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AQUACULTURE PRACTICES AMONG THE FISH FARMERS OF BHALUKA UPAZILA, MYMENSINGH - SCENARIO FROM A DECADE AND HALF AGO

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Key words : Pond fish culture, Socioeconomics, Constraints, Bhaluka, Mymensingh

Abstract

Mymensingh is the top inland aquaculture producer in Bangladesh. This study was undertaken to identify the barriers to develop earthen pond fish farming entrepreneurship in Bhaluka Upazila, Mymensingh about a decade and half ago when the fish culture revolution has been started. In this study, fish farmers were selected randomly from three villages that followed mono or composite-fish culture in earthen pond environment. More than 14 species being cultured of which half of them were exotic. The feasibility of pond fish culture was found viable due to proper communication with Dhaka wholesale fish market along with other destinations. In addition, hatchery sources of fish fry and fingerling, access to fish feed and financial support were further encouraged farming these perishable items. Education level of farmers, lack of technical knowledge of fish culture, poor extension service and lack of information about the pond management were identified as the potential barriers for the improvement of fish farming entrepreneurship. The higher stocking density as well as poor water quality conditions were facilitated to lead lower fish production and profit. The small-scale farmers (47.79%) with higher stocking density had lower profit (Tk 1.44 /fish) and large-scale farmers (19.85%) with lower stocking density showed higher profit margin of Tk 3.53 /fish. Therefore, this study suggests the optimal fish stocking density in earthen pond fish farming system which could be augment the fish production and enhanced profitability.

Introduction

Fish and fishery resources play a vital role in improving the socio-economic condition, combating malnutrition and creating employment opportunities in Bangladesh. This country is endowed with vast water resources and it has two sources of

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inland fisheries: open water fisheries and closed water fisheries. The inland closed water fisheries dominantly used for culture fisheries. In the past, inland open water capture fisheries were the major source of fish and even in 1997-98 it contributed about 48% of total fish production in Bangladesh[1]. But due to some man-made intervention and natural degradation, production of this natural source has declined to 41% in 2006-2007[2]. In this regard, for the Department of Fisheries of government has placed great importance in culture fisheries and production of this source has increased steadily and made the production from 945,812 mt (39% contribution) in 2006-2007 to 2,466,601 mt (56.76% contribution) in 2019[3]. In this context, development of culture fisheries (aquaculture) is very important to meet the increasing demand for fish and to feed the people of Bangladesh. There are around 1,12,000 fish farmers, mostly in Trishal, Gouripur, Phulpur, Tarakanda, Bhaluka and Muktagachha upazilas, as well as 300 hatcheries and 900 nurseries in the Mymensingh district. The fish from the district are sent to different parts of the country including Dhaka, Sylhet and Chattogram year-round[4].

Considering economic profitability of earthen pond fish culture in comparison to cultivating rice or any other crops, farmers of Mymensingh district is converting their rice fields into pond. Now a days pond fish culture has become a popular enterprise to the farmers in the study area. However, study of socio-economic and culture of a particular area was taken in Bangladesh especially for an adequate culture area like Mymensingh to investigate and identify the fish culture practice and to find out the potential barriers of pond fish culture.

Materials and Methods

The present study was conducted in January to October 2007 at Bhaluka Upazila, Mymensingh district (Fig. 1). This Upazila with an area of 444.05 sq km is bounded by Fulbaria and Trishal upazilas on the north, Sreepur Upazila on the south, Gafargaon Upazila on the east and Sakhipur and Ghatail Upazila on the west. Bhaluka Upazila, there are more than 329 beels and 15,342 of ponds[2]. Farmers were randomly selected from the three villages depending upon their cooperation.

A questionnaire was prepared for data collection and for pre-tested. Principal method of data collection was participant observation (Annex 1). For the purpose of interview, a prior appointment was made with the sample farmers. The dates, time and place of interview were fixed on mutual agreement. At first, the purpose of interview was explained to the farmers. Such interviews were done with particular persons involved only with fish culture. About 30 parameters thought to be good indicators for assessing the socio-economic status of the farmers Islam and Dewan[5]. The parameters covered the aspects of farmer's personal and family profile. The parameters were age

group of fishermen, family size, literacy status of farmers, income distribution, expenditure, loan holding, source of fry and fingerling, source of fish food etc.

In the initial stage, rapport building was made with the fish farmers. Three of the informants from local communities who is much familiar with the fishermen were engaged with this survey at the beginning. This has aided to build easy rapport with the people. Some secondary data were collected before going to field. Photographs on different aspects of fishing life were taken Fig. 2 A-C.

Fig. 1. Map of Mymensingh district showing the study area (marked)

Fig. 2. A. Selected ponds, B. fish farmer giving feed to pond fishes and C. Bhaluka fish pond.

The interview schedule and collection of data is the crucial part of this study. Before preparing the final interview session a draft or pre interview session was conducted to make the necessary changes in the questionnaire so that participants enjoy and do not get bored to give the answers. After draft interview, modified and rearranged the questionnaire according to the experience gathered in the pre-testing. The final schedule was then developed in logical sequence, so that the farmers could answer chronologically (Annex 1).

Results and Discussion

Trend in fish culture: In 2001-02 fiscal year Mymensingh is one of the nine districts of Bangladesh produced fishes of more than 20,000 metric tons (Fig. 3; FRSS 2003). But in tine at present (2018-2019) Mymensingh district is producing the highest of 370836 metric tons (Fig. 3). Among five upazilla's, Bhaluka is important.

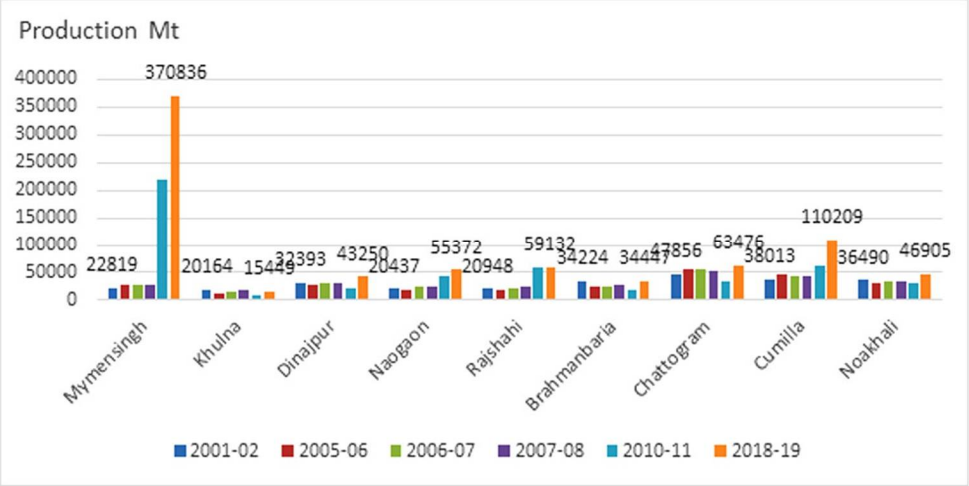

Fig. 3. Culture fish production of nine districts of Bangladesh based on more than 20,000 mt production from 2001-02 to 2018-19 with different intervals.

Professional fish farmer: People engaged only with fish culture round the year is called professional fish farmer. They have no other occupation. This type of family totally depends on fishing. On the basis of percentage composition, the professional fish farmers were accounted of 12% of total fish farmers (Fig. 4).

Part-time fish farmer: People engaged with fishing along with the other occupation is called part-time farmer or seasonal farmer. Among the sample farmers 88% were part time farmers (Fig. 4 and 5). Part-time farmers were found to be engaged with different sectors (such as agriculture, business, teacher etc.).

Size of the pond: Size of pond is crucial factor influencing the use of inputs in fish ponds. A suitable size of pond is required to minimize the cost and maximize the production of fish. Farmers are also classified according to the size of pond they owned. On the basis of pond size farmers are categorized into three, viz. Small scale farmer, middle and large scale farmer.

The farmers have pond <1 acre is called small scale farmer, those have between 1 to 4 acre is called middle scale farmer and the farmer's have pond >4 acres called large scale farmer. In the current study, the number of small scale farmers was 13, middle scale farmers were 9 and the large scale farmers quantity were only 3 (Fig. 5). When a joint family breaks down into a number of families fishing assets also breaks down. As a result with the breakdown of family, the size of pond gradually decreased. So, it is observed that in this area large scale farmers were very few.

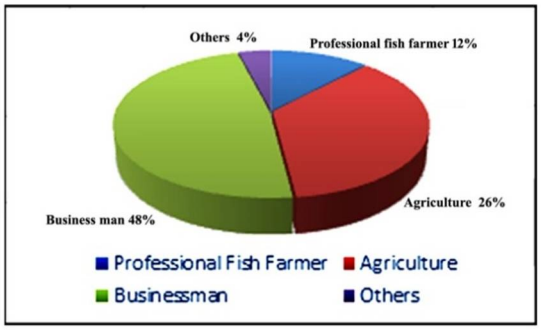

Fig 4. Ratio of sample farmer's basis on profession.

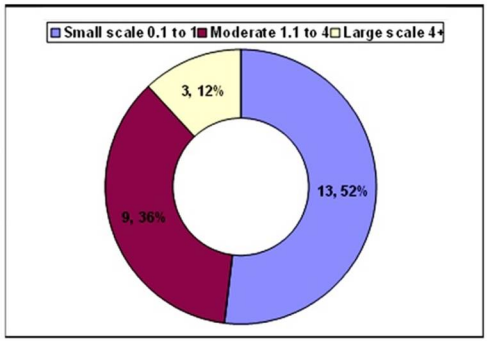

Fig. 5. Showing the farmers type.

Source of fry and fingerlings: In the study area there was one fish hatchery in Bhaluka Upazila. About 70 percent farmers collected their fry and fingerling from the hatchery and rest of the farmers were collecting fry and fingerling from local vendor. Average profit of the farmers who collected fingerlings locally was BDT 62,000 and the farmers who collected fingerlings from the hatchery, profit was BDT 105,000 each year. Locally supplied fingerlings are not maintaining scientific knowledge base and thus they are not high disease resistance.

Fish feed types and feeding method: Most of the farmers supply dry readymade pelleted food. In the study area there were two fish feed factories. Most of the farmers totally depended on this food. Some farmers were found to use homemade food along with this readymade food. Feeding method depends on size of the pond and types of fish and nature of feeding. Some farmers cultured Thai koi, shing, magur and for these types of fish the farmers delivered feed by throwing from all around the pond. Feed was given three times per day. Majority of farmers cultured pangas, tilapia, piranha (banned after 2008), and others carp. These farmers make a platform inside the pond that is quite far

from the bank. From the platform the farmers throw the food. The feed was given two times per day.

Stocking density: Fish cultural methods depend on the stocking ratio of fingerlings. If the stocking density is high the production will get down. In the study area stocking density was 65,000 fingerling/acre for small scale farmer and that was 27,000 fingerling/acre for the large scale farmer. The standard stocking density is 13,320 fingerling/ha according to Chaudhuri *et al.*[3]. It was observed that, stocking density was higher than the standard due to lack of technical knowledge about fish culture.

Harvesting method: Harvesting method depends on the types of fish. Some fishes attain marketable size within a short time. So, these types of fish should be harvest early. Most of the farmers harvest fish several times a year. Mainly native fishes need to harvest early. Most of the small scale farmers have low investment that is why they need to harvest before standard and sell and then spend this money for family purpose. There are very few farmers who harvest fish one time only or follow the standard.

Cost and profit calculation method: Cost was calculated as, Total cost= Food cost + Pond cost+ labor cost + other management cost. Profit is the destination of every business. In fish culture profit depends on expert management, knowledge about fish culture, nutritional quality of feed, suitability of the environment and land for culture, selection of fish species and many other things.

Net profit was calculated as, Net profit = Total sell – Total investment/cost according to Rabbani[6], Shafiqul[7]. After collection, data were analyzed using Microsoft Excel Program to produce graphs.

Education is one of the key factors for the improvement of every sector in a country. On the basis of education, the farmers are categorized into four classes – illiterate, up to primary, up to secondary and above secondary. Percentage of illiterate and below Class V was 56%. Only 32% people were found to complete their primary level education. The percentage of well-educated people was very low (12%) (Fig. 6) indicating the low level of education among the participants in the current study.

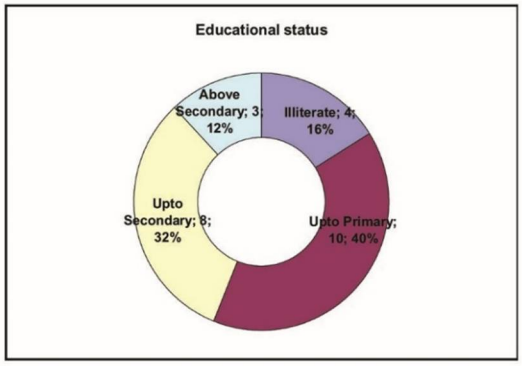

Fig. 6. Showing educational status of farmers.

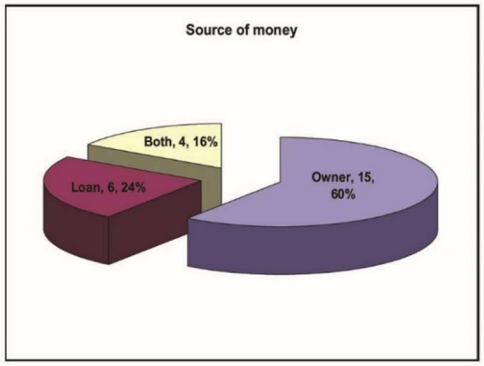

Fig. 7. The source of funding.

Finance is the main factor of every business. Financial condition of the farmers was more or less better in the study area. Most of the farmers were rich and invest their personal money. About 70% of the total farmers used their personal money (Fig. 7). Some of the farmers were found to take loan from different sources such as Mahajan, local cooperative, Krishi bank etc. The farmers get credit facilities from two feed factories- Saudi fish feed and Sunny fish feed mill located near the study area.

In this study area farmers practiced polyculture method. Varieties of freshwater fishes (mainly 14 species) are cultured in this study area. Among them 50% are exotic and 50 % are indigenous (Table 1). Major species are Pangas, Rui, Tilapia, Silver carp which shared more than 75% of total stock. Highly culturable fishes were pangas (29%), rui (20%), tilapia (18%), silver carp (10%), Thai koi (6%), piranha (6%), mrigel (3%), sarpunti (2%), common carp (2%), bighead carp (2%), catla (1%), magur, shing and foli (1%) (Fig. 8).

Table 1. Preferences of different exotic and indigenous fish species found in cultured ponds at Bhaluka in 2007.

Sl. No.	Category of fishes	Scientific name	Local name	Percent farmers involved in culture (%)	Fish released in the pond (%)
1.	Indigenous	*Labeo rohita*	Rui	**92**	20
2.	Indigenous	*Gibelion catla*	Catla	**40**	1
3.	Indigenous	*Cirrhinus mrigala*	Mrigel	**72**	3
4.	Indigenous	*Clarias batrachus*	Magur	**4**	0.9
5.	Indigenous	*Heteropneustes fossilis*	Shing	**4**	0.1
6.	Indigenous	*Notopterus notopterus*	Foli	**4**	0.03
7.	Exotic	*Pangasius hypophthalmus*	Thai Pangas	84	29
8.	Exotic	*Barbonumus gonionotus*	Sarpunti	**64**	2
9.	Exotic	*Hypophthalmichthys molitrix*	Silver carp	**72**	10
10.	Exotic	*Cyprinus carpio*	Common carp	**76**	2
11.	Exotic	*Aristicthys nobilis*	Bighead carp	**36**	2
12.	Exotic	*Oreochromis niloticus*	Tilapia	**92**	18
13.	Exotic	*Piaractus brachypomus**	Red-bellied Paco *	**24**	6
14.	Exotic	*Anabus testudineus*	Thai Koi	**12**	6

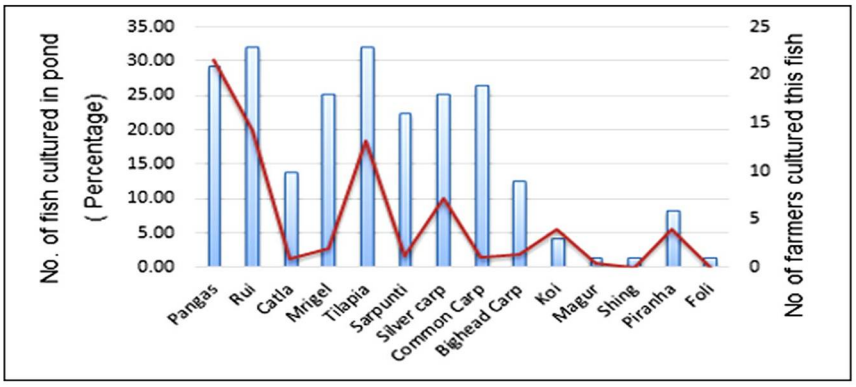

Fig. 8. Comparative statistics of farmers choice of species cultured (fish in blue bar; farmers in line).

Tilapia and pangas are fast growing exotic fish, disease resistant, easy to culture, delicious exotic fish, opined by the farmers. Rui is also favorite and popular among the people of Bangladesh. During culture system artificial food is essential. Large amount of feed need to supply for exotic fish. Several indigenous fishes are cultured with the exotic fish for extra income. There will be no need to supply additional food and the average production cost will decrease. As a result, most of the farmer cultures these fish together.

Items of cost for fish farming was the cost of fingerlings, feed, fertilizer, and use of human labor for different operation were the main cost items of variable cost while land use cost was considered as fixed cost. Secondly, not all variable costs were incurred at the beginning of the season rather costs of fish production were spread over the whole production period. Accordingly, interest on operating capital (OC) was charged on total investment at the rate of 13% per year according to the Serajul and Rashid[8], Zaman *et al.*[9]. For intensive culture feed cost is another prime cost and the amount is high (Fig. 9).

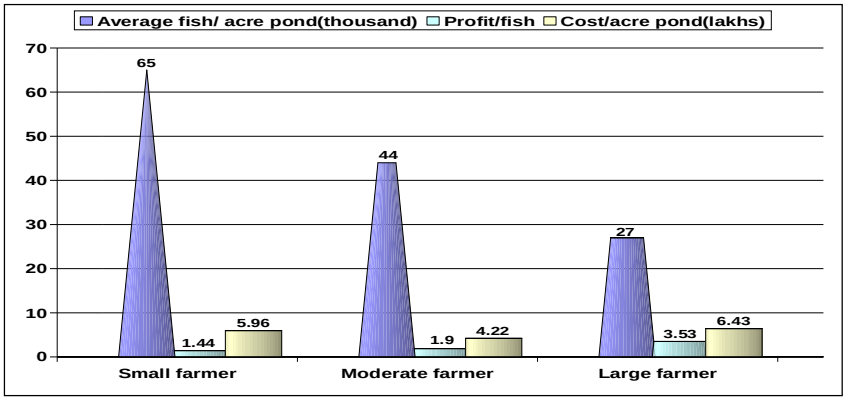

Fig. 9. Showing the relationship among average stocking density, cost and profit.

In this study it has been observed that stocking density or average number of fish was higher for the small farmer but their investment is low. In the middle stage of the project they cannot bear the feed, labor and other management cost. To complete this project, they have to harvest partially before the standard time. As a result, they are not getting the desired profit. On the other hand, large scale farmers have the sufficient investment and at the same time their total cost is lower due to maintain the standard stocking density. The very recent data of culture fish status is given in Table 2.

Profit is the key point of fish culture. From Fig 9, it was observed that among the small farmers stocking density high 65,000/acre than the others, but profit is low that is BDT. 144,000/acre. Land area the small farmer group made a noticeable profit than other

Table 2. Culture fish production in Bhaluka in 2016 (DoF[2]).

Sl.	Sources	Area (ha)	Production (mt)	Unit production (kg/ha)
1.	Pond	2912.47	33176.30	11391.12
2.	Commercial farms	1796.10	47325.35	2634895.05
3.	Other ponds	9039.11	5107.14	565.00
4.	Rice-fish culture	86.21	32.27	374.32
5.	Cage -fish culture	1.20	15.43	12858.33

two groups. On the other hand, among the large farmers stocking density is very low 27,000/acre but profit is high which is BDT. 350,000 /acre. Among the moderate farmers stocking density and profit is in between large and small farmers. It can be concluded that poor education level, lack of technical knowledge on pond fish culture, poor extension service and lack of information about the pond management were identified as the potential barriers of improvement of pond fish culture entrepreneurships in the study area.

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Annex. 1. Salient features of Questionnaire

Personal information		
Name- Address- Other occupation-	Age-	Family Size-
Farming information		
Number of pond-	Size of pond-	Pond – Owner / Lease
Type of culture- Mono culture / Poly culture	Method of culture- Intensive / Semi intensive/ Extensive	Farmer types- Large/mid/small
Investment - Loan/self	Duration of fish culture –	Duration of fish culture –
Name of fish fingerlings Price of fingerling –	Type of fish – Native / Exotic	Source of fingerling
Ratio of fingerling	Time of Release	How to ensure the quality of fingerlings
Type of feed- Method of feeding	Source of food- Firm made feed / readymade	Name of Ingredients (if firm made)- Feed making process-
Learning source of fish culture-Ancestor/ Training	Have any idea about soil / water quality- Yes / Not If yes how?	Duration of fish culture Time of harvesting-
Market Channel- Whole sale / Retailer	From where buyers come from	Selling price- Size or weight during sell-
Labor cost-	Total cost-	Profit-
Which fish culture is profitable-Native/ Exotic	High price in which fish- Native / Exotic	How to improve culture native fishes
Problem faced during culture-	Diseases- What measure taken	