

## ORIGINAL ARTICLE

# Study of Fish Consumption Patterns in Assam for Development of Market Driven Strategies

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### ABSTRACT

The study was carried out in six districts of Assam to find 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. A total of 660 respondents, covering both rural (330) and urban (330), have been selected following quota and judgment sampling. The study revealed that the per capita consumption of fish in the study area was 14.27 kg. The annual per capita consumption of fish in rural area was 14.54 kg and in the urban area 13.99 kg. Majority of the non-vegetarian consumers (60.3%) in the study area had the highest preference for fish followed by chicken, and mutton. The study clearly indicates that fish consumption increases with increase of family income. The average monthly expenditure on fish over total expenditure of food items varies from 11.63% to 23.12% among different income groups. Majority of consumers (53.7%) had consumed fish twice a week, 25.2% daily and 13% once a week. The average quantity of fish purchased at a time by majority of consumers (48.3%) was 500g. Among different factors influencing fish consumption, palatable taste of the fish was the first reason followed by high nutritive value, easy digestibility, less fat content and easy availability of fish in comparison to meat at affordable price. Based on the findings of the study some strategies for improvement of fish production and marketing scenario in Assam such as production of consumer preferred fish with preferred size and form; good network for handling, transporting, distributing, displaying, and holding facilities to support marketing of fish in live and fresh etc have been developed.

**Keywords:** Fish consumption pattern, per capita consumption of fish, strategies, Assam

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### INTRODUCTION

Fish has long been an important food item and associated with the social life of the people of the Northeast India, especially in Assam. Assam is the most resourceful State in surface water coverage in the Northeast India with covering about 4.8 lakh ha in the form of rivers (2.05 lakh ha), beels (1.0 lakh ha), ponds and tanks (0.6 lakh ha), derelict water bodies (1.16 lakh ha), forest fisheries (0.05 lakh ha) and reservoir fisheries (0.03 ha) having a greater potentiality. But, the production of fish is only 0.294 million tonnes during 2015-16 against an annual demand of 0.33 million tonnes which is calculated on the basis of minimum nutritional requirement of 11kg per capita per annum as recommended by WHO and considering 95% of the state's population is fish eaters [6].

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 the per capita consumption of fish in the State is only 9.0 kg which is less than the recommendation of WHO. The per capita annual consumption of fish in India is estimated to be 5 kg/yr for the whole population and it is 8 kg for the non-vegetarian population of the country as against the world average of 16 kg [21]. The regional tastes and preferences of fish eating population of the country and the frequency of fish consumption also exert substantial influence on the market [22].

The success of fisheries development programmes depend partly on the marketing technique of fish. Fish production as well as marketing strategy is essential for reinforcing each other for the development of fisheries. In order to be successful in the liberalized market scenario it is necessary to shift focus from 'supply driven' to market driven' and produce according to the market needs and earn high returns [10]. The concept of marketing calls for understanding the needs of the consumers so as to give satisfaction to the consumers. 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 etc [15].

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 [12].

Most of the studies carried out on fish consumption patterns reveal that preference for fish and fish consumption pattern depend on income, urbanization, tradition, habit, shift in dietary pattern, higher economic growth, rising population, availability of fish, taste and nutritive value of fish etc [1, 4, 5, 7, 10, 20, 21, 8, 9, 25].

Rao and Raju [16] studied differential patterns of fish consumption in India. The study carried out by Bhatta [2] 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. The study conducted by Bhatta [0] on fish consumption patterns of urban and rural fish consumers in five Indian states viz. Haryana, Karnataka, Orissa, Uttar Pradesh, and West Bengal. Kumar, Dey and Paraguas [4] examined the fish consumption pattern with analysis of fish demand by species group.

The study carried out by Sabat, Sharma and Shyam [17] 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.

Shyam [21] analysed the fish consumption pattern across urban consumers in Cochin, Chennai and Mumbai. The study focused on income and expenditure pattern, buying behaviour, constraints in fish consumption and willingness to pay (WTP) for high value fishes among the consumers.

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. Upadhyay and Pandey [24] 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.

Though different studies on fish consumption patterns had been carried out in different parts of the country such studies are very scanty in Assam. With this backdrop, the present study had been undertaken in Assam to examine the variation in consumption and preference patterns for fish among different groups of consumers, so as to develop market-driven strategies of production and marketing of fish in Assam.

## MATERIALS AND METHODS

The study was carried out in six agro-climatic zones of Assam. 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. 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** district 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 based on urbanization and fish production potential following judgment sampling.

The total sample size for consumer survey was 660, of which 330 were from urban and 330 from rural areas. To get representative sample of consumers, respondents were drawn from four different communities (Assamese, Bengali, Nepali and Bihari) from both rural and urban areas of each selected districts. For selection of rural consumers, one Community Development Block from each of the selected districts had been selected randomly. Villages under each block were categorized on the basis of majority of four different communities in the population. One village from each category was selected randomly. Again, from each of the selected villages 20 households of Assamese, 15 households of Bengali, 10 households of Nepali, 10 households of North Indian communities had been selected by using the right hand rule (random walk method).

Urban consumers were also selected in the same way from different wards of Municipal Corporation, Municipal Boards, Town Committee and census town. 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. Thus 55 rural consumer respondents and 55 urban consumer respondents from each district had been selected and ultimately 330 rural and 330 urban consumers constituted a total sample size of 660 from all the six selected districts.

Consumers were categorized into five groups depending on monthly household income, viz., Category-I (Less than Rs.5000.00), Category-II (Rs.5000.00 to Rs.10,000.00), Category-III (Rs.10,000.00 to Rs.20,000.00), Category-IV (Rs.20,000.00 to Rs.40,000.00) and Category-V (More than Rs. 40,000.00) after collection of primary data from the respondents.

A structured questionnaire was developed to collect information about fish consumption patterns from the consumers. 5 point Likert scales was used in closed ended questionnaire part of the structured interview schedule. 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 [14].

The relevant data collected were tabulated and analyzed using statistical tools of SPSS package (Version-16). Different descriptive, parametric test (t-test and ANOVA) and non-parametric test (Chi-square test) were applied on the basis of necessity.

## RESULTS AND DISCUSSION

Table -1. 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	100	330	100	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 service	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

### Demographic Profile of the Consumer Respondents:

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%). Majority of respondents (52.4%) belonged to general caste, followed by 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%. The detailed demographic profile of the consumer respondents is presented in Table-1 and Fig.1 to 5.

**Fish Consumption Patterns**

**Per Capita Consumption of Fish**

The average annual per capita fish consumption in the study area was 14.27 kg. The monthly average quantity of fish consumed in each household was 5.94 kg and monthly per capita consumption of fish was 1.19 kg.

Monthly per capita consumption of fish in rural area was 1.21 kg in rural area and 1.17 kg in urban area (Table -2). The findings of the study revealed that per capita fish consumption was more in rural area than in urban area which may be due to availability aquatic resources and fish in rural area. This finding also found to matches with earlier findings of Bhatta [2, 3] and Dey *et al.* [4].

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). 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,

$\mu_1$  = mean fish consumption of rural consumers

$\mu_2$  = mean fish consumption of urban consumers

Independent Samples Test (Table- 3) indicated that there was 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 monthly average quantity of fish consumed per household varies from 4.2 kg to 8.31 kg among different income groups. The annual per capita consumption estimated at also varies from 10.20 kg to 21.21 kg. The study clearly indicated that fish consumption had increased with increase of family income (Table- 4). This finding was found similar with the findings of Bhatta [2]; Dey *et al.* [4], Kumar and Kumar [10]; Sekar *et al.*, [19]; and the report of FAO [7].

The difference in per capita fish consumption among different income group categories had 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,

$\mu_1$  = mean fish consumption of category-I

$\mu_2$  = mean fish consumption of category-II

$\mu_3$  = mean fish consumption of category-III

$\mu_4$  = mean fish consumption of Category-IV

$\mu_5$  = mean fish consumption of Category-V

Table -2. Quantum of Fish Consumption in the Study Area

Respondent's profile	Average monthly total consumption of fish per household (Kg)	Monthly per capita consumption 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)
Overall	5.94 ± 4.34(SD)	1.19	0.04	14.27 ± 10.36(SD)

Table-3. 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

Results of the ANOVA test revealed that ‘p’ value is 0.000, which is less than the level of significance. Therefore null hypothesis was rejected which implies that there was significant difference in per capita

consumption of fish across different income groups. The post- hoc analysis indicates that there was significant difference in fish consumption among income Category-I, Category-II and Category-V, but no significant difference was seen between Category-III and Category-IV. The descriptive statistics revealed that per capita fish consumption is highest in Category-V (21.21 kg) and lowest in Category-I (10.20 kg). The estimated annual per capita consumption of fish obtained from household survey (14.72 kg) was higher than those of the state (Assam) average (9.0 kg) and the national average (9.8 kg). The reason for this may as explained by Dey *et al.* [5] was that estimate of national statistics on per capita fish consumption commonly based 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 was generally believed that the actual per capita fish consumption in many developing countries was higher than the national average reported in official databases. It was also reported that difference between the estimated per capita fish consumption in India derived from the survey data which covered only the non-vegetarian population and the national average is an average figure for both vegetarian and non-vegetarian population.

#### **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 (Table-5). 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%).

The percentage share of monthly expenditure on fish over total food expenditure (Table-6) was highest (14.56%) followed by meat (13.22%), milk (7.4%) and egg (2.5%). Share of monthly expenditure in animal protein food items (fish, meat, egg and milk) over total expenditure on food was estimated at 37.67%. Overall, the proportion of monthly household expenditure on staple food in the study area was 62.33%. The proportion of household expenditure on staple food in rural area (62.79%) was slightly higher than the urban area (61.96%). Results of Independent sample 't' test indicated that the expenditure of urban consumers on fish is significantly higher than that of rural consumers.

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. The percentage share of monthly expenditure on other animal sourced food also increased with income. These findings were in line with those of Bhatta [3], Sekar and Senthilnathan [20] and Gopal and Annamalai [8] who reported that average fish consumption expenditure increases with increase in income. Sekar, Randhir and Meenhakshi [21] also reported that the average expenditure share of fish across different income groups increased from the lowest to the highest income groups.

#### **Frequency of Fish Consumption**

Overall, 53.7% of respondents had taken fish twice a week, 25.2% daily, and 13.0% once a week. The average frequency of fish consumption in the study area was twice a week (Fig.-6).

The majority of consumers in both rural and urban areas had consumed 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 twice in a week. The frequency of eating fish daily was more (26.1%) in rural area than in urban area (24.2%). In rural area 13.3% consumers and in urban area 12.7% ate fish once in a week. Findings of Sekar (1996), BOBP (1992) also indicated that majority of consumers ate fish twice a week.

Table - 4 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 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.

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 is found less than 0.05.

Table -5 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
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-6. 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
Overall	62.33	14.56	13.22	2.50	7.4

**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.

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 (Fig.7).

The study revealed 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%).

Chi-square test revealed that there is significant relationship between income and average quantity of fish purchased.

**Form of Fish Preferred**

Overall, 93.9% respondents had preferred to purchase local fish and only 6.1% to 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 huge demand for local

fish in the study area. Respondents of all categories preferred local fish in live and fresh condition than frozen/iced fish.

### **Types of Fish Preferred**

#### **Indian Major Carps (IMC):**

Majority of respondents (72.1%) had shown their first preference for Rohu, second preference for Catla (67.3%), and third preference for Mrigal (35.5%). Similar findings were also reported by Dey *et al.* [4] where consumers of India and Bangladesh ranked Rohu, Catla and Mrigal as first, second and third preferred species respectively. Bhatt [2] 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 1<sup>st</sup> rank followed by Grass carp and Silver carp. Dey *et al.* [4] also revealed that common carp was the most preferred species followed by grass carp and silver carp. Upadhyay and Panday (2009) revealed that Silver carp was the most preferred fish in Tripura among these exotic carps.

#### **Minor carps:**

The consumer preference patterns for three different minor carps- Bhangon (*Cirrhinus reba*), Kurhi (*Labeo gonius*) and Koilajara (*Labeo calbasu*) were obtained from the respondents. Among these Bhangon was given first rank in order of preference by all respondents followed by Kurhi and Koilajara.

#### **Live fish:**

Among different live fishes the highest preferred live fish in the study area was magur Magur (*Clarias batrachus*), followed by Koi (*Anabas testudineus*, *sol* (*Channa striatus*), Singi (*Heteropneustes fossilis*), and *Goroi* (*Channa punctatus*). 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 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> respectively.

#### **Big varieties of fish:**

Consumer preferences for three big varieties of fish- *Arii* (*Aorichthys seenghala*), *Chital* (*Notopterus chitala*) and *Borali* (*Wallago attu*) 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* was the highest preferred fish both in rural and urban areas. Next to *Chital* the rural respondents preferred *Borali* whereas the urban respondents preferred *Arri*.

#### **Preferences among Pabda, Kandhuli and Singorah:**

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

#### **Small varieties of fish:**

Majority of respondents in the study area, irrespective of rural/urban and communities, expressed their preferences for moa, *Amblypharyngodon mola* (32.9%) followed by puthi, *Puntius spp* (22.9%), Boloria, *Aspidoparia spp* (10.3%), Dorikona, *Esomus danricus*, prawn, and kholihona (*Colisa fasciatus*)

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 *Pabda* in different strata of the population.

Sugunan [23] 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*, *Puntius sophore* and *Ompok spp* had 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 [24] revealed that among carps, Rohu (*Labeo rohita*), Catla (*Catla catla*), Mrigal (*Chirrhinus mrigala*), Silver carp (*Hypophthalmichthys molitrix*) are most commonly consumed fish in Tripura by all income groups.

#### **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.

Information on preferred size of carps shall benefit fish farmers and marketers 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.

### **Preferences for Fish compared to other Animal Protein**

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 was 61.8 in rural area and 58.8 in urban area. The analysis indicates that both rural and urban respondents had the highest preferences for fish followed by chicken, mutton, beef, pork and eggs.

#### **Factors Influencing Fish Consumption:**

Palatable taste, high nutrition value, habit, easy digestibility, affordable price of fish in comparison to meat, easy availability, less fat content, status symbol were ranked by the respondents as 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup>, respectively as the factors influencing fish consumption. The various reasons indicated by respondents for preferring fish as first choice were largely in conformity with the findings of Santhakumar and Sanjeevraj [18], Verbeke and Vackier [25] and Jamdade *et al.* [9].

#### **Factors responsible for low consumption of fish:**

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' was the single largest known factor responsible for low consumption of fish. The results were found somewhat similar with the findings of Sabat, Sharma and Shyam [17] where they reported that presence of bones in fish and price 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 [16] the bad odour can be removed by better processing methods of fish with some other food items. 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 will increase fish consumption even among the non-eaters of fish.

#### **Place of Purchasing Fish**

In rural area, 80.3% consumers had purchased fish from village market, 13.3% from vendors/fish peddlers and 6.4% from town market. On the other hand, 59.7% consumers of urban area purchased fish from town market, 23.6% from village market and 16.7% at place of residence i.e. from vendors/fish peddlers. Overall, majority of respondents (52%) in the study area purchased fish from the village market followed by town market (33%) and at place of residence (from vendors 15%).

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 [14].

#### **Strategies and major policy recommendations:**

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

##### **1. To give emphasis on production of consumer preferred carp and non-carp varieties with preferred size.**

More emphasis on production of consumer preferred carp and non-carp varieties should be given in order to make them available at affordable price by the consumers. 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*, *Pabda*, and *Moa* should be extended through adoptive research in agro-climatic situation of Assam so that farmers can adopt it successfully.

##### **2. To develop an elaborate network for handling, transporting, distributing, displaying, and holding facilities to support marketing of fish in live and fresh.**

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. 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.

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. A district level business model for fish marketing is developed based on the findings of the study which is given in Fig.8.

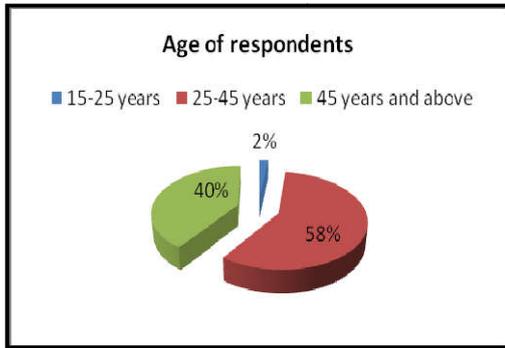


Fig.1 Age of the Respondents

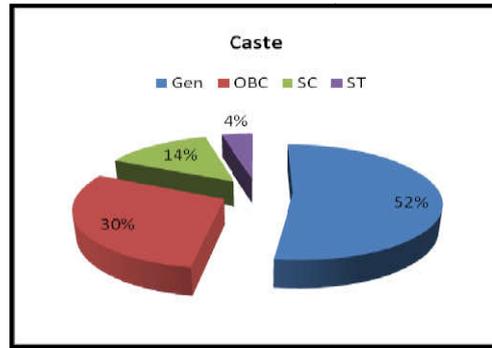


Fig.2. Caste of the Respondents

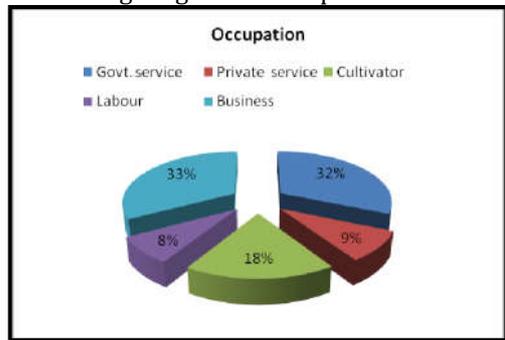


Fig.3 Occupation of Respondents

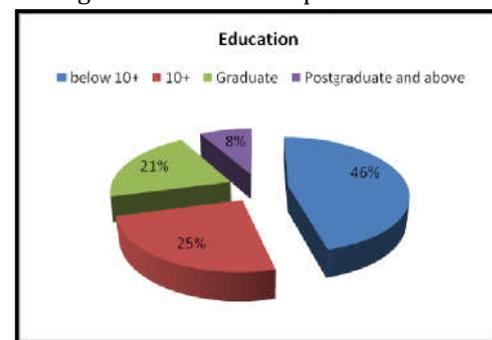


Fig.4. Education of the Respondents

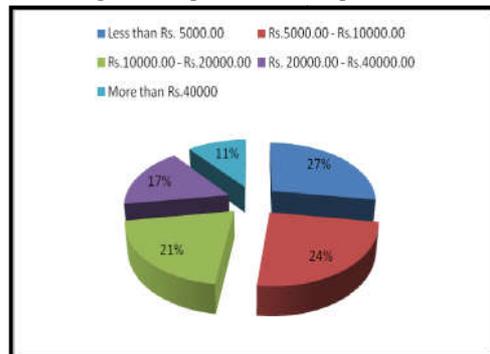


Fig. 5. Monthly Average Income

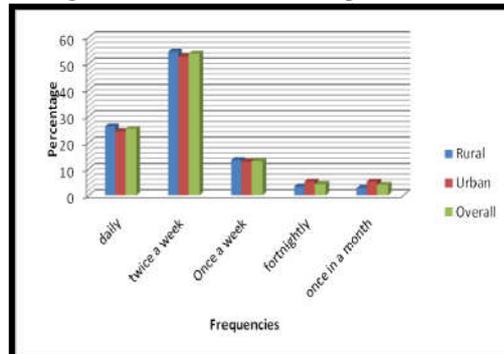


Fig.-6. Frequency of eating fish in rural and urban area of Households

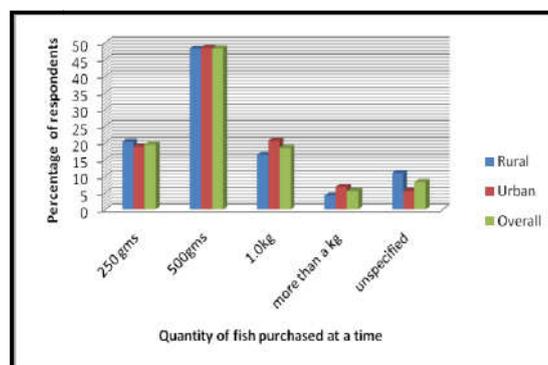


Fig. -7 Average quantity of fish purchased at a time in rural and urban area

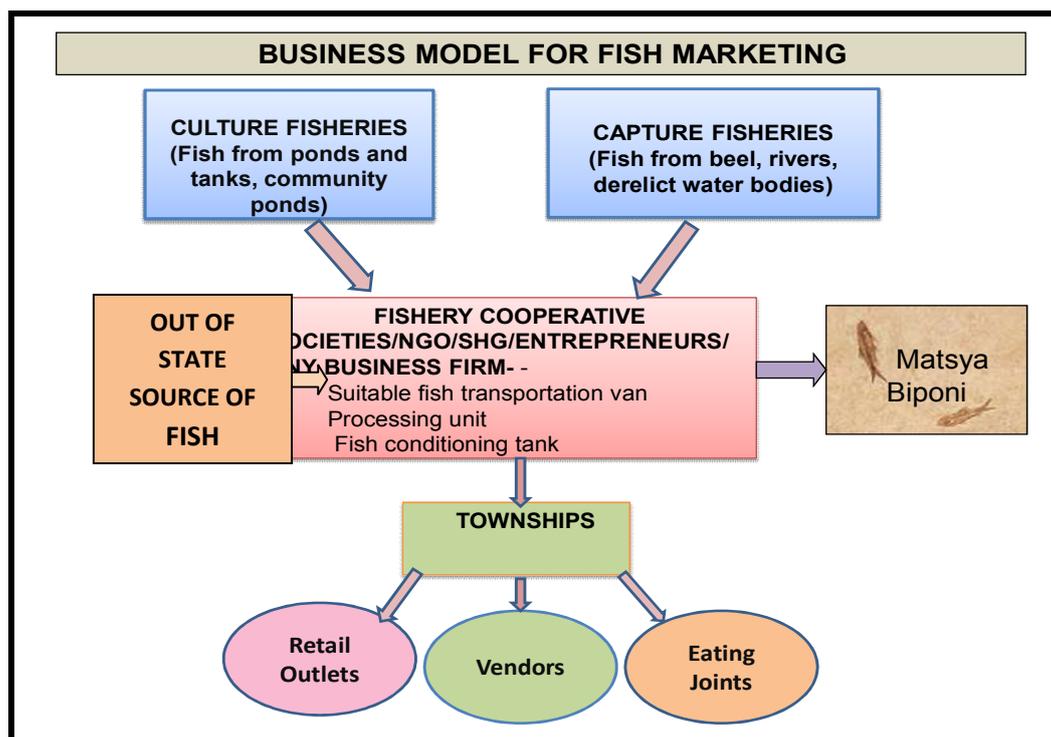


Fig. 8 District level business model for fish marketing

## CONCLUSION

The study contributes to existing knowledge as it provides information on fish consumption patterns in Assam based on primary data. With the changing scenario from production driven marketing to market driven production the findings of the study and strategies suggested would be able to help decision making process of fish farmers as well as all stakeholders who are working for development of fisheries and aquaculture sector of Assam.

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