

SOCIO-ECONOMIC IMPACT OF FRESHWATER POND FISH FARMING IN RURAL BANGLADESH

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ABSTRACT

In Bangladesh aquaculture has developed mainly as a rural activity integrated into existing farming systems. Rural aquaculture has made significant contributions to the alleviation of poverty. Rural pond fish farming products can be treated as a commodity, which can be traded for cash or essential household items, both of which increase household economic security of the farming community. Considering the above facts, the study was conducted on rural fish seed production, marketing and fish marketing functionaries in Bangladesh. It was found that many of the hatchery farmers, *aratdars* and some of the nursery farmers and wholesalers had surplus income after meeting their household needs. A general trend of increase in expenses for clothing, education, health, and housing with the increase in income was also evident. Data also reveals that all of the sample respondent families took fish protein more than the national average. The development of freshwater pond fish culture in rural Bangladesh has generated income and employment opportunities for the poorly resourced farmers, as it was found that hatchery based fish farming operations had provided opportunities for employment for a large number of rural people both directly or indirectly. A large number of rural people were engaged in fingerling production in nursery and hawking fish fry/fingerling to the fish farmers. In developing countries like Bangladesh, aquaculture could play an important role as a stimulant for economic activity in rural areas. Rural aquaculture has the potential to be a major income-generating component in poverty alleviation programs, such as integrated rural development program. Introducing rural pond fish farming systems can improve the economic and ecological sustainability of poorly resourced farms.

Key words: Rural aquaculture, Income generation, Poverty alleviation.

INTRODUCTION

Inland fish production provides significant contributions to animal protein supplies in many rural areas. In some regions freshwater fish represent an essential, often irreplaceable, source of high quality and cheap animal protein crucial to the balance of diets in marginally food secure communities. Most inland fish produce is consumed locally, marketed domestically, and often contributes to the subsistence and livelihood of poor people. The degree of participation, including a significant number of women and children, in fishing and fish farming can be high in some rural communities, and fish production often is undertaken in addition to agricultural or other activities.

In the Asian region, aquaculture has developed mainly as a rural activity integrated into existing farming systems. Rural aquaculture, including enhancement and culture-based fisheries, has made significant contributions to the alleviation of poverty directly through small-scale household farming of aquatic organisms for domestic consumption or income and indirectly by providing employment for the poor or low-cost food for poor rural and urban consumers. Recent experiences in these countries indicate that there are wide opportunities for the poor, to integrate aquaculture into their existing farming systems.

Bangladesh is among a few countries in the world which is blessed with rich and varied inland and marine fishery resources. The Fisheries sector plays a strategic role in the economy of Bangladesh by contributing to national income, exports, food and nutritional security and employment generation. It accounts for some 4% GDP and more than 8% of annual export earnings. The sector provides income to some 1.5 million to 2 million full-time fisherfolk, and provides part-time employment for around 12 million poor people, male as well as female. Sixty percent of the national protein supplies come from fish (FAO: 1999) [1]. Within the sector, inland capture fisheries contributes 46%, aquaculture 33% and marine fishery 21% to total production (BBS: 1998) [2]. Bangladesh is considered as one of the most suitable countries in the world for aquaculture, due to favorable agro climatic conditions.

The development of aquaculture in Bangladesh has generated considerable employment through the culture of marketable fish, fish seed production and the marketing of fish and fish seed. The production from aquaculture can increase availability of protein for household consumption. Alternatively, aquaculture products can be treated as a commodity, which can be traded for cash or essential household items; both of which increase household economic security. The Potential contribution of aquaculture to the livelihoods of the rural poor is presented in the following figure-1.

technology more quickly than the non-educated people and might have the opportunity to apply this technology efficiently to their farms. The people who are involved in fish seed vending are mostly the landless rural poor who had less opportunity to go for formal education.

In view of high profitability in seed production of carps, many enterprising personnel, irrespective of their creed and social status have taken up the venture as a profession. This coupled with high economic return has uplifted the social status of the fish farmers, thereby boosting entire fish farming operations. It was found that all of the hatchery and nursery farmers were involved in fish seed production activities as their principal occupation, and 71% of the fish seed vendors reported that fish seed vending was their principal occupation. Some of the fish seed producers and distributors had a subsidiary occupation like, agricultural farming, small business, day laborer, fishermen etc. (Table I). It was also found that the fish seed farmers and distributors got the major portion of their earnings from fish seed production and distribution. The hatchery and nursery farmers reported that about 90% and 86% of their earnings were from fish seed and fish farming activities and with 56% for the fish seed vendors (Table I). The other sources of earnings had a very insignificant contribution to their total earnings. So, it can be argued that the fish seed production and its marketing had a very important role in rural employment generation and earnings at the farmers' level.

- *Fish marketing intermediaries*

In Bangladesh, in the early period of time, mostly the low caste Hindu and few poor Muslim people worked as fish-marketing intermediaries. According to Bob Pokrant et.al. (1997), fishing was able to sustain a substantial number of professional fishermen, who working in various water environments, used a diverse range of fishing instruments of production, and supplied local, regional and even international markets with a great variety of fish. [3].

They were poor, non-educated, and the most disadvantaged group in the society and were yet to get well recognition in the society. Table-I, indicates that, in the case of education 35% of the *aratdars*, 15% wholesalers, 27% *farias*, 20% *beparis* and 21% retailers were educated. Here educated referred to those, with 5years of schooling. In the case of 20 *aratdars*, 13 had more than five years of schooling, 5, ten and 2 had 12 years of schooling. Most of the *farias*, *beparis*, wholesalers, and retailers, have five years of schooling, only few of them have more than five years but less than ten years of schooling.

The fishery business was the main occupation for all categories, and in the case of *aratdars* and wholesalers, all of the respondents said fishery business was their only occupation and sources of earnings (Table: 1). Some of the *Farias*, *beparis* and retailers were also involved in some other income generating activities, like fishing, agricultural labourers, agricultural farming, fish farming, petty traders and so on. However a major portion of their income came from fish marketing, and some other fishery related activities like fishing, fish farming, making and sale of fishing gears and traps. Most of the intermediaries said that they get involved in the fishery business through inheritance.

Table I: Education, Occupation and Sources of Earnings of the Respondents

Respondents	Education	Main occupation			Sources of earnings		
		% of total respondents			% of total income		
	% of respondents	Fishery business	Fish farming	others	Fishery business	Fish farming	others
a) Fish seed production and Marketing Functionaries							
• Hatcher farmers	65	-	100	-	-	90	10
• Nursery farmers	55	-	100	-	5	86	9
• Fish seed vendor	33	71	5	24	65	5	30
b) Fish marketing Intermediaries							
• <i>Faria</i>	27	63	-	17	76	-	24
• <i>Bepari</i>	20	83	-	17	78	-	22
• <i>Aratdar</i>	35	100	-	-	100	-	-
• Wholesaler	15	100	-	-	100	-	-
• Retailer	21	84	-	14	66	-	34

Source: Field Survey (2001)

Land Holding

In this study the respondents were classified into four categories according to their land holding such as i) land less (0-0.49 acre), ii) small farmers (0.50-2.49 acre) iii) medium farmer (2.50-7.49 acre) and iv) large farmer (7.50 acre and above). The study findings revealed that (Table II), majority (61%) of the fish seed vendors belong to the land less category followed by 39% to the small farmers' category, but none of them belongs to large and medium farmers' category. On the other hand, majority (64%) of the nursery farmers belong to small farmers' category followed by 20% under medium farmers' category with a few of them belong to the large farmers category. In addition the majority (54%) of hatchery farmers belongs to medium farmers followed by 27% and 18% small and medium farmers; none of them were landless farmers. The results of the study indicate that the hatchery farmers were mostly rich people and the nursery and fish seed vendors belong to middle class and poorer section of the rural community.

Majority of the *farias* (67%), *beparis* (68%) retailers (64%) and fish seed vendors (60%) were under the landless category and the rest of them were under the small farmers' category. In the case of *aratdars*, wholesalers and hatchery farmers, majority of them were under the medium farmers category and a substantial number of them were under the small farmers category and a few of them were large farmers (Table II). It is also evident from table-II, that fish seed production, marketing, fish marketing, fishing and other fishery related activities gives the landless and small farmers' people a source of income in rural areas of Bangladesh.

Table II: Land Holding Size of the Respondents

Land holding (acre)	Percentage of total respondents							
	Hatchery farmer	Nursery farmer	Fish seed vender (FSV)	<i>Faria</i>	<i>Bepari</i>	<i>Aratdar</i>	Whole saler	Retailer
Land less (0-0.50)	0.00	16.00	60.00	67	68	10	20	64
Small farmer (0.50-2.49)	27.27	64.00	39.00	30	30	25	35	30
Medium farmer (2.50-7.49)	54.55	20.00	1.00	3	2	60	40	6
Large farmer (7.50 acre and above)	18.18	0.00	0.00	0	0	5	5	0

Source: Field Survey (2001).

IMPACT ON HOUSEHOLDECONOMY

Household Income

The rural people of Bangladesh earn their livelihood mainly from crop farming. The contribution of crop agriculture to GDP is about 18% . On the other hand about 12% of GDP is contributed by non-crop sub-sectors namely forestry, livestock and fisheries, of which 4% is from fisheries. In such circumstances, the rural people being vast and dependent on agricultural activities, of whom large proportions are poor.

In this study it was found that majority of the respondents of fish producers and fish market functionaries were getting a major part of their income from different stages of fish farming operations and marketing of the products. It was 90%, 85%, and 56% for hatchery farmer, nursery farmers and FSVs respectively and 76%, 78%, 100%, 100% and 66% for the *farias*, *beparis* *aratdars*, wholesaler and retailer respectively. Many of them have a good amount of earnings per household per month (Table III).

Table III reveals that, hatchery, nursery farmers and the *aratdars* and wholesalers have the highest average household income in comparison to the rural household income in Bangladesh. It was found that majority of the hatchery farmer (48%) had an average household income of Taka more than 10,000/month, 45% of the nursery farmers had more than Taka 6000. Majority of the *aratdars* (60%) had their monthly income of Taka more than 6000, which was 56% in the case of wholesalers. The other functionaries like Fish Seed Vender (FSV), *farias*, *beparis*, and the retailers had an average monthly income equivalent to the lower middle income group of rural Bangladesh, which was Taka 2500-6000. These data indicate that hatchery and nursery business is a very profitable venture in rural Bangladesh which also generates employment opportunities in rural areas.

Table III Household Classified by Monthly Income Group.

Household income group	Rural Bangladesh (%)	% of household category							
		Hatchery farmer	Nursery farmer	FSV	<i>Faria</i>	<i>bepari</i>	<i>Aratdar</i>	Whole saler	Retailer
< 999	4.8	-	-	-	-	-	-	-	-
1000-1499	11.7	-	-	5.00	-	-	-	-	5.00
1500-2499	27.02	-	-	23.00	11.67	11.67	-	-	15.00
2500-3999	27.62	-	7.00	30.00	25.00	36.67	-	6.67	26.67
4000-5999	15.69	11.65	21.00	40.00	40.00	33.33	20.00	28.89	38.26
6000-7999	6.59	12.75	48.00	2.00	23.33	11.67	36.67	44.44	13.33
8000-9999	2.68	18.46	14.00	-	3.33	6.67	26.67	11.11	1.67
10000-14999	2.43	24.45	4.00	-	-	-	6.67	6.67	-
15000-19999	0.84	23.44	5.00	-	-	-	6.67	2.22	-
20000+	0.62	9.25	-	-	-	-	3.33	-	-

Source: a) Rural Bangladesh data from statistical yearbook of Bangladesh (1997) [4]

b) Field Survey, 2001.

Household Expenses

The respondents of the study have to purchase most of the supplementary food like rice, meat, fish, wheat flour, various kinds of species, oils, pulses and vegetables etc. The fish seed vender, *faria*, *bepari*, and retailers spend more than 60% of their living expenses on food items, which means that more than half is being spent on food. As the majority of them belong to landless and small farmers groups, a large portion of them have to purchase main food items. In the case of hatchery and nursery farmers and the *aratdars* and wholesalers, about 40% of their expenses have been spent for food items. The same table reveals that the expenses on cloth was around 5% in the household category of fish seed vendors, *farias*, *beparis*, and retailers, which was around 10% in case of hatchery and nursery farmers and *aratdars* and wholesalers. The expenses on health and education were very high in case of hatchery and nursery farmer as well as *aratdars*, and wholesaler groups. The table also indicates that higher income groups had more expenses in health and education, which means that they can, spend money for health care for their family and to educate their children. On the other hand, the lower income group household like fish seed vendors, *farias*, *beparis*, and the retailers could not be able to spend much money for health care and education purposes, but at least they have the income to satisfy their basic needs. Study conducted by Quddus and Shamim Ara (1991), on Nutrition in Rural Communities with Seasonal Variations revealed that three fourth (75%) of the income of the households having an income between Tk. 5,000 and Tk. 10,000, was spent for food only. The rest was spent on clothing, education, health and housing. Households having annual income from Tk. 5000 to Tk. 15000 did not have savings or expenditures on any other items. Savings and other expenses started from the income level over Tk. 15000 and gradually increased with an increase in income [5]

Table IV: Living Expenses per Household

Expenditure	Rural Bangladesh (%)	% of household expenses							
		Hatchery farmer	Nursery farmer	FSV	<i>Faria</i>	<i>bepari</i>	<i>Aratdar</i>	Whole saler	Retailer
Food	61.02	43.45	50.15	65.75	63.44	60.66	40.75	45.60	61.35
Clothing	5.66	6.88	4.75	5.85	4.99	5.65	7.95	6.99	4.95
Housing	7.81	11.75	9.88	8.19	7.85	9.15	10.75	9.10	6.75
Health	2.88	15.25	6.34	2.25	3.15	3.75	13.25	10.55	2.38
Education	2.14	12.73	9.78	1.75	2.65	3.15	8.65	8.95	2.10
Others	20.48	10.04	19.10	18.52	20.67	15.85	17.65	18.81	22.47

Source: Field Survey, 2001.

Household Consumption

A balanced food intake ensures appropriate nutrients required by individuals for the growth and maintenance of their body. In fact, many of the causes of widespread malnutrition in Bangladesh lie in the food consumption patterns of the people. Dietary habits are again influenced by a number of factors ranging from economic, social, cultural and religion etc.

Malnutrition and starvation are two serious problems being faced by millions of rural poor including fish farmers, and fishermen in fishing communities in Bangladesh. The problem of malnutrition is in fact more severe and of bigger dimension than the starvation problem and it is caused mainly due to an animal protein- deficient diet. When food is in short supply and prices rise, the poor in rural areas, especially the landless and marginal farmers are more likely to be malnourished than those who are in urban areas. Aquaculture has the potential to produce more protein, provided acceptable food calories, and to change the availability of protein for the poor.

Rice was the common food of all meals of the sample families. They took it during breakfast, lunch and dinner almost everyday of the week. The amount of rice eaten was slightly more in hatchery, nursery, aratdars and wholesaler household families (Table V). Vegetables, pulses and fish were the three major food items that were taken with rice almost on half of the weekdays [6].

Table V, reveals that the pond fish farmer, hatchery and nursery farmer have consumed fish on an average of more than 100 gm/capita/day, and they consumed fish frequently (the national average is 25gm/capita/day). The study conducted by Thompson et.al. (2001), found that pond owning households consumed 211 kg per household in 1998-99 (just under 90 g/person/day), and about 25% of that came from their own ponds. There was no significant difference in consumption according to pond size. Small farm households consumed 83g /person /day, medium farm households consumed 85 g/person/day and large farm households consumed 96 g/person/day.

Among the monitored household only fish seed vender had consumed the exact national average, 25gm/capita/day. Due to them being involved only in fish seed selling process, they had no other opportunity for fish cultivation. The fish production functionaries like fish farmers, hatchery and nursery farmers have their own pond for fish farming from which they obtained fish to be consumed in their households. When they harvest the fish for selling or any other purposes, a portion was been kept for household consumption. In the case of fish marketing functionaries, the farias, beparis, aratdars, wholesalers and retailers all of the household consumed fish more than the national average per capita per day. Among these groups aratdar consumed 165 gm/capita/day followed by wholesaler 85 faria 35, *bepari* 39 and retailer 45 gm/capita/day respectively. Usually the *aratdars* got some fish as commission for their services in the fish market, which gave them opportunity to eat more fish than the other market functionaries.

Meat, fish, eggs and milk are important food items because they are rich animal protein and other nutrients. Some of these items are taken rarely by the rural families in Bangladesh; these food items have definite roles to play to meet the special needs of growing children and mothers. The consumption of eggs, milk, meat and fruits were less among fish seed vender, farias and beparis household families. These families rarely consumed meat and fruits. Milk and milk products were consumed in small amounts and fruits intake was mainly seasonal by these household families. The general pattern of food intake was heavily based on rice, and it was normally consumed with curries consisting of vegetables, fish and pulses in the form of *dal*.

The same table also reveals that the better household income groups like hatchery and nursery farmers, *aratdars*, and wholesalers consumed higher amount of other protein food like meat, milk, eggs and pulses than the national rural average. Due to their higher income from the fish production and marketing process it's possible for them to spend the money on items other than rice for better health. This indicates that the fish farming operations have contributed to increasing the living expenses, changing household consumption pattern and consequently raising the living standard of the respondent's household.

Table V: Food Intake Per Capita per Day

Food Item	Rural Bangladesh Gram/capita	Unit: grams/capita							
		Hatchery farmer	Nursery farmer	FSV	<i>Faria</i>	<i>bepari</i>	<i>Aratdar</i>	Whole saler	Retailer
Rice	455.00	493.8	490.5	440.2	456.1	459.3	485.6	475.2	456.2
Vegetables	199.30	250.2	235.1	201.5	198.5	205.4	261.7	225.8	211.1
Meat	10.30	95.5	87.5	11.30	9.95	8.99	89.6	79.8	13.5
Fish	29.10	170.5	115.5	25.4	35.5	39.6	165.8	85.5	45.5
Milk	29.70	45.6	33.4	28.9	30.3	34.2	54.2	39.1	31.5
Pulses	18.10	44.6	36.4	20.5	19.5	17.6	52.1	39.7	25.8
Eggs	3.10	29.30	15.3	5.6	4.9	7.4	24.7	21.8	4.3
Others	134.30	178.5	177.9	128.4	138.4	133.2	156.6	166.1	144.3

Sources: a) Rural Bangladesh data from statistical yearbook of Bangladesh (1997)

b) Field Survey, 2001.

Others: Other cereals, species, edible oil, fruits etc.

Household Sanitation Facilities

Good sanitation facilities can reduce the incidence of fecal-borne diseases. Widespread incidence of fecally related and fecally transmitted diseases. Diseases such as gastro-intestinal and parasitic infestations are the direct consequences of indiscriminate disposal of human waste. Sanitary disposal of human excreta and the waste is therefore, one of the most important pre-conditions for overcoming the public health problems, but in rural Bangladesh only 7% households have sanitary defecation facilities. Environmental hygiene, sanitary latrines, provisions of safe water and other primary healthcare services are essential pre-requisite for the preservation of health and promotion of nutritional well being

Considering the above facts, an attempt has been made to understand the sanitation situation in the studied households (Table VI). It was found that the majority of hatchery farmers (41%) had the facilities of sanitary/*pucca* latrine followed by 35% for aratdars, 28% for wholesaler and only 11% for nursery farmers. The household belonging to the middle and lower income groups mainly used slab or pit latrine and *katcha* latrines. A substantial number of households like fish seed venders, *farias*, *beparis* have also used open space. Quddus and Shamim Ara (1991), also, revealed that, sanitary latrine were more used by male and female members of large farm households (42 % and 37%) respectively than the members of other farm households. Water sealed latrines were more used by male and female members of medium farm households (83% and 42%) respectively and open pit was more used by male and female members of small farm households (46% and 79% respectively) [7].

This indicated that the situation of sanitation facilities among the middle and lower income group was very poor in condition. This is because of their lack of awareness as well as financial inability.

Table VI: Sanitation Facilities by Type Per Household

Sanitation Facility	Rural Bangladesh (%)	% of household category							
		Hatchery farmer	Nursery farmer	FSV	<i>Faria</i>	<i>bepari</i>	<i>Aratdar</i>	Whole saler	Retailer
Sanitary /Pucca	7.3	50.00	17.00	-	-	3.33	43.33	35.55	-
Slablatrine	21.3	40.14	46.00	23.00	40.00	36.67	50.00	62.22	35.00
Katcha	40.40	9.86	29.00	65.00	48.33	43.33	6.67	2.23	53.33
Open space	28.6	-	11.00	12.00	11.67	16.67	-	-	11.67
Others	2.5	-	-	-	-	-	-	-	-

Source: Field Survey, 2001

Employment Generation

The role of aquaculture in providing employment and income generation is not well documented in Bangladesh. Rural small-scale fisheries, particularly for income generation and improving standard of living of the fishermen and fish farmers, have been matters of major concern. It is well known that adoption of aquaculture as a part-time occupation could contribute substantially to the income of farmers. Integration of aquaculture with agriculture and or animal husbandry is becoming a major rural development activity in the rural areas of Bangladesh. It is evident that aquaculture could be the most appropriate part-time occupation, if not full time, for many fish farmer families. It has the appreciable potential for the involvement of women and the overall increase of family incomes.

The development of inland aquaculture with proper utilization of water bodies can generate employment and higher income in the rural areas. The valuable inland aquaculture resources of Bangladesh provide a tremendous opportunity to uplift the conditions of the rural poor from the continuous oppression of poverty. The interest in investment in aquaculture is now increasing.

Pond fish production leads to the demand for fish production in hatchery. The hatchery based fish seed production is mostly a technical part of the pond fish production process. The hatchery farmer needs to know the technical know how on seed production technology and they have to work full time in the hatchery during the seed production season. Some times they have to hire people to work in their farm as full or part-time workers. The hatcheries produce spawn^g or fry^h to sell to the nursery farmers for producing fingerling. The production of fingerling is also an intensive farming system. The farmer has to work in their farm at least 3-4 months full time during the fish seed rearing season. The hatchery produced fingerling is usually brought by the fish seed vendor to the pond fish farmer. So, it's a production cycle, which is providing employment opportunities in each of the farming operations for the rural inhabitants in Bangladesh.

In this study, it was observed that hatchery based farming operations has provided opportunities for employment for a large number of persons, both directly and indirectly. The hatchery farmers were engaged full

time in their hatchery business. Each hatchery farmer employs on an average five people on full time basis other than some of their family members, including women were also engaged in this business. A large number of people were also engaged in fish fingerling production as nursery farmers. It was found that 500 people were employed in a full time basis in the nursery business. A large number of people (3000) were hawking fish fry, who were mainly seed vendors. Increased employment opportunities have also been created due to the increasing use of unutilized pond for fish cultivation.

Figure -2 shows the employment opportunities created in the study sample.

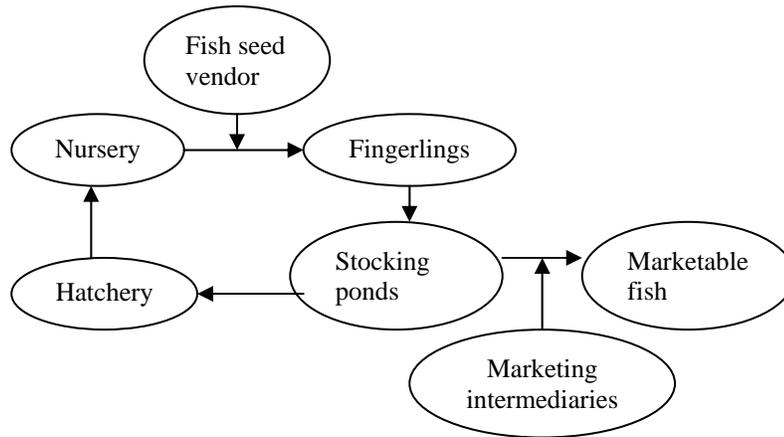


Fig: 2-: Employment opportunities created in different stages of fish farming operations

Generally small-scale aquaculture farming provides more employment opportunities per unit of capital invested than the larger farms. In addition, they have the advantage of being more widely distributed geographically and locally owned, enabling improved income distribution among the population. Therefore preference should be given for small-scale farms in people oriented aquaculture. However, the size and production should be adequate enough to reach the targeted income in order to meet their basic household needs and should also conform to the minimum economic size of the particular type of farming.

CONCLUSION

Irrespective of economic or other benefits of large-scale aquaculture operations, greater emphasis is laid on small-scale farming in developing countries like Bangladesh. This is largely because of the opportunities it offers for part and fulltime employment, which help in sustaining farmers and fishermen in rural areas, and reducing the drift of population to urban areas.

In this study it was found that majority of the fish seed production and fish marketing functionaries reported that different stages of fish farming operations and marketing of fish and other fishery related activities were their principal occupation. They got a major part of their earnings from these sources and have a good amount of earnings per household per month. Many of the hatchery farmers, aratdars and some of the nursery farmers and wholesalers had surplus income after meeting their basic household needs. They use their surplus in their farming operations and marketing business, purchasing land etc.

In case of living expenses, the fish seed vendors, farias, beparis, and retailers spend more than half of their income on food items, which was about 40% for aratdars, wholesalers and hatchery and nursery farmers. Share of expenses on non-food items like clothing, housing, health, education also varies within the sample respondent household group. A general trend of increase in expenses for clothing, education, health and housing with the increase in income was also evident, but the proportion of incomes spent on food gradually decreased with the increase in income level.

Rice was the common food of all meals of the sampled families. Data also reveals that, all of the sampled families took fish protein more than the national average and the consumption rate was much higher in case of pond fish farmers, hatchery and nursery farmers and the aratdars (more than 100gm/capita/day). The consumption of other protein food like eggs, milk and meat were higher in higher income groups like hatchery and nursery farmers and aratdars and wholesalers.

In the household surveyed it was evident that, the overall sanitation situations among the sample respondents were in poor condition. Only some of the household categories like hatchery farmers, aratdars, and

wholesalers had better sanitation facilities than the others. Sanitation conditions were poor not only due to their financial inability, but also due to the lack of their awareness.

The development of freshwater pond fish culture in rural areas of Bangladesh can generate income and employment opportunities, as it was found that hatchery based fish farming operations had provided opportunities for employment for a large number of rural people both directly or indirectly. In each hatchery at least 5 persons were engaged as full time employee besides members of the family who own or ran the hatchery. A large number of people were engaged in fingerling production in nursery and hawking fish fry/fingerling to the fish farmers.

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Endnotes

^a. Hatchery: It is the fish seed farm for spawning and hatching.

^b. Nursery: Ponds where hatchlings are grown to fingerlings

^c. Fish seed vendors: The People hawking fish seed and sell it to the fish farmers.

^d. *Faria*: The *farias* are small traders who purchase fish mostly from the fishermen and the fish farmers and sell them to the *beparis*.

^e. *Beparis*: They are the traditional fish traders, who purchase fish from the fishermen and sell their commodities to the wholesaler or retailers through the *aratdar* or commission agents.

^f. *Aratdars*: The *aratdars* is a licensed holder commission agent. He has a fixed establishment in fish assembly centers or wholesale fish market and operates between *farias* and *beparis* on the one side and with retailers on the other.

^g. *Spawn*: It is the newly hatched fish larva up to the stage so long derives food from the yolk as attached to body.

^h. *Fry*: It is the fish larva when it starts feeding upon the natural food from water body after the absorption of yolk sac and takes the actual shape of a baby fish. Fry length varies from 15-30mm.