variation in fish consumption among different strata of population in Sonitpur District, Assam.

2. To find out the factors affecting the fish consumption patterns among different strata of population in Sonitpur District, Assam.

3. To formulate effective strategies for marketing of fish.

METHODOLOGY

The study was carried out in Sonitpur district, which is one of the resourceful districts in the state of Assam in terms of its fishery resource potential. The district has 117.65 ha of ponds and tank areas, 1146.93 ha *beels* (flood-plain wetlands), 6533 ha riverine fisheries, 461.35 ha derelict water bodies, 144.10 ha forest fisheries, covering a total area of about 9879.33 ha, producing 7565.38 tonnes of fish during 2008-09 (Office of the DFDO, Sonitpur).

Secondary data about fisheries resources, present fish production and demographic profile of Sonitpur district were collected from the office of the DFDO, Sonitpur, Directorate of Fisheries, Govt. of Assam and Hand Book of Economics and Statistics, Govt. of Assam.

For collection of primary information, quota sampling technique had been followed. Sonitpur district was first divided into two broad categories – rural and urban. This was followed by selection of sampling units from both the rural and the urban areas, again making divisions on the basis of community. Four different communities were considered for selection of sampling units – the Assamese, the Bengalis, the Nepalis and the Biharis. 40 respondents of the Assamese (20 from rural areas and 20 from urban areas), 40 respondents of the Bengali community (20 from rural areas and 20 from urban areas), 30 from the Nepali community (15 from rural areas and 15 from urban areas) and 12 from the Bihari community (6 from rural areas and 6 from urban areas)- a grand total of 132 respondents had been selected following the quota sampling. The incomes of the respondents were also considered while selecting the sampling units and were divided into four income group categories. - Category-I (Income up to ₹10000.00),Category-II (₹ 10000.00 to ₹ 20000.00), Category-III (₹ 20000.00 to ₹ 40000.00), and Category -IV (income above ₹ 40000.00).

For collection of the responses from the respondents about fish consumption pattern and related information, a structured questionnaire was personally administered.

DEMOGRAPHIC BREAK- UP OF THE RESPONDENTS IN THE STUDY AREA

a) Educational Status Of The Respondents : In general, a higher percentage of the respondents (32.6%) had education up to the graduate level and above, followed by respondents with education below 10th standard (31.1%), upto 10th

standard (19.7%), undergraduate (9.1%) and primary level (7.6%). The education scenario in the study area is presented in the Table 1.

Table 1 : Educational Status Of The Respondents (Figures In Percentage)					
Respondent's Profile	Graduate level and above	Undergraduate	10+2	Below 10th standard	Primary level
Geographic					
Rural	24.2	9.1	15.2	43.9	7.6
Urban	40.9	9.1	24.2	18.2	7.6
Demographic					
Assamese	50	10	15.5	17.5	7.5
Bengali	30	7.5	22.5	32.5	7.5
Nepali	27.5	12.5	22.5	30	7.5
Bihari	-	-	16.7	75	8.3
Overall	32.6	9.1	19.7	31.1	7.6

b) Caste of The Respondents : In the study area, the majority of the respondents (56.15%) belonged to the General caste; followed by OBC (33.85%), SC (6.15%) and ST (3.85%). The Table 2 shows the distribution of the respondents over different castes in the study area.

Table 2 : Caste Of The Respondents (In Percentage)							
Caste	Overall	Rural	Urban	Assamese	Bengali	Nepali	Bihari
General caste	56.15	47.00	66.70	60.00	40.0	60.0	91.7
OBC	33.85	43.9	22.70	37.5	40.0	30.0	8.3
SC	6.15	6.10	6.10	-	20.0	-	-
ST	3.85	3.00	4.50	2.5	-	10.0	-

c) Type of Family System: On an average, 65.2% of the respondents had a nuclear type of family system, and the rest had a joint type of family system in the study area. More than 60% of the consumers had a nuclear family in both the rural and urban areas. The percentage of the nuclear family is comparatively more in the urban areas than in the rural areas. The nuclear type of family system was found to be more prevalent among all the communities, and its percentage was found to be the highest among the Bengalis. More than 60% of the respondents of different income group categories had nuclear type of family system.

d) Family Size: The average family size in the study area was found to be 4.83. The average family size in the rural areas was 4.92 and in the urban areas, it was 4.73. The average family size was 5.25, 5.03, 4.75 and 5.03 respectively among the Bihari, Bengali, Assamese and the Nepali communities. The average family size among the different income group categories varied from 4.47(Category-III) to 5.10 (Category-II).

e) Occupational Status: A higher percentage of the respondents (53.0%) were engaged in business, followed by service (42.4%) and professionals (4.6%). More than 50% of the respondents were engaged in business and 42.2% of the consumers were doing service in both the rural and urban areas and the rest were professionals. The percentage of respondents engaged in service was found to be the highest in the Assamese (60%), followed by the Nepali (50%), the Bengalis (27.5%) and others (8.3%). The percentage of respondents engaged in business was found to be the highest in others (91.7%) followed by the Bengalis (65%), the Nepalis (42.5%) and the Assamese (40%).

f) Monthly Average Family Income : The average monthly income in the study area was found ₹14450.00. The monthly average income in rural areas was found to be ₹11553.00 and in the urban areas, it was ₹17348.00. Majority of the respondents (32.3 %) had their monthly average income up to ₹10000.00 and 30.3 % of the respondents had ₹10000.00 – ₹20000.00 as their average monthly income, 11.4% had ₹20000.00– ₹40000.00 as their average monthly income, and only 6 % had a monthly income above ₹40000.00.The monthly average income in urban areas (₹

17186.57) was more than it was in the rural areas (₹ 11630.77).

The monthly average income was found to be ₹ 20750.00, ₹ 13425.00, ₹ 11512.00 and ₹ 6667.00 respectively among the Assamese, the Nepali, the Bengali and the Bihari communities.

FISH CONSUMPTION PATTERNS

❖ Per Capita Consumption Of Fish : The per-capita fish consumption in the study area was found to be 13.22 kg. The per-capita consumption of fish in the rural areas (13.68 kg) was more than it was in the urban areas (12.76 kg). The per-capita consumption of fish, irrespective of rural or urban areas was found to be 13.2 kg in the study area, which is more than the national average (5.0 kg). The finding of the present study revealed that the per-capita fish consumption was more in the rural areas than in the urban areas. The per-capita consumption of fish was found to be the highest among the Assamese (16.2 kg), followed by the Bengali (13.4 kg), the Nepali and the Bihari (9.8 kg) community. All the communities of the rural areas consumed more fish than the communities residing in the urban areas. The Table 3 shows the exact scenario of fish consumption among different communities and geographic locations.

Table 3 : Per Capita Consumption Of Fish (Kg/Annum) Among Different Communities			
Communities	Rural	Urban	Overall
Assamese	17.46	15.07	16.26
Bengali	12.61	14.18	13.40
Nepali	11.95	9.79	10.87
Bihari	11.05	8.72	9.88
Overall	13.78	12.67	13.22

To find out whether the difference in consumption among different communities is statistically significant, one way ANOVA was carried out with the null hypothesis -

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$$

$$H_1: \mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4$$

Where,

μ_1 = mean fish consumption of the Assamese community;

μ_2 = mean fish consumption of the Bengali community;

μ_3 = mean fish consumption of the Nepali community;

μ_4 = mean fish consumption of the Bihari community;

ANOVA results show that 'p' value is 0.006 , which is less than the level of significance (alpha) at 95% level of confidence. Hence, the null hypothesis is rejected.

It indicates that there is a difference in the mean consumption of fish among the different communities. To know the existence of significant difference of per capita consumption of fish among different communities, post-hoc analysis was done and it was found that there is a significant difference of per capita consumption of fish between Assamese, Nepali and Bihari communities. The difference of per capita consumption of fish between Assamese and Bengalis was not significant.

To know which communities among the Assamese, the Nepali and the Bihari consume more fish, the descriptive statistics were studied. This revealed that the per capita consumption of fish is the highest in the Assamese (16.26 kg) followed by the Nepalis (10.87 kg) and the Biharis (9.88 kg).

Similar analysis with income as the independent variable revealed that the per capita fish consumption is highest among the category-IV (13.22kg) and lowest in the Category-I (10.02kg).

❖ Expenditure On Fish Over Total Expenditure On Food Items : The average monthly expenditure on fish per family in the study area was found to be ₹ 505.15. This expenditure on fish in rural areas was found to be ₹ 480.63 and in the urban areas, it was ₹ 528.94. The monthly average expenditure on fish was found to be the highest among the Assamese (₹ 665.50) and lowest among the Biharis (₹ 383.33). The monthly average expenditure on fish was found to be ₹ 481.25

and ₹400.00 respectively among the Bengali and the Nepali communities.

The monthly average expenditure on fish has been analyzed among the different income groups. The monthly average expenditure on fish was found to be ₹ 322.46, ₹ 644.36, ₹ 636.67 and ₹ 1248.57 respectively in Category-I, Category-II, Category-III and Category-IV respondents. The percentage of expenditure on fish with respect to total household expenditure was 11.63%, 16.9%, 16.32% and 23.12% respectively for Category-I, Category-II, Category-III and Category-IV.

Data analysis on fish consumption across income groups revealed that the amount of money spent on fish as a percentage of total food expenditure tends to increase with increase in income level, indicating a positive income elasticity of demand.

◆ **Frequency Of Eating Fish :** Overall, 46.2% of the respondents consumed fish twice a week, 20.0% consumed it three days in a week, 13.1% consumed it thrice a week, and 11.5% consumed it five days in a week. The majority of the consumers in both the rural and urban areas consumed fish at least twice a week. In the rural areas, 47% of the consumers and in urban areas, 45.5% of the consumers ate fish at least twice a week.

Most of the respondents (more than 40%) of different communities consumed fish at least twice a week and only 2.5% of the consumers of both Assamese and Bengali communities consumed fish daily. The frequency of eating fish 5 days a week was found to be the same between the Assamese and Bengali respondents.

About 43% of the consumers of the Category-IV consumed fish 5 days a week, whereas only 5.8%, 12.5% and 20% of the consumers of Category-I, Category-II and Category-III respectively consumed fish 5 days in a week. The majority of the percentage of consumers of Category –I, II and Category-III consumed fish at least twice a week. It clearly indicates that the high income group was found to consume fish more frequently, in general, as compared to the lower income groups.

Based on this information of frequency of eating fish, the producer and marketing intermediaries can take decisions for making schedules of supplying fish to realize higher prices in the market.

◆ **Average Quantity Of Fish Purchased :** Overall, the average quantity of fish purchased at a time by consumers was found to be 500 gms. 63.1% of the respondents purchased 500 gms of fish at a time, while 18.5% of the respondents bought 250 gms of fish, 17.7% of the consumers bought 1 kg and only 0.8% bought more than 1.0 kg at a time. The average quantity of fish purchased at a time in each family was 500gms both in the rural and urban areas.66.7% of the respondents of the urban areas and 59.4% of the respondents of the rural areas purchased 500 gms of fish at a time. Only a few numbers of consumers purchased fish more than one kg at a time. The average quantity of fish purchased at one time was found to be 500gms among all the communities. The average quantity of 250gms purchased at a time was found to be the highest among the Bengalis (25%) followed by Biharis, Nepalis and the Assamese. Only 2.5% of the consumers of the Assamese community purchased more than 1 kg of fish at a time. No consumers were found to buy more than 1 kg of fish at a time. The percentage of consumers who purchased 500 gms fish at a time was found to be the highest among all the income groups. No consumers were found to be buying 250 gms of fish at a time in the income group category-III and IV.

◆ **Form of Fish :** Overall, 75.4% of the consumers had purchased local fish and 24.6% had purchased imported (*chalani*) fish. About 72% of the consumers of the rural areas consumed *local* fish and 28% consumed *chalani* fish, but in the urban areas, 79% of the consumers took local fish and 21% of the consumers consumed *chalani* fish. It clearly reveals that there is a demand for local fish in the study area and the district as a whole.

The percentage of local fish consumers was found to be more among all the communities than imported (*chalani*) fish and its percentage was found to be the highest among the Assamese (85%), followed by the Bengalis (77.5%), the Nepalis (68.4%) and the Biharis (58.3%).

Though majority of the consumers of different income group categories consumed *local* fish than the *chalani*, the highest percentage of consumers (87.5%) buying *local* fish was found to be the consumers of Category-IV, which may be due to the high price of *local* fish.

SPECIES OF FISH PREFERRED BY THE RESPONDENTS

◆ **Among Carps :** Overall, 57.6% of the respondents had shown their preference for *rohu*, 27.3% of the respondents preferred *catla*, 11.4% of the respondents preferred *bhangon* and only 2.3% of the respondents preferred *mrigal*.

55.4% of the consumers of the rural areas and 59.7% of the consumers of the urban areas showed their preference for *rohu*. The percentage of consumers who showed their preference for *catla* were 26.2% in rural areas and 28.4% in urban areas. 13.3% and 9% of the consumers of both the rural and urban areas respectively had shown their preference for *bhangon*. The preference for *rohu* was the highest both in rural and urban areas followed by *catla* ,*bhangon* and *mrigal*.

❖ **Among Live Fish** : Overall, among different types of *live fish*, the most preferred variety was *the magur* (*Clarias batrachus*). About 63.6% of the respondents preferred *magur* followed by *singi, Heterropneustus fossilis* (11% of the respondents), *koi, Anabus testudineus* (10.6% of the respondents), *sol, Channa straitus* (7.6% of the respondents) and *gorol, Channa punctatus* (6.1% of the respondents).

About 71% of the consumers of rural areas and 57% of the consumers of the urban areas preferred *magur*, whereas, 12.3% and 9.0% of the consumers of the rural and urban areas, respectively, had shown their preference for *singi*. The *magur* is the highest preferred live fish in both the rural and urban areas.

Consumers of the category –IV had shown the highest preference for *magur* (75% of the consumers of this category preferred *magur*). The *magur* is the highest preferred live fish among all the categories.

FACTORS INFLUENCING FISH CONSUMPTION

The respondents were asked to indicate the factors which influence the consumption of fish. The factors were mentioned in the questionnaire in the form of statements. The respondents were asked to give their degree of agreeing or disagreeing to the statement using the Likert scale. The highest percentage of respondents (97.7%) agreed that the taste of the fish is the main factor that influences the consumption of a particular fish. Among the respondents, 93.1% opined that high nutritive value is the other factor which influences fish consumption.

PRODUCTION AND CONSUMPTION GAP

The per capita consumption of fish in the study was found to be 13.2 kg. Based on this information, the total fish consumption in Sonitpur district had been estimated at 21,086.17 tonnes. This estimation was made on the basis that 95% of the population of Assam are fish eaters (Das and Goswami,2002) (Figure was taken from the 2001 Census). The existing fish production in the district was 7,565.38 tonnes, as reported by the office of the DFDO,Sonitpur district. Thus, the consumption and production gap in the district was estimated at 13,520.79 tonnes based on this study. Considering ICMR's recommended per capita consumption of 11.0 kg fish, the requirement of fish for the district is estimated at 17,571.81 tonnes and thereby, the gap is 10,006.43 tonnes.

Based on this study, it is calculated that 95% of the fish eater population was consuming 3.34 lakh tonnes against 1.80 lakh tonnes of present fish production in the state. Thus, the production and consumption gap of fish in the state is calculated at 1.54 lakh tonnes.

The study clearly indicates that to meet the production and consumption gap, the district as well as the state has to import fish, which results in drainage of crores of rupees to other states. This finding has the policy implication of laying emphasis on fish culture in Assam.

MAJOR FINDINGS

1. The per capita fish consumption in the study area was 13.22 kg. The per capita consumption of fish in rural areas was 13.68 kg and in the urban areas, it was 12.76 kg.

2. The per capita consumption of fish was the highest among the Assamese (16.2kg), followed by the Bengalis (13.4kg), the Nepalis (10.8kg) and the Biharis (9.8kg).

3. The per capita consumption of fish increases with increase in income. The high income group consumes more fish in comparison to the low income group.

4. The average monthly expenditure on fish per family in the study area was ₹505.15.The percentage of monthly expenditure on fish with respect to total monthly household expenditure on food items was more in urban areas (15.18%) than in rural areas (14.77%).The monthly average expenditure on fish was found to be the highest among the Assamese followed by the Bengalis, the Biharis and the Nepalis. ...

5. The average quantity of fish purchased at a time by all types of respondents was 500gms.

6. Majority of respondents preferred *local* fish than the imported (*chalani*) fish. The preference for local fish was found to be the highest among the Assamese (85%). The highest percentage of respondents (87.5%) buying *local* fish was found among consumers of Category-IV, which may be due to the high price of *local* fish.

7. 43.5% of the respondents purchased fish from the village market, followed by the town market (33%) and fish peddlers (23.5%).

8. *Rohu* was the highest preferred carp followed by *Catla, Bhangon (Cirrhenous reba)* and *Mrigal*. The Bengalis had shown their highest preference for *Catla*.

9. Among different types of live fish, the most preferred variety was *magur*. About 63.6% of the respondents preferred *magur* followed by *singi* (11% of respondents), *koi* (10.6% respondents), *sol* (7.6% of respondents) and *goroi* (6.1% of respondents).

10. The consumption and production gap in the district was estimated at 13520.79 tonnes and it was estimated at 1.54 lakh tonnes for the state.

11. The highest percentage of consumers (97.7%) agreed that the taste of the fish is the main factor that influences fish consumption followed by high nutritive value, easy digestibility, less fat content and easy availability of fish in comparison to meat at affordable price.

CONCLUSION

With the changing scenario from production driven marketing to market driven production, more emphasis should be given on production of those fish which have a high consumer demand. Apart from Indian Major Carps, there is a good consumer demand for some indigenous fish like *magur, singi, koi, chital, sol, borali, pabda* and other small fish. The production of these fish should be a part of the policy for pisciculture development of the state of Assam.

Since fish is highly perishable in nature and the consumer prefers live and fresh fish, there is a need for improvement of existing domestic fish marketing system. Infrastructure development in the form of cold storage and refrigerated van for direct marketing of fish will lead to higher levels of satisfaction among consumers. Adequate training to fish peddlers in handling such vans and handling of live fish and scientific method of cleaning fish will increase marketing effectiveness.

Since per capita fish consumption was found to be the highest among the Assamese consumers as compared to the other communities, more emphasis should be given on production and marketing of those species of fish which are preferred by this community.

As it has been found that there is a gap between demand of fish in Assam and its locally produced supply, there are ample opportunities for development of entrepreneurs in this field. The state govt. can undertake policies to encourage entrepreneurship in fish culture, thereby reducing the unemployment in the state. This will also reduce resource outflow from Assam to other states for importing fish.

Modern marketing considers the role by the consumers in the marketing process. Hence, more managerial attention should be focused on consumption behaviour of fish consumers, which will enhance consumer satisfaction. An integrated approach for development of fish culture in the district as well as for the state as a whole should be taken to cater to the demand of fish in the state. The part of imported value may be spent for development of fish culture, which not only reduces the total imported quantum of fish, but also increase the state domestic product by raising fish production in the district. Since majority of the production decisions are influenced by the forces of demand and supply, the findings of such research will be helpful for producers and policy makers in taking decisions for producing those fish which are mostly preferred by consumers in order to realize higher prices in the market. It will also help in generating employment programmes.

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Exploring the Possibilities of Marketing Value-Added Fish and Fish Products in Assam

Pradip C Bhuyan* and Chandan Goswami**

This paper attempts to explore the possibilities of production and marketing of value-added fish products based on the consumption and preference patterns of consumers in Assam. The study revealed that the percentage of respondents opting for ready-to-eat fish is more in urban areas than rural areas. About 41% of respondents were willing to pay up to 20% extra for ready-to-eat fish. Non-availability, lack of awareness, not having tasted the product yet, disliking the taste and fear of presence of intramuscular bones were stated as the reasons for not taking or less eating of ready-to-eat fish. Out of the different fish recipies/fish products, fish curry and fried fish were found to be more popular among the eating joints. A majority of the managers/owners of eating joints opined that there is a probability of utilizing low-valued fish like grass carp, silver carp, common carp, etc. for preparation of value-added fish products. The problems associated with producing and selling value-added fish products, as perceived by eating joints, were: less demand, non-availability of suitable varieties, irregular supply of suitable variety of fish, high cost of suitable varieties of fish, non-availability of boneless fish like boneless chicken, etc. The study suggests some strategies which would help the planners, policy makers and farmers in decision-making for need-based fish production and efficient fish marketing for improving the production and marketing of value-added fish and fish products in the state.

Introduction

In order to sustain fish farming as a profitable venture, value addition is very essential. Value addition implies processing of the end product or addition of ingredients which increases the acceptability of the product in terms of either convenience or increase in shelf life. A broad definition of value addition is to economically add value to a product by changing its current place, time, or form in conformation with market preference (Coltrain *et al.*, 2002). According to the requirements of different markets, value can be added ranging from live fish to ready-to-serve convenience products such as fish fingers, fish burgers, fish cake, fish balls, fish steaks, fish silage, de-boned fish, cured fish, frozen fish, etc. Sharma and Sharma (2006) reported that value addition includes different

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aspects under different national backgrounds. In a poor country, even icing of fresh fish is a high level of value addition. In general, value-added food products are raw and processed commodities whose value has been increased through the addition of ingredients and processes that make them more attractive to the buyer and/or more readily usable by the consumer. It is a production and marketing strategy driven by customer needs and perceptions. Value addition is the most important aspect of food processing industry particularly in export-oriented fish processing industry because of increased realization of valuable foreign exchange.

Under the modern marketing concept, consumer is the fulcrum around which the entire marketing activities revolve (Santhakumar and Sanjeeviraj, 2000). The analysis of the consumers' behavior in terms of consumption patterns, consumer preferences, consumption motivation, consumer buying process and shopping behavior is a helpful parameter to formulate a firm's marketing strategy (Reddy, 2011). Shaw (1986) reports that for any business which wishes to exchange its products with customers for money or other goods, the customers' requirements have to be understood and the products which meet these requirements should be offered. Understanding consumer motivations and knowing the relative importance of various criteria for different consumer groups is essential for the development and promotion of local products. The development of attractive and convenient processed foods from local staples combined with active commercial marketing can succeed in increasing the urban demand of such domestic produced foods. Thus, in addition to the aspects of production, efforts in processing, marketing and distribution need adequate emphasis. Unless local food production and distribution systems are able to cope with and adapt to this growing and changing food demand, market tensions shall grow or countries' reliance on imported foods shall increase (Delisle, 1990).

Fishery sector is considered as an important economic activity in the socioeconomic context in the State of Assam. It is the most resourceful state in surface water coverage in NE region having 3.89 lakh ha of vast and varied inland freshwater resources of great fisheries potential. Having a greater potentiality, these resources yielded 0.23 million tons of fish during 2010-11 (Economic Survey, Assam, 2011-12) against an annual demand of 0.31 million tons (calculated on the basis of minimum nutritional requirement of 11 kg per capita per annum as recommended by the World Health Organization (WHO) and considering 90% of the state's fish eaters).

Since there is good potentiality for fisheries development in Assam in terms of fish resource availability and potentiality, it is the need of the hour to develop strategies based on consumption and preference patterns of value-added fish and fish products which have not received much attention in the state. This paper focuses on exploring the possibilities of production and marketing of value-added fish products in the state of Assam.

Literature Review

Convenience food has become a major item in today's food market. Demand for convenience food, like ready-to-eat or ready-to-serve or other value addition in food, has increased over the past few years due to increase in urbanization, breaking up of the traditional joint family system, the increment in single-person and small households, increasing number of working women, rise in per capita income, changing lifestyles, lack of cooking interest and skills, desire for quality food, etc. (Pavithra, 2008; Papagieorgiou, 2011; and Bernues *et al.*, 2012). Karmakar and Banerjee (2009) reported that a considerable change occurred in consumer preference within the country during the last 40 years and there is an increasing demand for value-added products in the domestic market. The study emphasized on creating a domestic niche market for such products and provided some important suggestions as Research and Development (R&D) road map considering the existing potentials of the fishery industry.

Hussain and Helal Uddin (1995) studied the marketing of fish and fish products in Bangladesh. People of Bangladesh preferred fresh fish to iced fish. Other forms of fish products available in market were frozen, salted, sun dried, salted and dried, salted and dehydrated, smoked and canned fish and fishmeal for the poultry farms. Bangladesh Fisheries Development Corporation (BFDC), established in 1964, developed a range of ready-to-cook products such as fish burgers, fish fingers, fish cake, fish cutlets, fish balls and minced blocks. The study reported that though these products got a good response from consumers, there was no price policy fixed by the government or the fisheries cooperatives or the trade associations, and the price of commodities was influenced by the supply and demand situations.

Sehgal and Sehgal (2002) expressed that carps have low market value due to the presence of intra-muscular bones which results in low consumer acceptability. The study emphasized development of some boneless convenience products for enhancing the consumer acceptability of the carps. Three value-added de-boned fish products—fish patty, fish finger and fish salad—from carp flesh were prepared and compared with a reference product—'fish *pakoura*'. The sensory evaluation of these products yielded highly encouraging results. All the three products scored higher than the reference product in terms of taste and overall acceptability. The methods of preparation of these products were transferred to some progressive farmers who prepared and sold these products at very attractive prices. The study concluded that there exists good scope for the processing of carp flesh into value-added products and for boosting the production of these species for the continued expansion of fish culture ponds. Rao and Raju (2006), in their study, reported that fishes are fried and sold to consumers in small stalls in Tokyo. They reported that fish biscuits and fish wafers can be manufactured and these products have already been sold in Kerala and some other states of India. Sabat *et al.* (2008) have analyzed the consumption pattern and consumer preferences towards value-added fish and fish products in Haryana, Punjab and Delhi. The study revealed that 90% respondents in rural, 77% in semi-urban and 50% in urban areas were unaware of value-added fish

and fish products. About 10% had consumed value-added products of fish, out of whic a majority were from urban. The consumers have shown their preference for boneles fish products like fish pakoura and fish cutlet. Similar studies by Mugaonka *et al.* (2011) in Mumbai revealed that 57.9% consumers were aware of different value added fish products. A majority (95.7%) of the consumers were willing to buy new fis products, but a considerable proportion (84.3%) reported that these products were nc available in the local markets. The percentage of respondents who were willing to bu value-added fish and prawn products shows highest preference for fish munch (84% followed by prawn masala (78%), fish *keema* (72%) and prawn pickle (64%). The stud suggests that technology should be disseminated to the willing entrepreneurs and wome Self-Help Groups (SHGs) of the country to prepare such products since such technologie are available with Central Institute of Fisheries Education, Mumbai and other institute like Central Institute of Fisheries Technology, Kochi.

Majumdar (2006) elucidated that the successful launching of any value-adde products depends on many factors. The important ones are consumer's acceptabilit study, test marketing, packaging and presentation, awareness of pricing systems, publicit etc. Value addition, coupled with product diversification, adherence to stringent qualit controls and creation of new export zones through advanced marketing system, migh immensely help to maintain a steady position in this era of severe competition. Nayan Tara *et al.* (2012) have conducted a consumer survey to know the consumption patterr and customer perceptions about fish. The study designed an integrated marketing strateg and an effective branding strategy to increase the sale and improve the profitability c the fisheries business in Karnataka. The West Bengal State Fishermen's Co-operativ Federation Ltd. (BENFISH) also plays an important role in the marketing of fish an value-added fish in West Bengal. It has mobile and stationary counters to sell variou ready-to-eat products. BENFISH has set up a modern fish processing center at Sa Lake for processing raw fish and preparation of various value-added fish products (http /ipshabengal.com/admin/upload).

Objectives of the Study

The study aims at the following objectives:

- To study the consumer awareness and their preference for value-added fish products.
- To explore the possibilities of production and marketing of value-added fish.
- To formulate measures for better marketing of value-added fish and fish products.

Methodology

The study is carried out in Assam which is situated in the foothills of the easter Himalayan region between 88°.25' E to 96.0° E longitudes, 24.5° N and 28.0° N latitud Of the six agro-climatic zones of Assam, one district from each of the agro-climatic zor has been selected based on urbanization and fish production potential followin judgemental sampling. Thus, six districts—(1) Sonitpur district from the North Ban

Plain zone; (2) Nagaon district from the Central Brahmaputra valley zone; (3) Dibrugarh from the upper Brahmaputra valley zone; (4) Metro Kamrup district from the lower Brahmaputra valley zone; (5) Cachar from the Barak valley zone; and (6) Karbi Anglong from the Hill zone—were selected for the present study. Quota and judgmental sampling techniques were used for selection of sampling units. Geographic profile/place of residence (rural and urban) was taken as control characteristic of the quota sampling. The total sample size for consumer survey was 660, representing consumers of four different communities from rural area (330) and urban areas (330) of the six districts. A structured questionnaire was developed to collect information from the consumers. The questionnaire concentrated on finding out the psychological profile of the consumers with respect to buying and consumption of value-added fish. It also puts emphasis on finding out the consumers' acceptance level and willingness to pay with respect to value addition in the selling process of fish and introduction of new products. In addition to the consumer survey, 300 marketers of eating joints (71 fast-food restaurants, 57 restaurants, 59 bar-cum-restaurants, 57 *dhabas* and 56 *chaat* houses) were also interviewed during the investigation. A manual describing details about different value-added fish products with distinct photographs was used as stimuli for better interaction with the respondents. The data were collected from March 2011 to February 2012.

Different statistical tools were applied on the basis of necessity of the study. Statistical Package for Social Sciences (SPSS) version-16 was used for data entry and analysis.

Results and Discussion

General Profile of the Consumers

General demographic profile of the respondents was collected and is presented in Table 1. A majority of the respondents were found to be in the age group of 25-45 years (57.8%

S. No.	Variables	Specification	Frequency	Percent
1.	Age of the Respondents (Years)	15-25	13	2.0
		25-45	382	57.8
		45 and above	265	40.2
		Total	660	100.0
2.	Gender	Male	525	79.5
		Female	135	20.5
		Total	660	100.0
3.	Caste	General	346	52.4
		OBC	195	29.5
		SC	92	13.9

Table 1: Overall Demographic Profile of the Respondents in the Study Area

Table 1 (Cont.)

S. No.	Variables	Specification	Frequency	Perce
		ST	27	4
		Total	660	100
4.	Community (Based on Mother Tongue)	Assamese	240	36
		Bengali	180	27
		Nepali	120	18
		North Indian	120	18
		Total	660	100
5.	Education	Below 10+	304	46
		10+	164	24
		Graduate	137	20
		Postgraduate and Above	55	8
		Total	660	100
6.	Type of Family	Nuclear	449	68
		Joint	211	32
		Total	660	100
7.	Occupation	Government Service	208	31
		Private Sevice	61	9
		Cultivator	119	18
		Business	218	33
		Labor	54	8
		Total	660	100
8.	Monthly Family Income (₹)	<5000	182	27
		5,000-10,000	161	24
		10,000-20,000	136	20
		20,000-40,000	110	16
		>40,000	73	11

of the total sample), followed by 45 years and above (40.2%), and 15-25 years Overall, a higher percentage of the respondents (46.1%) have education below rural areas, 3.9% of respondents had education up to postgraduate level and ab its percentage was more in the urban areas (12.7%). With regard to the occu status, a higher percentage of respondents (33%) were engaged in business, foll

government service (31.5%) and cultivation (18%). A majority of the respondents (33.3%) in rural areas were engaged in cultivation, followed by business (27.3%), government service (20%), labor (12%) and private service (6.7%). But in urban areas a higher percentage of respondents were engaged in government service (43%), followed by business (38.8%) and other occupations.

On an average, a majority of the consumers (27.6%) have their monthly average household income less than ₹5,000.00 in the study area. Again, 24.4%, 20.6 %, 16.7% and 10.7% of respondents have monthly average household income of ₹5,000 to 10,000, ₹10,000 to ₹20,000, ₹20,000 to ₹40,000 and above ₹40,000, respectively.

Consumption Behavior with Respect to Fish and Fish Products

The per capita fish consumption in the study area was 14.27 kg which is more than the national average per capita fish consumption of 9.8 kg. The per capita consumption of fish in rural area is more (14.54 kg) than in the urban area (13.99 kg). The annual per capita consumption among different income groups varies from 10.20 kg (Category I – less than ₹5,000) to 21.21 kg (Category V – more than ₹40,000). The per capita consumption of fish increases with increase in income. This has been established by Chi-square test (χ^2) where 'p' (probability value) was found to be 0.000 which is less than the level of significance (0.05). Again, the result of ANOVA gives 'p' value 0.000 which is less than the level of significance (0.05). Therefore the null hypothesis is rejected. This means there is significant difference in per capita consumption of fish across different income groups. Overall, 53.7% of respondents take fish twice a week, 25.2% take daily, 13.0% take once in a week, 4.2% take fortnightly and only 3.9% take once in a month. The average quantity of fish purchased at a time by all types of consumers is 500 g. Most of the fish consumers (93.9%) prefer live and fresh fish.

Table 2 indicates the frequency of taking snacks outside home. A majority of the respondents (87.3%) do not have any specific frequency of having food outside. Of the total respondents, 5.8% take food outside every day, 3.8% take once a week and 3.2% take twice a week.

Table 2: Frequency of Taking Snacks Outside Home				
Respondents' Profile	Frequency			
	Everyday (%)	Once a Week (%)	Twice a Week (%)	Unspecified (%)
Geographic Profile				
Rural	4.2	4.2	2.1	89.4
Urban	7.3	3.3	4.2	85.2
Income Groups (₹)				
Category I (<5,000)	2.8	3.3	2.8	91.2

Table 2 (Cont.)

Respondents' Profile	Frequency			
	Everyday (%)	Once a Week (%)	Twice a Week (%)	Unspecified (%)
Category II (5,000-10,000)	7.4	1.2	3.1	88.3
Category III (10,000-20,000)	5.1	2.2	4.4	88.2
Category IV (20,000-40,000)	5.5	7.3	0.9	86.4
Category V (>40,000)	11.3	8.5	5.6	74.6
Overall	5.8	3.8	3.2	87.3

Consumer Awareness and Willingness for Different Value-Added Fish Products

The study of awareness of consumers about different value-added products is essential so that producers and marketers can devise their production and marketing plans. Awareness about value-added fish products such as fish cutlet, fish finger, fish ball, fish pickle etc. (other than cleaned and chopped fish, iced/frozen fish, and dry fish) was studied. Out of the total respondents (660), 95 respondents (14.41%) were aware of and purchased different value-added fish products. About 73 respondents (22.1%) of the urban area and 22 (6.7%) of the rural area were aware of and purchased different value-added fish products. Awareness and purchasing of different value-added fish products was found to be highest among the respondents of income Category V (39.4%) followed by Category IV (24.5%), Category III (14.0%), Category II (6.8%) and Category I (5.5%). Fish cutlet, fish finger, fish ball, fish *pokoura* and fish pickle are the ready-to-eat value-added fish products found to be consumed by a small section of the respondents (Table 3). Overall, the highest percentage of consumers consumed fish finger (10.2%), followed by fish cutlet (8.6%), fish *pokoura* (1.7%), fish ball (1.1%) and fish pickle (0.3%). The result of χ^2 test shows a significant association between the respondents' income and awareness/purchasing intention of value-added fish products as 'p' value (0.000) was found to be less than 0.05 at 95% level of confidence. This indicates a pattern of increase in the acceptance level of value-added fish products with increase in income.

Table 3: Value-Added Fish Products Purchased by Consumers					
Respondents' Profile	Fish Cutlet (%)	Fish Finger (%)	Fish Ball (%)	Fish *Pokoura* (%)	Fish Pickle (%)
Geographic Profile					
Rural	3.6	2.4	0.9	0.9	0.6
Urban	13.6	17.9	1.2	2.4	nil
Income Groups (₹)					
Category I (<5,000)	3.3	2.2	0.6	1.1	nil

Table 3 (Cont.)

Respondents' Profile	Fish Cutlet (%)	Fish Finger (%)	Fish Ball (%)	Fish Pokoura (%)	Fish Pickle (%)
Category II (5,000-10,000)	2.5	5.6	nil	1.2	nil
Category III (10,000-20,000)	7.4	7.4	1.5	2.9	nil
Category IV (20,000-40,000)	10.9	19.1	1.9	2.7	nil
Category V (>40,000)	35.2	32.4	4.2	nil	0.9
Overall	8.6	10.2	1.1	1.7	0.3

Overall, 98.9% of respondents in the study area have shown their willingness to purchase fish as dressed and chopped, 46.5% as ready-to-eat fish, 11.2% as iced/frozen fish and 8.5% as fried fish (Table 4). In urban areas, almost all the respondents (99.7%) wanted chopped and cleaned fish, and in rural areas, it is opted for by 98.2% of respondents. The reason cited by the respondents about more willingness for dressed and chopped fish is that the value addition saves their time and they can opt for smaller quantity of large fish. The percentage of respondents opting for ready-to-eat fish is more in the urban areas (55.2%) than in rural areas (37.9%). 11.5% respondents of the urban areas and 10.9% of the rural areas wanted iced/frozen fish. The percentage of consumers showing willingness for value addition in fish as ready-to-eat fish was 24.9% among income group Category I, 40.1% in Category II, 58.1 % in Category III, 63.6% in Category IV and 67.6 % in

Table 4: Willingness for Value Addition in Fish				(%)
Respondents' Profile	Value Addition As			
	Dressed and Chopped	Fried	Iced/ Frozen	Ready-to-Eat
Geographic				
Rural	98.2	9.4	10.9	37.9
Urban	99.7	7.6	11.5	55.2
Income Groups (₹)				
Category I (<5,000)	97.8	8.3	8.3	24.9
Category II (5,000-10,000)	99.4	10.5	11.1	40.1
Category III 10,000-20,000)	98.5	8.8	10.3	58.1
Category IV (20,000-40,000)	100.0	9.1	10.9	63.6
Category V (>40,000)	100.0	12.7	21.1	67.6
Overall	98.9	8.5	11.2	46.5

Category V. Willingness for value addition as iced/frozen was found maximum among Category V (21.1%) and lowest among Category I (8.3%).

Willingness to Pay Extra Amount for Value Addition

Table 5 represents the consumers' willingness to pay extra for different types of value addition in fish. The results of the study showed that a majority of the respondents (87.9%) were willing to pay 5% extra for value addition as cleaning and chopping and only 8.2% and 0.6% respondents were willing to pay 5-10% and more than 10%, respectively. In the urban areas, 91.8% respondents and in rural areas 83.9% have the willingness to pay up to 5% extra for cleaning and chopping. The willingness to pay extra up to 10% for fried fish is shown by 6.2% of respondents. The willingness to pay 10-15 % and more than 15% for fried fish is also very less. Willingness to pay extra for

Value Addition	Willingness to Pay Extra	Rural		Urban		Overall	
		F	P	F	P	F	P
Dressed and Chopped Fish	Up to 5%	277	83.9	303	91.8	580	87.9
	5-10%	29	8.8	25	7.6	54	8.2
	More than 10%	4	1.2	–	–	4	0.6
	Do not want to pay extra	20	6.1	2	0.6	22	6.1
Fried Fish	Up to 10%	23	7.0	18	5.6	41	6.2
	10-15%	7	2.1	6	1.8	13	2.0
	More than 15%	1	0.3	1	0.3	2	0.3
	Do not want to pay extra	299	90.6	305	92.4	604	91.5
Frozen Fish/ Iced Fish	Up to 10%	35	10.6	31	9.4	66	10.0
	10-15%	2	0.6	3	0.9	5	0.8
	More than 15%	–	–	–	–	–	–
	Do not want to pay extra	293	88.8	296	89.7	589	89.2
Ready-to-Eat Fish (Except Fried Fish)	Up to 20%	114	34.5	155	47.0	269	40.8
	20-30%	13	3.9	26	7.9	39	5.9
	More than 30%	1	0.3	1	0.3	2	0.3
	Do not want to pay extra	202	61.2	148	44.8	350	53.0

Table 5: Willingness to Pay Extra for Different Value Addition in Fish in Rural and Urban Area

Note: F = Frequency (No. of Respondents); and P = Percentage of Respondents.

ready-to-eat fish (except fried fish) up to 20% was shown by 40.8% of respondents and only 5.9% and 0.3% respondents were willing to pay 20-30% and more than 30%, respectively. Only 10% of the respondents were willing to pay up to 10% extra for iced/frozen fish.

A majority of respondents (23.2% to 55.1%) of different income groups were willing to pay up to 20% extra for ready-to eat fish. Only 18.3% respondents of the high income Category V were willing to pay 20-30% extra for ready-to-eat fish. Willingness to pay extra for different value addition in fish across the income groups is presented in Table 6.

Value Addition	Willingness to Pay Extra	Income Groups				
		I	II	III	IV	V
Dressed and Chopped Fish	Up to 5%	89.5	90.1	87.5	88.2	78.9
	5-10%	3.9	6.2	6.6	11.8	21.1
	More than 10%	0.6	0.6	1.5	nil	nil
	Do not want to pay extra	6.1	3.1	4.4	nil	nil
Fried Fish	Up to 10%	3.9	9.3	5.1	6.4	7.0
	10-15%	0.6	1.2	3.7	1.8	4.2
	More than 15%	nil	nil	nil	0.9	1.4
	Do not want to pay extra	95.6	89.5	91.2	90.9	87.3
Frozen Fish/ Iced Fish	Upto 10%	7.2	10.5	9.6	11.0	16.9
	10-15%	nil	nil	0.7	0.9	4.2
	More than 15%	nil	nil	nil	nil	nil
	Do not want to pay extra	92.8	89.5	89.7	89.1	78.9
Ready-to-Eat Fish (Except Fried Fish)	Upto 20%	23.2	35.8	55.1	53.6	49.3
	20-30%	1.7	4.9	3.7	9.1	18.3
	More than 30%	nil	nil	nil	0.9	1.4
	Do not want to pay extra	75.1	59.3	41.2	36.4	31

Table 6: Willingness to Pay Extra for Different Value Addition in Fish Across Income Groups

Note: Figures in percentage of respondents.

Reasons for Taking Less or Not Taking Ready-to-Eat Fish Other Than Fried Fish and Fish Curry

'Not easily available', 'lack of awareness' and 'has not tasted the product yet' are stated as the reasons for not taking or less eating of ready-to-eat fish products by 99.7%, 88.0% and 84.5% respondents respectively in (Table 7). 'Lack of awareness' is reported by 96.1% respondents of the rural and 80% of the urban respondents. About 99.7% of the respondents in both rural and urban areas reported that ready-to-eat fish products

Table 7: Reasons for Less Taking or Not Taking Ready-to-Eat Fish Products

Respondents' Profile	Reasons for Not Taking Ready-to-Eat Fish Other Than Fried Fish and Fish Curry				
	Lack of Awareness	Not Easily Available	Has Not Tasted the Product Yet	Do Not like the Taste	Presence of Intramuscular Bones
Geographic					
Rural	317 (96.1)	329 (99.7)	298 (90.3)	34 (10.3)	15 (4.5)
Urban	264 (80)	329 (99.7)	260 (78.8)	25 (7.6)	6 (1.8)
Income Groups					
Category I	174 (96.1)	180 (99.4)	172 (95.0)	5 (9)	8 (4.4)
Category II	152 (93.8)	161 (99.4)	144 (88.9)	14 (8.6)	4 (2.5)
Category III	123 (90.4)	136 (100)	116 (85.3)	16 (11.8)	5 (3.7)
Category IV	89 (80.9)	110 (100)	83 (75.5)	13 (11.8)	3 (2.7)
Category V	43 (60.6)	71 (100)	43 (60.6)	7 (9.9)	1 (1.4)
Overall	**581 (88)**	**658 (99.7)**	**558 (84.5)**	**59 (8.9)**	**21 (3.2)**

Note: Figures in brackets indicate percentage of consumers in that category.

are not easily available. Most of the respondents in rural areas (90.3%) and urban areas (78.8%) have not tasted value-added fish products yet. Again 10.3% of rural consumers and 7.6% of urban consumers stated that they do not like the taste of ready-to-eat fish products. Among other reasons of less eating/not eating ready-to-eat fish is the price of these products and health consciousness which were reported by 16.06% and 23.57% of respondents respectively. According to Sabat *et al.* (2008), the major problems for consumption of value-added fish and fish products were lack of awareness, unavailability, no preference and unacceptable taste. North Indian respondents were ready to pay a reasonable amount for value-added fish and fish products, but no such product is available in the market.

Consumer's Perceptions on Choosing Ready-to-Eat Fish

Consumer's acceptance of ready-to-eat fish is measured with a statement 'I will increase consumption of ready-to-eat fish if different delicacies are available', using a 5-point Likert scale (Table 8). The results indicated that 39.8% of respondents in the study area

Table 8: Consumer's Perceptions on Choosing Ready-to-Eat Fish

Respondents' Profile	I will Increase Choosing Ready-to-eat Fish if Different Delicacies are Available					
	Strongly Agree (%)	Agree (%)	Neither Agree (%)	Disagree (%)	Strongly Disagree (%)	Mean (%)
Geographic Profile						
Rural	7.6	37.9	36.7	16.4	1.5	0.34
Urban	10.3	41.8	34.2	11.2	2.4	0.46
Income Groups						
Category I	3.9	19.3	48.6	26.0	2.2	0.03
Category II	6.2	39.5	40.7	12.3	1.2	0.37
Category III	10.3	51.5	30.1	5.9	2.2	0.62
Category IV	10.9	55.5	20.9	10.0	2.7	0.62
Category V	22.5	46.5	22.5	7.0	1.4	0.82
Overall	8.9	39.8	35.5	13.8	2.0	0.40

irrespective of geographic and demographic profile have agreed and 8.9% strongly agreed to the statement which shows a good possibility of production and marketing of ready-to-eat fish. In the urban areas, a higher percentage of respondents (41.8%) agreed and 10.3% strongly agreed to choosing ready-to-eat fish if different delicacies are available than the rural respondents where 37.9% agreed and 7.6% strongly agreed to increase their consumption.

The percentage of respondents agreed to increase choosing ready-to-eat fish if different delicacies are available were 19.3%, 39.5%, 51.5%, 55.5% and 46.5% respectively among the income group Category I, II, III, IV and V. Again 22.5%, 10.9%, 10.3%, 6.2% and 3.9% of respondents of income group Category I, II, III, IV and V, respectively, strongly agreed to increase choosing of ready-to-eat fish if different delicacies are available. Willingness for choosing ready-to-eat fish increases from lower income groups to higher income groups if different delicacies are available. The mean value of the table also indicates that the degree of response to the statement 'I will increase choosing ready-to-eat fish if different delicacies are available' increases from lower income groups to higher income groups. The result of χ^2 test shows that p-value is less than 0.05, indicating a significant relationship between income and choosing ready-to-eat fish by respondents, if different delicacies are available. This implies that while marketing ready-to-eat fish products, the higher income group should be targeted. Hence, the process should start at the premium restaurants of urban areas that are listed by the elite group of the population.

Existing Scenario of Value-Added Fish Products in Eating Joints

To fulfill the second and third objectives of the study, eating joints of different categories (Fast food restaurants/outlets, Restaurants, Bar-cum-restaurant, *Dhaba* and *Chaat* house)

were visited in the main towns of selected districts except Karbi Anglong districts (under hill zone) where urbanization is comparatively less.

Demand for Fish in Eating Joints

The average daily requirement of fish was found to be high only in restaurants (4.28 kg), the reason being that most of these restaurants serve rice as the core item where fish curry and fried fish are in the menu. The demand for fish was found to be less in Fast food restaurants/outlets, Bar-cum-restaurants, *Dhabas* and *Chaat* houses in comparison to meat. The detailed information about average daily requirement of fish and meat in different eating joints are presented in Table 9. Overall, it reveals that the average daily requirement of fish in eating joints is less (2.39 kg) than meat (5.23 kg).

Table 9: Demand of Fish and Meat in Eating Joints		
Type of Eating Joint	Average Daily Requirement of Fish and Meat (in kg)	
	Fish	Meat
Fast Food Restaurant/Outlets	1.69	5.77
Restaurant	4.28	3.04
Bar-cum-Restaurant	2.85	9.22
Dhaba	3.18	6.95
Chaat House	0.05	0.80
Overall	2.39	5.23

Types of Fish Items Sold in the Eating Joints

During the survey in the eating joints, it was found that altogether 18 fish items were sold in different eating joints. In comparison to different fish recipes, the numbers of meat recipes were more (28 items). The varieties of fish items that were served in eating joints are listed in Table 10. Out of these, fish curry and fish fry with different ingredients were found to be the highest selling items in eating joints, followed by fish fry, steamed fish, fish chilly, fish *bhujia*, fish finger, fish *tikka*, fish *tandoor*, fish cutlet, fish *momo*, etc.

A few eating joints which have not yet introduced value-added fish products would like to introduce fish finger, fish cutlet and fish momo. This has been reported by 3 fast food restaurants, 6 bar-cum-restaurants and 5 *dhabas*, 10 fast food restaurants, 2 restaurants, and 2 *chaat* houses.

Perception of Eating Joints about Consumers Choosing Fish Products

The managers/owners of eating joints were asked about the opinion regarding the probability of consumers choosing fish products (other than fish curry and fry) if they are made available. About 55% of fast food restaurants, 68.4% of restaurants, 67.8% of bar-cum-restaurants, 63.25% *dhabas* and 46.4% *chaat* houses expressed the possibility of choosing different value-added fish products if they are made available (Table 11).

S. No.	Fish Item	Type of Eating Joints where Ready-to-Eat Fish Items Sold					
		Fast Food Restaurant	Restaurant	Bar-cum-Restaurant	Dhaba	Chaat House	Overall
1.	Curry	31 (43.7)	57 (100)	51 (86.4)	57 (100)	–	196 (65.3)
2.	Fry	30 (42.3)	56 (98.2)	53 (89.8)	56 (98.2)	1 (1.8)	196 (65.3)
3.	*Sorsori*	22 (31.0)	34 (59.6)	39 (66.1)	33 (57.9)	–	128 (42.7)
4.	*Tenga Jul*	25 (35.2)	47 (82.5)	25 (42.4)	52 (91.2)	–	149 (49.7)
5.	Steamed with Mustard Seed	12 (16.9)	14 (24.6)	20 (33.9)	13 (22.8)	–	59 (19.7)
6.	*Patat dia* (Fish in Banana Leaf)	1 (1.4)	1 (1.8)	–	7 (12.3)	–	9 (3.0)
7.	Gooseberry Fish Curry	1 (1.4)	–	–	–	–	1 (0.3)
8.	Fish in Bamboo	1 (1.4)	–	–	2 (3.5)	–	3 (1.0)
9.	Fish Chilly	10 (14.1)	1 (1.8)	25 (42.4)	18 (31.6)	–	54 (180)
10.	Fish Do-Piaza	–	–	6 (10.2)	8 (14.0)	–	14 (4.7)
11.	Fish *Bhujia*	–	4 (7.0)	6 (10.2)	25 (43.9)	–	35 (11.7)
12.	Fish Toasted	–	2 (3.5)	3 (5.1)	6 (10.5)	–	11 (3.7)
13.	Fish *Momo*	1 (1.4)	–	–	–	–	1 (0.3)
14.	Fish Finger	6 (8.5)	1 (1.8)	26 (44.1)	6 (10.5)	1 (1.8)	40 (13.3)
15.	Fish *Tikka*	1 (1.4)	–	12 (20.3)	1 (1.8)	–	14 (4.7)
16.	Fish *Tandoor*	–	–	5 (8.5)	5 (8.8)	–	10 (3.3)
17.	Fish Cutlet	–	–	5 (8.5)	–	–	5 (1.7)
18.	Fish *Pokoura*	1 (1.4)	–	1 (1.7)	2 (3.5)	–	3 (1.0)

Note: Figures in bracket indicate percentage in that category.

Overall, 60% of eating joints opined that there is a good possibility of choosing value-added fish products if they are made available.

S. No.	Types of Eating Joints	Probability of Consumers Choosing Fish Products if they are Made Available		
		Yes	No	Cannot Say
1.	Fast Food Restaurant	39 (54.9%)	15 (21.1%)	17 (23.9%)
2.	Restaurant	39 (68.4%)	3 (5.3%)	15 (26.3%)
3.	Bar-cum-Restaurant	40 (67.8%)	10 (16.9%)	9* (15.3%)
4.	Dhaba	36 (63.2%)	6 (10.5%)	15 (26.3%)
5.	Chaat House	26 (46.4%)	8 (14.3%)	22 (39.2%)
	Overall	180 (60.0%)	42 (14.0%)	78 (26.0%)

Table 11: Perceptions of Eating Joints About Consumers Choosing Fish Products

Probability of Value Addition in Low-Valued Fish

Fish species like Common Carp, Grass Carp, and Silver Carp are not popular among consumers of live fish. They also fetch comparatively less price in the market. Hence, it was tried to find out the probability of using these low-valued fish species for the production of value-added fish product in the eating joints. About 63.0% *Dhabas*, 60% restaurants, 59% *chaat* houses, 46% bar-cum-restaurants and 45% fast food restaurants have expressed that low-valued fish may be utilized for value-added fish products like fish finger, fish ball, fish bhujia, fish pickle, etc. The detailed responses of respondents are presented in Table 12. On an average, 54.0 % of eating joints opined that there is probability of utilizing low-valued fish for preparation of ready-to-eat/value-added fish products.

S. No.	Type of Eating Joint	Probability of Utilizing Low-Valued Fish for Preparation of Ready-to-Eat/Value-Added Fish Products		
		Yes	No	Cannot Say
1.	Fast Food Restaurant	32 (45.1%)	18 (25.4%)	21 (29.6%)
2.	Restaurant	34 (59.6%)	4 (7.0%)	19 (33.3%)
3.	Bar-cum-Restaurant	27 (45.8%)	20 (33.9%)	12 (20.3%)

Table 12: Probability of Utilizing Low-Valued Fish

Table 12 (Cont.)

S. No.	Type of Eating Joint	Probability of Utilizing Low-Valued Fish for Preparation of Ready-to-Eat/Value-Added Fish Products		
		Yes	No	Cannot Say
4.	*Dhaba*	36 (63.2%)	6 (10.5%)	14 (24.6%)
5.	*Chaat* House	33 (58.9%)	4 (7.1%)	19 (33.3%)
	Overall	162 (54.0%)	53 (17.6%)	85 (28.3%)

Conclusion

1. Overall, 98.9% of respondents in the study area showed their willingness to purchase fish as chopped and cleaned fish, 46.5% as ready-to-eat fish other than fried fish (46.5%), 11.2% as iced fish and 8.5% as fried fish. The percentage of respondents opting for ready-to-eat fish was more in the urban areas (55.2%) than in rural areas (37.9%).

2. A majority of respondents (87.9%) were willing to pay 5% extra for value addition as cleaning and chopping. Willingness to pay extra for fish delicacies (except fried fish) up to 20% were shown by 40.8% respondents.

3. Overall, 60% of eating joints opined that there is a good possibility of choosing value-added fish products (other than fish curry and fish fried) if they are made available.

4. On an average, 54.0% managers/owners of eating joints opined that there is a probability of utilizing low-valued fish like grass carp, silver carp, common carp, etc., for preparation of value-added fish products like fish cutlet, fish ball, fish bhujia, fish pickle, etc., and for preparation of ready-to-eat/value-added fish products.

5. Major problems associated with producing and selling value-added fish products (e.g., fish finger, fish cutlet, fish ball, fish pickle, etc.) as perceived by the respondents of eating joints were: less demand for value-added fish item, non-availability of suitable varieties for preparation of fish items, irregular supply of suitable varieties of fish, high cost of suitable varieties of fish, non-availability of boneless fish (like boneless chicken), etc.

The study clearly shows that there is an opportunity for commercial production and marketing of value-added fish products which will further encourage development of entrepreneurship in this area. As a strategy, production and promotional actions for value-added ready-to-eat fish are suggested as a priority area for development of the fisheries sector. To achieve this, the following measures are suggested:

- Department of Fisheries, College of Fisheries and NGOs of the state may come forward to impart specific training on the preparation of value-added ready-to-eat fish and market intervention of these products.

- Niche marketing of value-added products can be thought of for creating a need for marketing of these products. In this case, products should be developed through proper market planning by targeting high income group of consumers.

- Effective market promotion should be considered which can provide better guide to both the producers and marketers of fish and fish products to produce products of desired quality and good price in the market.

- Training and demonstration on preparation of value-added products like fish cutlet, fish finger, fish pickle, etc. should be organized involving unemployed youth, members of SHG and cooperative societies. Involvement of women's groups for preparation of value-added products can play a significant role in bringing change in this aspect.

- Necessary infrastructures like de-boning machines, etc. for preparation of some value-added products should be provided to the entrepreneurs at the initial stage.

Though fish is a commonly accepted food product in the study area, upgradation of the product for better acceptance in the market has not yet been studied. It was found that though fish as a part of the menu in lunch or dinner at home is common, ordering fish items at restaurants is not common. It has the status of the common man's food in the society. To make the product more acceptable socially and to give it a status symbol, this study was undertaken. The measures suggested here are based on the findings of the study and will go a long way in increasing the acceptability of the product.o

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