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Pond fish culture and socio-economic status of fish farmers in Parbatipur upazila of Dinajpur district, Bangladesh

Kaniz Fatema • Kamrun Naher • Krishna Chandra Roy • Rubaiya Pervin

Department of Fisheries Management, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh.

Correspondence
Rubaiya Pervin; Department of Fisheries Management, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200, Bangladesh.
rubaiya_parveen@yahoo.com

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Abstract

This study investigates the socio-economic conditions of the fish farmers and aquaculture status in Parbatipur of Dinajpur district during May to October 2016. Majority of the fish farmers belonged to the age group of 31 to 40 years (44.3%) and represented by 68.6% Muslims. Among them 40% had secondary level of education and most of the families were nuclear (64.3%). Farmers were involved in fish culture as their primary (24%) and secondary occupation (53%). Over 80% of the farmers had electricity facilities and 41% of them received health services from the village doctors. Only 9% of the fish farmers received formal training on fish culture. The average aquaculture pond size was 0.18 ha, where 84% ponds were perennial. The average stocking density was 23208 fingerlings ha^{-1} whereas organic fertilizer, urea and TSP were applied at 8665.4 kg ha^{-1} yr^{-1}, 210.1 kg ha^{-1} yr^{-1} and 133.5 kg ha^{-1} yr^{-1} respectively. Pre and post stocking liming doses were 205.7 kg ha^{-1} yr^{-1} and 138.4 kg ha^{-1} yr^{-1} respectively. Necessary training facilities with institutional supports, credit facilities and extension services could play an important role in improving the fish production.

Keywords: Fish farmer; livelihood; pond aquaculture; Bangladesh

1 | INTRODUCTION

Bangladesh having an extensive and huge water resources scattered all over the country in the form of small ponds, beels (natural depressions), lakes, canals, haors, baors, small and large rivers and estuaries covering an area of about 4.7 million ha (FRSS 2016). Total pond area of Bangladesh is estimated to be 0.37 million ha where 1.6 million metric ton (MT) of fish is being produced yearly (FRSS 2016). Pond culture fisheries contribute 43.8% of the total fish production (FRSS 2016). Aquaculture is a significant socio-economic activity, especially for rural communities, contributing to livelihoods, food security and poverty reduction through such mechanisms as income generation, employment, services, diversified farming practices, domestic and international trade and other economic investments serving the sector (Edwards 2000; NACA/FAO 2004). More than 17 million people including about 1.4 million women depend on fisheries sector for their livelihoods through fishing, farming, fish handling, and processing (BFTI 2016).

For a good aquaculture and increased fish production, it is important to know the existing pond fish culture system

and the problems which are associated with fish culture. Increased pond fish production in Bangladesh would be of help to meet the increasing demand for fish. In order to meet the shortage of fish people are being encouraged by the Department of Fisheries (DoF) of Bangladesh government and some non-government organizations (NGOs) to introduce aquaculture in surrounding water areas, such as pond, beel, haor, baor, beel, etc. Profitable fish production depends on the application of necessary inputs, management and technological development, socio economic status of fish farmers and fishermen which is also an area of interest for researchers to identify the constraints and to improve the current status (e.g. Flowra *et al.*, 2009; Islam *et al.* 2013; Galib *et al.* 2016). In a view of this the present study was undertaken to know the existing culture system and socio-economic status of the fish farmer in Parbatipur of Dinajpur district, Bangladesh.

2 | METHODOLOGY

2.1 Study area and duration

The study site for survey, Parbatipur, was selected in Dinajpur district (25°39'49.28"N 88°55'51.35"E; Figure 1) located in the northern part of Bangladesh. Dinajpur district consists of 13 upazilas (sub-districts) including Parbatipur. This survey was conducted for a period of 6 months, from May to October 2016.

FIGURE 1 Map of Dinajpur district of northwest Bangladesh showing the study area, Parbatipur (source: Bangladesh Water Development Board)

2.2 Sampling procedure

Data was collected from 70 fishermen involved in full-time (primary income source) and part-time fish culture (secondary income source) through a structured interview schedule containing both open and close formed questions. The interview schedule was pre-tested for the necessary corrections, additions or modifications.

2.3 Data analysis:

The data were analysed in MS Excel and presented in simple descriptive forms.

3 | RESULTS AND DISCUSSION

3.1 Socio-economic status of pond fish farmers

The socio-economic status of pond fish farmer was presented in terms of human, natural, financial, physical and social capital.

3.1.1 Human capital: The age of the fish farmers ranged from 22 to 70 years. On the basis of their age, the fish farmers were classified into four categories *viz.* 20–30 years, 31–40 years, 41–50 years, and above 51 years. It was found that majority of the farmers (44.3%) belonged to age group of 31–40 years, followed by 20–30 years (18.6%), 41–50 years (25.7%) and above 51 years (11.4%) groups. Sarwer *et al.* (2016) found the highest numbers (24%) of farmers were within the ages 36–45 years old, 22% belonged to 26 to 35 years followed by 46–55 years (22%), 56–65 years and >65 years (12% each) and 15–25 years (6%) in Subarnachar, Noakhhali. The age group of 41–60 years was the highest (44%) and 20–30 years was the lowest (20%) for fish farmers in Shahrasti upazilla of Chandpur district (Pravakar *et al.* 2013). Ali *et al.* (2009) found that half of the fish farmers (50%) belonged to age group of 31–40 years in Mymensingh district which is more or less agreed to the present findings.

From the present survey, it was found that 68.6% of fish farmers were Muslims and remaining 31.4% were Hindus. Sarwer *et al.* (2016) found that 86% of the pond owners were Muslims and 14% were Hindus in Subarnachar, Noakhhali.

Education is important for the modernization of farm business operation. It was found that highest level of education was secondary (40% respondents) followed by higher secondary (12.9%). Overall fish farmers in general were educated persons. Sarwer *et al. (*2016) reported that 15% respondents had no education, 19% had primary level (up to 5 class), 31% had secondary level (6–10 class), 14% had SSC level (10 class pass), 12% had HSC level and 9% had bachelor level of education. Zaman *et al.* (2006) found that 23.3% farmers were illiterate whereas 14.4%, 8.9% and 6.7% were educated up to primary, secondary and higher secondary or above level respectively.

In Bangladesh, families are generally classified into two types, nuclear family (married couples with children or consist of the member of two generations) and joint fami-

ly (a group of people related by blood and/or by law means the member of three or more generations). In the present study 35.7% respondents lived as joint families where 64.3% lived as nuclear families.

The family sizes of the fish farmers were divided into four categories according to the number of the family member. The highest percentage (40%) was obtained in the 4–5 members and 2–3 members (15.7%), 6–7 members (15.7%) and above 7 members (28.6%) members family categories. Ali *et al. (*2008) observed that 52% of the fish farmers had 4–5 family members and 20% had >6 family members in Rajshahi district which is more or less similar to present findings.

3.1.2 Natural capital: Total land area, calculated in this study, by summing up the homestead, cultivated and pond area of the fish farmers. The mean (±SD) total land area was 2.28 ± 1.77 ha, where the maximum land area was 9.25 ha and the minimum was 0.14 ha. The mean (±SD) homestead area, cultivated land and pond area was 0.07 ± 0.04 ha, 2.02 ± 1.63 ha and 0.18 ± 0.1 ha respectively. Khatun *et al*. (2013) reported fish farmer's average overall land area of 2.12 ha in Charbata union including 0.51 ha homestead area, 1.37 ha cultivated land and 0.24 ha pond area.

3.1.3 Financial capital: In the present study majority of the fish farmers was involved in agricultural farming as the primary occupation (47%); other professions like business, fish culture, services and day labourer were represented by 14%, 24%, 13% and 2% respondents respectively. Sarwer *et al.* (2016) found fish culture as primary occupation for 10% respondents while 42%, 22%, 18% and 8% were involved in agriculture, business, services and day labourers respectively. Around 38% and 6% fish farmer reported to be involved in agriculture and fish farming as their primary occupation while 26%, 20% and 10% were business, services and day labourer respectively (Khatun *et al.* 2013).

In the study area 53% of the respondents stated that their secondary occupation was fish farming while, 42%, 3% and 2% were involved in agricultural farming, business and services respectively. Sarwer *et al.* (2016) stated that 36%, 28%, 22%, 8% and 6% were involved in fish culture, agriculture, business, services and poultry raising as the secondary occupation respectively. Ali *et al.* (2008) also found agriculture as secondary occupation for 48% of the respondents while 20% and 30% were involved in fish farming and business respectively.

It was found that 89% of the farmers spent their own money for fish farming. They also received loans from different sources (Bank, mohajon, GO and NGOs; Figure 2). Sarwer *et al.* (2016) also found that 91% of the farmers spent their own money for fish farming followed by bank loans (6%) and loan from other sources (3%). Ali *et al.* (2008) found that 80% of farmers spent their own money for fish farming, while the rest of the farmers received loans. This was happened due to shrinkage of bank loan facilities and higher interest was taken by the usury in the study area.

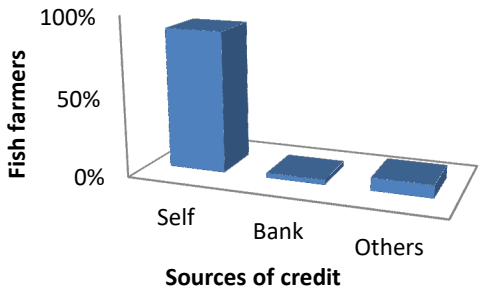

FIGURE 2 Credit sources of the fish farmers

3.1.4 Physical capital: Majority (81.4%) of the fish farmers had electricity in in their houses. However, Ali *et al.* (2008) observed that 62% of the fish farmers had electricity facilities in Rajshahi district. It was observed that 14% of the fish farmers used unconstructed sanitary, 46% semi constructed and 40% of the farmers used constructed sanitary. The sanitary conditions of the fish farmers were relatively satisfactory compared to the fish farmers in Mymensingh district where Ali *et al.* (2009) observed that 62.5% of the farmers had semi-pucca, 25% had kancha and 12.5% had pacca toilet.

The present study also showed that 41% of fish farmer's households, for medical treatment, were dependent on village doctors followed by Parbatipur upazila health complex (20%) and others (e.g. private chamber of MBBS doctors and district health complex; 39%). Ali *et al.* (2008) found that 46% of the farmers received health service from village doctors, 18% from upazila health complex, 14% from district hospital and 20% from MBBS doctors in Rajshahi district.

The study showed that all the fish farmers used their own tube-well for drinking, but during dry season 30% used their own tube-well, remaining 70% used other sources (e.g. neighbours' tube-well and underground water pumps). Kabir *et al.* (2012) also found that 100% fishermen's household used tube-well water for drinking, among them 40% had their own tube-well, 50% used shared tube-well and remaining 10% used neighbours tube-well. All the farmers had tube-well in the household because it is easy to install at a reasonable cost. Sometimes government offers some donations to the installa-

tion of tube-well. But in dry season, they used pump and dip tube-well because of lowering of ground water level.

3.1.5 Social capital: Cultural knowledge gained from various sources by the fish farmers in the study area are shown in Figure 3. Sarwer *et al.* (2016) found that 75% of the farmers gained experience by self-study followed by fiends (9%), NGOs (6%), and DoF and relatives (5% each) in Subarnachar, Noakhali. Similar observation was also made by Khatun *et al.* (2013) in Noakhali district.

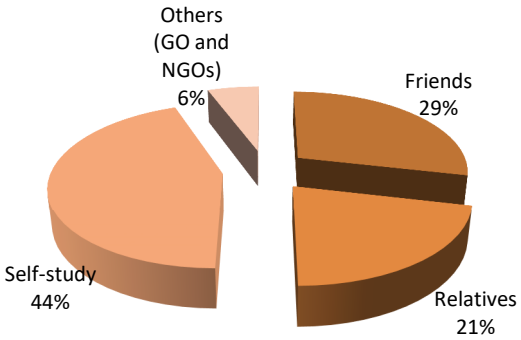

FIGURE 3 Culture knowledge gained from various sources by the fish farmers in the study area

Only 9% of the fish farmers received formal training on fish culture, primarily from Parbatipur upazila, Parbatipur hatchery and other organizations such as Boropukuria institute. Comparatively higher proportion of fish farmers (14 – 18%) received formal training on fish culture in Noakhali area of Bangladesh (Khatun *et al.* 2013; Sarwer *et al.* 2016). This variation may be due to the lack of training facilities and less awareness of the fish farmers about the benefit of the training. Sometimes they did not attend the training program because of lack of time.

3.2 Features of pond fish culture system

Pond size is an important factor for fish culture because all management measures are being considered on the basis of it. In the study area, ponds were of two categories, seasonal (16%) and perennial (84%). The water level of perennial ponds declined during dry season and then some farmers supply underground pump water to their ponds. Seasonal ponds were found unsuitable for fish culture throughout the dry season. Pravakar *et al.* (2013) recorded 10% seasonal and 90% perennial ponds in Shahrasti upazila of Chandpur district. Ali *et al.* (2008) found that 46% of the ponds were seasonal and 54% pond was perennial in Bagmara upazilla of Rajshahi district. In the study area, 47% of the fish farmers practiced extensive system and remaining farmers practiced semi-intensive aquaculture.

All the farmers were involved in polyculture of carps (cyprinids) including major carps, non-native Chinese carps and other species (Table 1) because of availability of the fish seeds, easy production system, higher growth rate and market demand. The mean (±SD) stocking density was 23208 ± 3214.1 fingerlings ha^{-1}. Sarker and Ali (2016) found that, the average stocking density was 15500 fingerlings ha^{-1} in Sreemangal upazilla of Moulavibazar district.

TABLE 1 Cultured fish species in the study area

Group	*Local name*	*Scientific name*
Major carp	Rui	*Labeo rohita*
	Katla	*Catla catla*
	Mrigal	*Chirrhinus cirrhosus*
	Kalibaush	*Labeo calbasu*
Non-native fish	Silver carp	*Hypophthalmichthys molitrix*
	Grass carp	*Ctenopharyngodon idella*
	Bighead carp	*Aristichthys nobilis*
	Common carp	*Cyprinus carpio*
	Tilapia	*Oreochromis niloticus*
	Thai pangas	*Pangasius hypophthalmus*
	Thai Punti	*Puntius gonionotus*
Others	Bata	*Labeo bata*

In the study area, fingerlings were collected from nearby ponds (79%), government hatchery (17%) and private hatchery (4%). In Kaliakair upazila of Gazipur district only 15.3% of the fish farmers collect fish seeds from the private hatcheries (Rahman *et al.* 2015).

It was observed that majority of the farmers used cow-dung as organic fertilizer to increase the primary productivity of the ponds. Farmers used both urea and TSP as inorganic fertilizers. Cow-dung was applied at the rate of 8665.4 ± 10591.4 kg ha^{-1} yr^{-1} on a regular basis or three to four times in a month. Whereas, for urea and TSP these values were 210.1 ± 199.2 kg ha^{-1} yr^{-1} and 133.5 ± 149.1 kg ha^{-1} yr^{-1} respectively. Most of the farmers used inorganic fertilizers irregularly at different rates. However, the application rate of cow-dung was higher than the farmers of Tangail district (2330 kg ha^{-1} yr^{-1}) but lower for urea (387 kg ha^{-1} yr^{-1}) and TSP (176 kg ha^{-1} yr^{-1}) (Saha 2004).

Farmers used lime in the culture system for the protection against various diseases and to improve the water quality of the pond. In the study area, among the 70 farmers only 63% used lime irregularly with no fixed doses. The mean (±SD) rate of liming before stocking was 205.7 ± 211.1 kg ha^{-1} yr^{-1} and this value was 138.4 ± 101.9 kg ha^{-1} yr^{-1} after the stocking. To get more fish production farmer used lime at the rate of 247 kg ha^{-1} yr^{-1} in Panchagar (Islam and Haque 2010). Zaman *et al.* (2006) found that 53.3% of the fish farmers used lime and fertilizers in their ponds properly. Similar application rate of lime was also reported from others parts of the country (e.g.

Mohsin *et al.* 2012a, 2012b).

It was found that fish farmers supplied various types of supplementary feeds such as rice bran, mustard oil cake, commercial pellet feeds, corn flour bran etc. both regularly or irregularly. The mean (±SD) application rates of rice bran and mustard oil cake were 419.2 ± 692.6 kg ha^{-1} yr^{-1} and 622.8 ± 1266.6 kg ha^{-1} yr^{-1} respectively. Various commercial feeds (e.g. Mega Feed) were also used and the mean (±SD) application rate was 410.3 ± 764.6 kg ha^{-1} yr^{-1}. According to Sarker and Ali (2016) the farmer usually use rice bran (at 2200 kg ha^{-1} yr^{-1}) and mustard oil cake (550 kg ha^{-1} yr^{-1}). The supplementations of rice bran and mustard oil cake were 1920 and 100–110 kg ha^{-1} yr^{-1} respectively in Debigonj and Boda upazilas of Panchagar district (Islam and Haque 2010). Majority of the farmers applied rice bran and mustard oil cake only because of easy availability and lower price.

3.3 Problems

Lack of technical knowledge (ranked I) was the major problem in the study area (reported by 60% of the fish farmers; Table 2). It was also noted that fish farmers did not have scientific knowledge regarding water quality management that may be due to poor extension service and lack of information. Farmers did not get necessary training (ranked II) from the extension agents (both GOs and NGOs) as reported by 37.2% of the fish farmers. The number of field extension workers is very limited in public sector which makes it harder for them to satisfy all the farmers.

TABLE 2 Frequency distribution of problems faced by fish farmers' (*N* = 70)

Problems	*Percentage*	*Rank*
Lack of Technical knowledge	60.0	I
Lack of training on aquaculture	37.2	II
Financial problem	22.86	III
Low level of education	14.29	IV
Lack of quality feed	14.29	IV
Lack of quality seed	10.0	V
Inadequate credit facilities	7.1	VI
Poaching	7.1	VI
Marketing problem	2.9	VII
Multiple ownership	1.4	VIII

Multiple responses were considered

Problems encountered by the farmers in the study area are not new and already reported in other studies (e.g. Mohsin *et al.* 2012c; Galib *et al.* 2013; Islam *et al.* 2013). Sarker and Ali (2016) also reported that 30% of the fish farmers were confronted by lack of fish fry during stocking period. In other survey in Shahrasti, Chandpur fish disease was reported by 30% of the fish farmers followed by non-availability of fish fry (20%), insufficient water in ponds during dry season (16%), poaching (14%), poor technical knowledge (10%), lack of money (6%) and lack of quality feed (4%) (Pravakar *et al.* 2013).

4| CONCLUSION

Considering the different observations during the present study, Parbatipur upazila was found to be potential area for fish culture. Government and other organizations should play their assigned roles by disseminating information to the farmers and training on fish culture need to be conducted in order to identify and solve the existing problems. Credit facilities for the farmers should also be increased and they should be motivated to utilise all types of waterbodies properly for fish culture.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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CONTRIBUTION OF THE AUTHORS

KN primary data collection and manuscript (MS) preparation; **KF** research supervision and MS preparation; **KCR** data analysis and MS preparation; **RP** data analysis and MS preparation