



# International Journal of Fisheries and Aquatic Studies

E-ISSN: 2347-5129

P-ISSN: 2394-0506

(ICV-Poland) Impact Value: 5.62

(GIF) Impact Factor: 0.549

IJFAS 2020; 8(2): 235-240

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[www.fisheriesjournal.com](http://www.fisheriesjournal.com)

Received: 01-01-2020

Accepted: 03-02-2020

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## Leased pond fish farming and livelihood status of farmers in Jamalpur district

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### Abstract

Sixty pond fish farmers of three upazilas (sub-districts) were interviewed with structured questionnaire. Farmers cultured fish more intensively using sufficient fertilizers and supplementary feeds and production was 7,549.5 kg/ha. Price of inputs, lack of money, lease cost and disease control were the major problems. Feeds cost was the highest (55.6%) of total cost and benefit cost ratio was 1.28. Fish farming was the primary occupation for 70% respondents and 48.3% farmers was found depending on loan. Most of the fish farmers (76.7%) had ordinary social status and 83.3% had scientific training. Household income was increased 69.6% and improved lifestyle after practicing fish farming. Farmers should be given facilities on input availabilities and credit facilities and communication should be developed with upazila fisheries officer and fisheries scientist.

**Keywords:** Leased water, fish farmer, cost-benefit, livelihood status

### 1. Introduction

There is great potential and scope for the fisheries and aquaculture sector in the economy of Bangladesh and its contribution is now well recognized in the world [1]. This sector plays a significant role for reducing protein deficiency and malnutrition, generating employment and earnings foreign exchange [2]. It performs a significant GDP growth rate over the last ten years, which is almost steady and encouraging varying from 4.76% to 7.32% with an average growth rate 5.61% [3]. Bangladesh stands 4<sup>th</sup> position at present in freshwater fish production, where closed water fisheries, i. e. aquaculture contribute 52.32% of the total fish production [4]. Closed water pond aquaculture can generate income and employment and could improve the quality of life of the rural poor in Bangladesh [5]. In order to meet the increased domestic demand for fish, the Department of Fisheries and some non-government organizations (NGOs) are encouraging people to increase fish production in closed water bodies.

A vast majority of the poor lives in rural areas with very limited employment opportunities and some of them are somehow involved in pond fish farming throughout the country. Jamalpur district is one of them where a vast opportunity exists in fish farming and large number of rural households is involved in this activity as a main source of employment as well as household income. Many farmers are converting their rice field into pond for fish culture in this area, as it is profitable than rice cultivation. Several NGOs (BRAC, Grameen Bank, ASA, Proshika, Caritas, World Vision, Gonosahajjo Sangstha, Annesha, etc.) are working in these areas with a view to providing better life for marginalized communities with providing financial facilities. Thus, marginalized people take such opportunities and invest money for leasing pond and other closed water body for fish culture. On the other hand, a large number of households having a single pond and they can not culture fish profitably and hence, some people take lease these ponds and cultivate them intensively on commercial basis. In addition to this, they take lease public closed water body and cultivate them either secondary or primary source of income by applying improved input management and technologies. Therefore, Jamalpur district has been chosen for this study.

A large number of studies have been done to determine the cost benefit of pond fish culture [6, 7, 8] and livelihood status of fish farmers [8-10]. But little work has been done like such types of investigation for leased water fish farming in the country. The research has given much emphasis on focusing the issue of farming practices and profitability of leased pond farming and farmers' livelihood.

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The findings of the study could be help government to enrich formulation and implementation of appropriate policy measures to improve living standard of the rural people and to provide valuable information to the researchers who are interested in conducting similar type of research in future. Thus, the study was conducted to know the status of leased water fish farming and to determine the cost-benefit and livelihood status of the farmers.

## 2. Materials and Methods

### 2.1 Experimental layout

The location Jamalpur was selected purposively as it has available closed water bodies, identical characteristics like topography and climate conditions for fish production and better communication facilities. Also, a large number of fish farmers take lease water for fish culture commercially. The district lies between 24°34' and 25°26' north latitudes and between 89°40' and 90°12' east longitudes with an area of 2031.98 sq. km. Three sub-districts (upazilas) Jamalpur sadar, Melandah and Madargonj were selected using simple random sampling technique from the list of sub-districts. The areas of these sub-districts were 508.80 sq. km., 258.32 sq. km. and 225.39 sq. km., respectively. A large number of these rural people are fishermen; they usually catch fish from inland water sources like ponds, beels and closed water body.

### 2.2 Sample and collection of data

Sixty farmers were selected through simple random sampling technique for conducting the survey, of which 28 from three villages of Jamalpur sadar, 18 from two villages of Melandah and 10 from one village of Madargonj sub-district. Data were collected from the selected farmers by face-to-face visits with a structured questionnaire. The time period for data collection was from January to April 2018 just after the harvesting period. The collected data were checked and verified by the upazila fisheries officer to be sure that the answers of each question were properly recorded. If any data appeared to be inconsistent, the farmers were again communicated for correct answers.

### 2.3 Data processing and analysis

The collected data were entered into Microsoft Excel and analyses were carried out using Statistical Package for Social Science (SPSS), version-16. The cost incurred for fingerlings, manure cum fertilizers (lime, manure, urea and TS), feed, labor (hired), utility (maintenance, lime cost, transportation cost, etc.) were considered as variable cost. Whereas the expenses on land rent and depreciation of farm tools and machineries were included under fixed cost. The total cost (TC) of production was calculated by summing total variable cost (TVC) and total fixed cost (TFC) incurred in the production process. Gross return (GR) = Total price of fish produced (price of consumed fish and price of selling fish). Gross margin (GM) was calculated by deducting total variables cost (TVC) from gross return (GR). Similarly, net return (NR) was calculated by deducting total cost (TC) from gross return (GR). The benefit cost ratio (BCR) was calculated by dividing gross return (GR) with total cost (TC).

## 3. Results and Discussion

### 3.1 Farming Practices of Leased Pond

#### 3.1.1 Culture System

The respondents in the study area cultured several types of fish species together such as Indian major carp (*Labeo rohita*, *Catla catla* and *Cirrhinus cirrhosus*), exotic carps and mono

sex tilapia (*Oreochromis niloticus*) to earn higher amount of profit from fish production, as poly-culture is a profitable fish culture strategy. Fish culture period ranged from 8 months to 10 months with an average of 9.03 months. This period ranged from March to December <sup>[11]</sup> and 4-6 months <sup>[1]</sup>. All of the surveyed farmers applied fertilizers and supplementary feed to expect higher fish production. Almost 90% farmers <sup>[12]</sup> and 95% farmers <sup>[1]</sup> applied supplementary feed in pond fish culture. It means that the studied farmers cultured fish more intensively for higher return. The data showed that 11.67% of the respondents had marginal (up to 50 decimal), farms whereas 41.66%, 40% and 6.67% of the respondents had small (51-150decimal), medium (151-250 decimal) and large (above 250 decimal) farms, respectively and average water body per farm was 0.64 ha (153.3 decimals).

#### 3.1.2 Input Use for Fish Production

To make fish culture as a profitable business; it is very essential to select quality fingerlings. The amount of fingerlings used per hectare ranged from 148.2 kg to 205.8 kg with an average of 166.7 kg. Two types of fertilizers: organic (cow manure) and inorganic (urea and TSP) fertilizers were used in pond fish culture. The amount of cow manure per hectare ranged from 154.4 kg to 988 kg with an average of 474.1 kg, urea 25.8 kg and triple super phosphate (TSP) 24.3 kg. These results agree with the result for cow manure (500 kg/ha) <sup>[13]</sup> and for urea and TSP (24.7 kg/ha) <sup>[14]</sup>. Farmers used fish feeds like nursery feed (2100.3 kg) for nursery ponds, starter feed (1503.6 kg) for starter ponds, grower feed (1941 kg) and finisher feed (2,557.1 kg) per ha (Table 1). The annual fish production varies because of differences in pond size, depth, categories, use of feeds and other inputs and management practices. In the study area it was found that per farm fish production ranged from 1,300 kg to 8,500 kg with an average 4831.8 kg and 7,549.5 kg/ha. Average fish production was found 3,598.7 kg/ha in carp poly-culture in Rajshahi and Natore districts <sup>[15]</sup>, 3,743 kg/ha in Mymensingh <sup>[16]</sup> and 6,641.7 kg/ha Indian Major Carp in Gupalpur of Tangail district <sup>[17]</sup>. Higher production of this study may be due to more intensive culture and commercial point of view.

#### 3.1.3 Problems of Leased Pond Fish Farming

Fish farmers were faced a number of problems in fish culture activities in the study area. The major problems were the high price of inputs (61.7% of the farmers) whose rank first, selling fish (45%), lack of money/ credit (40%), high cost of leased water body (38.3%), disease control (36.7%) and collection of fish fry (35%). The major problems in fish farming were disease control (48%), production cost (32%) and lack money (22%) <sup>[11]</sup>. Problem of production cost (mainly feeds and seeds) is common in most of the findings <sup>[11, 18, 19]</sup> in Bangladesh. Higher demand of labor for 11.67% and mortality of fish as a major problem (63.33%) due to lack of proper knowledge on the relevant technology <sup>[20]</sup>. Other constraints in leased pond fish farming were the inadequate extension services, thief/ crime/ social barriers, harvesting of fish, lack of education/training, transportation and improper road communication (Table 2). Closed water pond fish farming is profitable but farmers faced some problems and constraints in fish production activities like lack of credit facilities, high price of inputs, lack of scientific knowledge and lack of extension services <sup>[21]</sup>.

### 3.2 Cost Benefit Analyses

Total overall cost of the leased pond fish farming in the study area comprised with fertilization, fingerling, fish feed, lease rent, labor and utility cost for fish culture was Tk. 5,96,251 per hectare. Whereas variable cost was Tk. 4,85,834 per hectare that is 81.48% of the total cost and fixed cost was Tk. 1,10,417 per hectare i.e. 18.52% of the total cost (Table 3). The total cost and variable cost of fish production per hectare were Tk. 3,33,457.75 and Tk. 297,753.86, respectively, i.e. 89.29% of the total cost in Mymensingh<sup>[13]</sup>. Whereas the total cost was Rs. 7,43,798 and the total variable cost was Rs. 5,85,724.58 i.e. variable cost was 79% of the total cost in Nepal<sup>[22]</sup>. The production cost of fish was higher compared to most of the previous study, especially, due to the increase of the price of fingerlings, feeds, fixed cost and labor cost.

**Table 1:** Amount of fingerlings, fertilizers and fish feed used

Characteristics	Range (kg/ha)	Mean (kg/ha)
Fingerlings (kg/ha)	148.2 -205.8	166.7
Cow manure	154.4 - 988.0	474.1
Urea	8.2 - 49.4	25.8
TSP	8.2 - 37.0	24.3
Nursery feed	1482 - 3087.5	2100.3
Starter feed	823.3 – 2964	1503.6
Grower feed	988 - 2964	1941.0
Finisher feed	1646.7 - 4940	2557.1

**Table 3:** Cost and return of pond fish production per hectare per year

Cost item	Cost (Tk./ha)	% Total Cost
<b>Variable Cost</b>		
Fingerlings	21926	3.7
Fertilizer/ manure	22556	3.8
Fish feeds	331385	55.6
Labor cost	88167	14.8
Utility cost	21800	3.6
<b>Total variable cost</b>	485834	81.5
<b>Fixed Cost</b>	110417	18.5
<b>Total cost</b>	596251	
Gross Return	762067	
Gross Margin (GM)	276233	
Net Return (NR)	165147	
Return over per Tk. Investment (NR/TC)	0.28	
BCR (GR/TC)	1.28	

1 US Dollar = Tk. 80

Gross return was found Tk. 7,62,067 and net return (profit) was Tk. 1,65,147 per hectare. The similar result of profit in fish culture was found by previous study<sup>[9]</sup>. The gross margin of pond fish production was estimated as Tk. 2,76,233 indicates that it is a good amount of return over variable cost of production. Return over per taka investment was calculated as the ratio between net return and total cost and this figure was 0.28 which indicates that by spending Tk.100 net return of Tk. 28 was obtained. The benefit-cost ratio (BCR) was 1.28 that indicates leased pond fish farming was profitable in Jamalpur. The finding justifies that benefit cost ratio was greater than one, suggesting there was a potential for pond fish culture through leasing system. Benefit cost ratio of pond fish farming was 1.51 in Tangail<sup>[20]</sup>, 1.30 in Mymensingh<sup>[13]</sup> and 1.78 in Jessore<sup>[13]</sup>.

### 3.3 Livelihood Status of Fish Farmers

The livelihood of a household or individual can be interpreted as their means of living and their means of living is based on

**Table 2:** Problems regarding fish farming

Problems	Numbers	%	Rank
Lack of money/ credit	24	40.0	III
Lack of education/ training	12	20.0	X
Thief/ crime/ social barriers	14	23.3	VIII
Improper communication	9	13.3	XII
High cost of leased water	23	38.3	IV
Collection of fish fry	21	35.0	VI
High price of inputs	37	61.7	I
Disease control	22	36.7	V
Inadequate extension services	20	33.3	VII
Harvesting of fish	13	21.7	IX
Transportation	11	18.3	XI
Selling/ marketing	27	45.0	II

The larger amount of money spent by fish farmer in the study area was mainly on purchase of fish feeds (55.58%) and labor cost (14.79%). The result of highest feed cost is in agreement with the findings of<sup>[23]</sup> who found out that feed accounted for the highest cost (59.45%) of fish production in Nigeria. Cost of fingerlings was Tk. 21,926 and fertilizers and manure was Tk. 22,556 per hectare and those were about 3.68% and 3.78% respectively of the total cost. Cost of fingerlings (5.39%) and labor cost (21.42%) were higher and fertilizer cost (1.25%) was lower<sup>[6]</sup> than this study. The total utility cost including pond management cost, liming cost and transportation cost was Tk. 21,800 i.e. 3.65% of the total cost.

their capabilities, assets (financial, physical, human, natural resource and social) and activities<sup>[25]</sup>. A livelihood is sustainable when it can cope with recover from stress and shocks and maintain to enhance its capabilities and assets both now and in the future<sup>[26]</sup>.

#### 3.3.1 Human Capital

The age of the fish farmers ranged from 30 years to 53 years with an average of 42.65 years. The data indicated that 20% of the selected respondents were of age group 30 years to 39 years, 60% of the respondents were of age group 40 years to 49 years and the rest 20% of the respondents were of age group above 50 years. This information implied that 60%, which was the majority of the sample farmers were of age group 40 years to 49 years indicating that they provided more physical efforts for fish farming. The results showed that 8.33% of the respondents in the study area were illiterate, 41.67% of the respondents had primary education, 23.33% of the respondents had secondary education, 16.67% had higher

secondary education and 10% had graduation and above. Education level is better than the study of Zaman *et al.* (2006) [26] who observed that up to primary level educated (14.4%) followed by secondary level (8.9%) and higher secondary or above (6.7%) levels. Family size of the respondents ranged from 4 to 9 with an average of 5.92. The data showed that 10% of the respondents had small size family (up to 4 persons), 65% of the respondents had medium size family (5 to 6 persons) and 25% of the respondents had large size

family (>6 persons). It is observed that the average family size was 5.92 that is higher than the national average of 4.50 persons. Experience in pond fish farming of the respondents ranged from 4 years to 15 years with an average of 8.02 years. It was observed that 28.33% of the respondents had low experience (up to 5 years), 58.33% had medium experience (6-10 years) and 13.33% had high experience (>10 years) in fish culture (Table 4).

**Table 4:** Human capital of farmers

Human capital	Numbers (N=60)	%
<b>Age (Year)</b>		
30-39	12	20
40-49	36	60
>49	12	20
<b>Level of Education</b>		
Illiterate	05	8.3
Primary	25	41.7
Secondary	14	23.3
Higher Secondary	10	16.7
Graduation	06	10
<b>Family size (Number)</b>		
Small (up to 4)	06	10
Medium (5-6)	39	65
Large (>6)	15	25
<b>Fish Farming Experience</b>		
Low (up to 5 years)	17	28.3
Medium (6-10 years)	35	58.3
High (>10 years)	08	13.3

### 3.3.2 Physical Capital

The nature of house, sources of drinking water, sanitary facilities, treatment facilities and transport and communication systems of farm households indicate their livelihood status. Most of the houses of fish farmers (56.7%) made of tin-shed, 30% brick-build and 13.3% were kacha. The study showed that 100% of the fish farmers used tube-well water for drinking purposes that indicates a positive sign for health. This result is agrees with the results of Provakar (2013) [8]. But a few farmers (20%) shared with relatives or collected from neighbor's tube-well. Health facilities of the fish farmers were limited. It was found that 58.3% of the fish farmers were depended on village doctor, 31.7% got health service from upazila health complex or private practitioners and 10% did not take treatments during sickness (Table 5). Almost all the farmers enjoyed electricity facilities in the study area. It becomes impossible for the rural people to enjoy the facilities of modern technology without improved transport system. The study areas are well communicated through concrete, semi-concrete, mud roads and railways. The people usually travel by van, bicycle and motorcycle from their native village to nearby highway and then they travel by buses, trains, CNG driven scooter, auto-rickshaws elsewhere in the country whenever they would like to go. Due to well communication with the different markets, farmer may get fair price for their fish. However, they very often go to district town for selling fish at those markets.

### 3.3.3 Financial Capital

Agriculture and fish farming are the main source of employment as well as income for people of the study area. Approximately 70% of the sample respondents considered fish farming as their primary occupation and 30% of the respondents considered fish farming as their secondary

occupation. Other sources like crop cultivation, business, shop keeping, rickshaw pulling, etc. Source of fund is an important factor, as huge fund is needed for fish culture. The major sources of fund of the farmers were own (51.67%), bank loan (35%), and loan from NGO, relatives and moneylenders 13.33% (Table 6). Proportion of own source is agreeing with the findings of Sarwer (2016)

**Table 5:** Physical capital of farmers in the study area

Physical capital	Numbers	%
<b>Nature of house</b>		
Brick build	18	30.0
Tin-shed	34	56.7
Kacha	8	13.3
<b>Source of drinking water</b>		
Own tube-well	48	80
Shared tube-well	12	20
<b>Sanitary facilities</b>		
Kacha toilet	17	28.3
Semi-paka toilet	27	45.0
Paka toilet	12	20.0
No toilet	4	6.7
<b>Health treatment facilities</b>		
Upazila health complex	19	31.7
Village doctor	35	58.3
No treatment	6	10.0

### 3.3.4 Social Capital

The fish farmers in the study area had the opportunity to receive training on different aspects of fish culture and related fields. The result showed that 83.3% of the respondents received training on scientific fish farming technique and management system (Table 6). It was found that, 62% farmer had training on fish farming [27] whereas, low proportion (14%) of farmers received training on fish farming [28] and

20% [29]. Most of the fish farmers (76.7%) had ordinary social status, 15% were respectable persons in the society and 8.3% were local leaders. This study is more similar with [8] in respect to ordinary farmers and respectable persons. The social content is important particularly access arrangement and assessments of benefits to livelihood [15].

**Table 6:** Financial and social capital of farmers

Financial and social capital	Numbers	%
<b>Occupational status</b>		
i) Primary occupation		
Fish farming	42	70.0
Crop cultivation	06	10.0
Business	12	20.0
ii) Secondary occupation		
Fish farming	18	30.0
Crop cultivation	11	18.3
Business	13	21.7
Shop-keeper	10	16.7
Rickshaw-puller	08	13.3
<b>Total annual income</b>		
From fish farming	-	60.9
From other sources	-	39.1
<b>Source of fund</b>		
Own source	31	51.7
Bank loan	21	35.0
NGOs and others	08	13.3
<b>Training on fish farming</b>		
Yes	50	83.3
No	10	16.7
<b>Social status of farmers</b>		
Ordinary	46	76.7
Respectable	9	15.0
Local leaders	5	8.3

### 3.3.5 Livelihood Outcomes

Farmer's average annual income was Tk. 1,70,500 before they were engaged in fish farming but it was increased to Tk. 2,89,149 after practicing fish farming, i.e. 69.6% of the total income was increased due to leased pond fish farming. Similarly, their average annual savings were Tk. 8,000 before starting fish farming and it was increased to Tk. 24,000. Also, their average land asset was increased to 47.65 decimals in place of 31.86 decimals. Farmers had been economically benefited after engaged in fish farming and their lifestyle had become changed. As a result, they had realized the importance of education and they were interested in education and started to send their children to school. After being economically self-reliant through leased pond fisheries by increasing income capacity, savings and creating employment opportunities, the rural fish farmers had developed their lives and livelihoods. Livelihood outcomes of fish farming and related activities are positive, most of the people have increased their income and 92 per cent farmers have improved their socioeconomic conditions [9].

### 4. Conclusions

Leased pond fish farming plays an important role to improve farmers' income, socioeconomic conditions and livelihood status in Jamalpur district. Increase of income, savings, land resource, child education, employment opportunity as well as higher fish production from intensive culture indicated leased pond fish farming is a profitable business that can help the farmers to improve their livelihood status. Government should take proper steps to minimize the cost of inputs, especially

feed price and solve relevant problems. Farmers should be given facilities on improved training program, input availabilities and credit facilities. Effective linkage should be developed between Upazila Fisheries Officer, fisheries scientist and fishermen. The scope and findings of this research should be generalized through all over the country.

### 5. Acknowledgement

Comments from Professor Dr. Muhammad Mahfujul Haque, Department of Aquaculture, BAU, are much appreciated. Thankful acknowledgment to Fisheries Office, Jamalpur sadar upazila and fish farmers to actively participated and coordinated for conducting the study.

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