



## Present status, problems and prospect of fish farming at Gazipur Sadar upazila in Bangladesh

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### Abstract

The present study was conducted to reveal the present scenario, problems and the prospect of fish farming of Gazipur Sadar upazila Bangladesh. The primary data were collected through field survey, questionnaire interview and focus group discussion from the fish farmers of several villages and urban areas of the upazila. Secondary data were collected from the Department of Fisheries and aquaculture extension section. Gazipur Sadar upazila has 14462.42 ha potential fisheries resources of which floodplains, seasonal water bodies, and ponds comprise 71.01%, 13.04%, and 8.57%, respectively. The total fish production of the upazila in 2016-17 was 14492.7 MT, 27% of the Gazipur district. The highest fish production of 5436 MT and 4.39 MT/ha/year came from the pond sector. Among different pond culture systems, the semi-intensive system had the highest fish production output (2826 MT). Exotic carps were the highest produced fish in the ponds. However, in spite of comprising a huge proportion of seasonal floodplains the fish production from this sector was only 0.42 MT/ha/year in 2016-2017. This indicates the poor utilization of inland open water resources for fish production in the study area. The major areas were identified to improve the existing pond fish farming situation were access to low-interest loan, quality seed, supply of advanced technologies, need-based training, and marketing facilities. Along with improving the pond fish farming, community-based fisheries management and some aquaculture initiatives on private own seasonal floodplains should be taken on a priority basis to improve open water management and to flourish inland fish production in the study area.

**Key words:** Fish farming, Gazipur Sadar, resources, production, problems

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### Introduction

Bangladesh is a land of water resources bestowed with rivers, beel, khal, floodplains, canals and thousands of small wetlands and ponds. Majority of those water bodies are suitable for the freshwater fish culture. Total fish production of Bangladesh in 2016-17 was 41.34 lakh MT where aquaculture contributes 56.44% (DoF, 2017). Bangladesh is now ranked 5<sup>th</sup> in world aquaculture production (FAOSTAT, 2016). Fisheries sector contributes 3.65% of total GDP and 23.81% of

the agricultural GDP (DoF, 2016). 18.5 million people have involved in this sector in which numbers of fish farmers are around 13.86 million. Total pond area of Bangladesh in 2016-17 was 1.83 million ha and annual production was 4.77 MT/ha (DoF, 2017). Freshwater fisheries play a significant role in the livelihoods of rural and poor people in Bangladesh (Mazid, 2002). Fish farming has been proved a profitable and attractive business comparing to the rice or other

agricultural cultivations. Therefore, many rice farmers are converting their fields into fish culture ponds (Islam *et al.*, 2002; Islam *et al.*, 2017). A large number of people have improved their socioeconomic conditions through fish farming activities in Bangladesh (Ara, 2005). Aquaculture practice has the potentiality to achieve self-sufficiency in the food sector and to reduce poverty in Bangladesh (Al-Amin *et al.*, 2012). Proper planning and development in any production sector need up to date information on available resources, prospect, current states, and problems. The implementation of the developmental program often turns to unsuccessful due to the lack of proper information and socio-economic data (Ellis, 2000; Hasan *et al.*, 2012). Gazipur is one of the most important districts for aquaculture and fish culture propagation in the division of Dhaka, Bangladesh. Gazipur Sadar upazila is one of the five upazilas of Gazipur district surrounded with the area of 446.38 km<sup>2</sup>, located in between 23°53' and 24°11' north latitudes and in between 90°20' and 92°30' east longitudes. Based on the location it could be one of the ideal fish production areas of Bangladesh. Although the involvement of large numbers of people in fish farming with available huge fisheries resources surprisingly, no study of present fish farming status, available fisheries resources, and emerging problems in that area is reported yet. Therefore, the present study was carried out to assess the present fisheries resources, fish farming conditions, livelihood status of fish farmers and major constraints faced in the fisheries sector in the Gazipur Sadar upazila, Bangladesh.

## Materials and Methods

### Study area

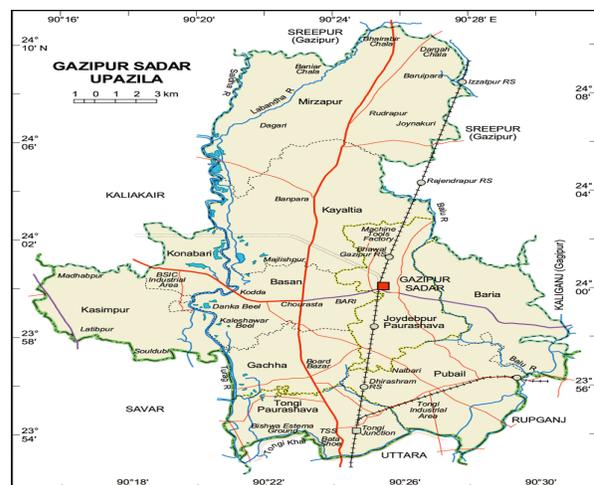
The present study was conducted at Gazipur Sadar upazila of Gazipur district, Bangladesh (Figure 1). Several types of waterbodies and fish farms located in different villages and urban areas were selected and monitored.

### Data collection

The study was conducted by collecting some primary and secondary data. Primary data were collected through the survey, monitoring, participatory rural appraisal (PRA) tool such as focus group discussion (FGD), and consultation among the resource users and stakeholders. A set of preplanned questionnaire was prepared to address several issues of fish farms, fish culture, production, farmers' socioeconomic conditions and problems related to fish culture. The fish farmers having several ponds that they utilize for sustenance and livelihood were selected randomly and interviewed at home or farming sites. In a given day approximately five to six interviews were performed. FGD was done with a group of 10-14 fish farmers. In addition, some secondary data of fisheries resources and fish production were collected from Department of Fisheries (DoF) and other extension departments.

### Data analysis

All the collected data were carefully scrutinized, recorded and analyzed using Microsoft Excel with the simple statistical method and presented in both graphical and tabular form for ease of understanding. Outline of the methodological approach is presented in Figure 2.



**Figure 1.** Map of the study area of Gazipur Sadar upazila.

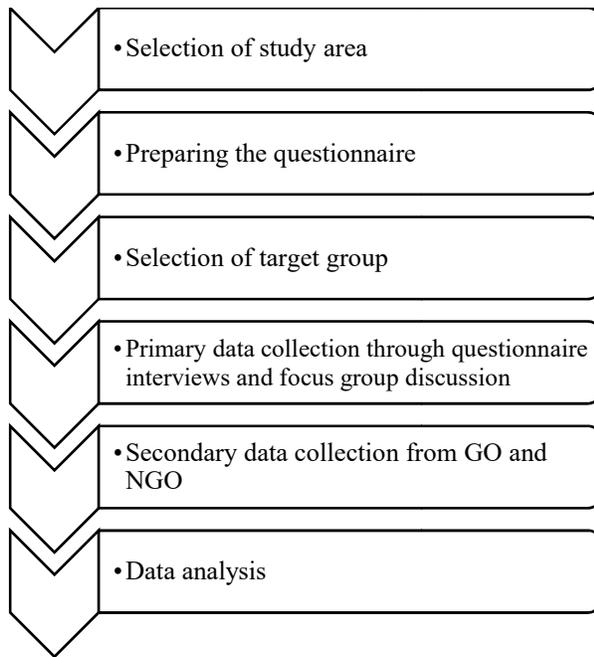


Figure 2. Outline of the methodological approach

## Results and Discussion

### *Fisheries resources and prospect of fish culture*

Gazipur Sadar upazila has vast fisheries resources including both open and closed water bodies. The large number of open and closed water-bodies and human resources present in Gazipur Sadar Upazila, of which most of the water resources are suitable for fish culture (BBS, 2012). Among the five upazilas in Gazipur district, total fisheries resource area in Gazipur Sadar was 14462.42 ha, which was about 30.61% of Gazipur district (47250.76 ha) in 2016-17. In Gazipur Sadar 71.01% water area was occupied by the floodplains while seasonal waterbodies, ponds, beel, river, and khal comprises 13.04%, 8.57%, 4.62%, 1.09% and 0.37% area, respectively. The sector-wise varieties of fisheries resources are summarized in Table 1. Among the seven rivers, the major rivers flow in this area is Turag, Balu, Labandaha, and Salda. The beels, floodplains, and ponds are highly potential water resources for aquaculture in Gazipur Sadar (Halim *et al.*, 2017).

Table 1. Fisheries resources of Gazipur Sadar upazila

Type of Resources	No.	Area (ha)	Area (%)
<b>Inland Open Water (Capture)</b>			
River	07	158	1.09
Floodplain	91	10270	71.01
- Natural	-	10120	-
- Fry released program	-	150	-
Beel	07	668.01	4.62
<b>Inland Closed Water (Culture)</b>			
Khal	09	52.91	0.37
Pond	-	1239	8.57
- Extensive	-	-	-
- Semi-intensive	1748	987	-
- Intensive	346	211	-
Highly Intensive	47	41	-
Seasonal water body (Paddy field and Boropit)	-	1886	13.04
Pen culture	65	143	0.99
Private commercial fish farm	15	45.50	0.31
<b>Total</b>	<b>2335</b>	<b>14462.42</b>	
<b>Others and Manpower</b>			
Fish hatchery	02		
Fish nursery	31		
Fish market	57		
Fish feed industry	14		
Fish farmers	2575		
Fisherman	2083		

Source: Department of Fisheries (DoF), Gazipur Sadar, Bangladesh.

*Present status, problems and prospect of fish farming*

**Fish production**

From the data, it is obvious that fish production of Gazipur Sadar had increased over the past three years (Table 2 and Figure 3). The production has increased from 14309.0 MT in 2014-15 to 14492.7 MT in 2016-17. In the year 20016-17, pond fish production had the

highest production rate of 4.39 MT/ha/year, followed by seasonal water bodies (2.19 MT/ha/year), beels (0.83 MT/ha/year), floodplains (0.42 MT/ha/year) and rivers (0.15 MT/ha/year).

**Table 2.** Sector-wise three years fisheries production in Gazipur Sadar and Gazipur district (Unit: Metric Ton)

Sectors	2014-2015		2015-2016		2016-2017	
	GD	GS	GD	GS	GD	GS
River	171	26	224	25.9	380	25.2
Floodplain	16136	4327	16397	4338.1	16764	4341
Beel	1189	545	1218	548	1245	552
Seasonal water	7994	3748	8296	3751.1	8623	3760.0
Pen culture	656	353	1233	365	1058	378
Khal	-	-	-	-	-	-
Haor	-	-	-	-	-	-
Pond	23481	5310	21909	5340	25588	5436
-Extensive	10	-	7	-	9	-
-Semi-intensive	11456	2852	8852	2838	9176	2826
-Intensive	7467	1690	7306	1725	10612	1858
-Highly Intensive	4548	768	5745	777	5791	752
<b>Total</b>	<b>50179</b>	<b>14309.0</b>	<b>49277</b>	<b>14368.1</b>	<b>53658</b>	<b>14492.7</b>

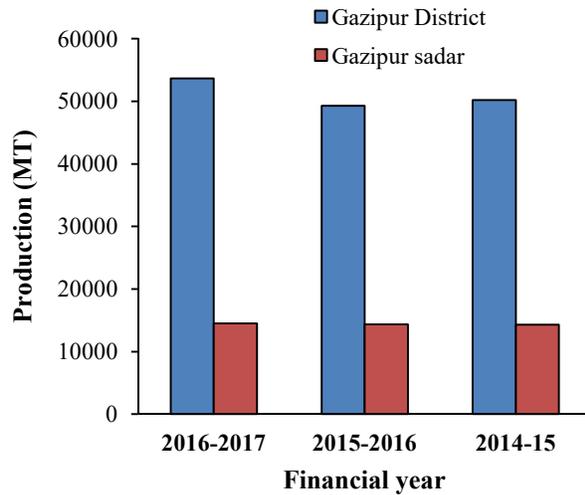
\*Extensive <1.5 MT/ha, Semi-intensive 1.5-4 MT/ha, Intensive 4> MT/ha, Highly Intensive 10.0>MT/ha, (GD: Gazipur District; GS: Gazipur Sadar). Source: Department of Fisheries (DoF), Gazipur Sadar, Bangladesh.

The annual pond fish production in the study area was lower than the Gazipur district (6.39 MT/ha) but about similar to national pond fish production (4.77 MT/ha) (BBS, 2016). The share of pond fish production in the total fish production of Gazipur Sadar was 37.69% in 2016-17. Khaled (2008) also reported that the share of pond fish production of Gazipur district was less than 40%.

In the year of 2014-2015, pond fish production in Gazipur Sadar was 5310 MT which was 22.61% of Gazipur district. In 2015-2016, it increased by 24.37%

and then slightly decreased to 21.24% in the following year. Pond fish cultures in this area are mainly conducted by the extensive, semi-intensive, intensive and highly intensive system. Semi-intensive culture contributed more than 50% (2852 MT) of the fish production of total pond sector. The extensive ponds' productions were done mainly for the home consumption and were not recorded in this study. The overall fish production of Gazipur district slightly decreased by 902 MT from 2015 to 2016 and then rose by 4381 MT in 2017. Among the total fish production of Gazipur district, about 27% came from Gazipur

Sadar upazila in 2016-17. Most of the open water bodies are hugely affected by agricultural, industrial and municipal waste in Bangladesh. However, similar to our study the closed water or pond fishery production in Bangladesh is increasing gradually (Ahmed, 2010).



**Figure 3.** Comparative figure of three years fish production in Gazipur Sadar upazila and Gazipur district

Farmers were found to culture various types of fish species including exotic carps, tilapia, Indian major carps, pungus, koi, small indigenous species, catfishes etc. From the species-wise fisheries production at 2016-17, it was recorded that exotic carps: silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharyngodon idella*), bighead carp (*Hypophthalmichthys nobilis*), common carp (*Cyprinus carpio*) and Indian major craps: catla (*Catla catla*), rohu (*Labeo rohita*), mrigal (*Cirrhinus cirrhosus*) contributed 22.89% (3318.10 MT) and 16.47% (2387.0 MT), respectively of total fish production of that area (Table 3). On the other hand, other varieties of wild caught species including small indigenous species mainly came from the floodplains comprised 28.80%. The monoculture production of tilapia reached 19.31% then followed by pungus (*Pangasius hypophthalmus*) 6.02%, catfishes (*Heteropneustes fossilis* and *Clarias batrachus*) 3.88%, and koi (*Anabas testudineus*) 2.62%. Catfishes had very lower production rate compared to the carps. There was no commercial production of freshwater prawn observed in the study area.

**Table 3.** Species-wise fisheries production in Gazipur Sadar upazila in 2016-2017

Types of fish	River	Beel	Flood plain	Pond	Seasonal water	Total (MT)	%	% in Gazipur district
Indian major Carp	3	15	18	1337	1014	2387	16.47	26.11
Exotic Carp	0.1	3	11	2212	1092	3318.10	22.89	32.32
<u>Pungus</u>	0.5			682	190	872.50	6.02	7.67
Tilapia	-	-	20	1178	1600	2798	19.31	28.94
Koi	-	49	331	-	-	380	2.62	0.33
Shing-Magur		79	482	2		563	3.88	0.43
Others Inland Fish	22.1	406	3479	25	242	4174.10	28.80	4.20
<b>Total</b>	<b>25.7</b>	<b>552</b>	<b>4341</b>	<b>5436</b>	<b>4138</b>	-	-	-
<b>Production</b>	<b>0.15</b>	<b>0.83</b>	<b>0.42</b>	<b>4.39</b>	<b>2.19</b>			
<b>MT/ha/year</b>								

Source: Department of Fisheries (DoF), Gazipur Sadar, Bangladesh.

**Demographic profile of fish farmers**

In the present study, different socio-economic indicators of the farmers have been studied (Table 4). In the area, 52.72% of the farmers were old aged whereas 34.54% and 12.72% fish farmers were middle and young aged respectively.

**Table 4.** Socio-economic and educational profile of fish farmers (n = 110)

Category	No.	Percentage
<b>Age group (Average age)</b>		
Young	14	12.72
Middle	38	34.54
Old	58	52.72
<b>Family Type</b>		
Nuclear	75	68.18
Joint	35	31.82
<b>Family Size</b>		
Small family (<5 members)	82	74.55
Large Family (>5 members)	28	25.45
<b>Education level of farmer</b>		
No formal education	14	12.72
Primary (I-V)	21	19.09
Secondary (VI-X)	56	50.90
Higher Secondary (XI-XII)	10	9.09
Graduation	9	8.18
<b>Investment in fish culture</b>		
Own	91	82.73
Bank Loan	14	12.73
Others	5	4.55
<b>Training on fish culture</b>		
No formal training	88	80
Training from GO	14	12.73
Training from NGO	8	7.27

Source: Field survey, 2017

However, most of the farmers have other job involvement such as agriculture, livestock, business, service etc. The farmers at Mirergao area were observed conducting fish culture commercially at very large scale especially in the beel area. The higher involvement of old people in fish farming indicates that

the young people are moving to other occupations. The higher percentage of the nuclear family (68.18%) was evidenced than the joint family (31.82%). The family size usually has a considerable influence on the income and expenditure of the family. In both family types, 74.55% family had more than five members. The study sketched that majority of the farmers (82.73%) were invested their own money in fish culture. A few of them, who were not economically solvent, took loan from the bank (12.73%). Rest of them managed the amount of investment from friends or neighbors. Most of the fish farmers of Bangladesh culture fish with their own money (Quddus *et al.*, 2000).

**Level of education**

According to the present study, 12.72% farmers were illiterate whereas 19.09%, 50.90%, and 8.18% had primary, secondary and graduation level of education respectively. However, the literacy rate (87.28%) in the surveyed area was higher than the national literacy level (72.3%) of Bangladesh (BBS, 2016). Pravakar *et al.* (2013) illustrated about the similar educational status of the fish farmers in Shahrasti, Chandpur of Bangladesh. Level of education of farmers hugely affects the utilization of pond and fish production (Khan, 1986)

**Training on fish culture**

During the study, it was observed that most of the farmers (80%) do not get any kind of scientific fish culture training. Only 12.73% farmers got training from DoF and 7.27% farmers got training from different Non-Govt. Organizations (NGO). Very little initiatives to conduct training are arranged by the DoF of Bangladesh (Khatun *et al.*, 2013; Rahman *et al.*, 2015). In most cases, farmers adopted fish culture techniques from their ancestors and neighbors that are not the scientific approach.

**Pond characteristics and ownership**

From the study, it was observed that majority of the cultured ponds (60%) were smaller (1-4 Decimal) whereas only 17.27% ponds were comparatively large

(>8 Decimal) in size (Table 5). In addition, more than half of the ponds had a lower depth between 1-2 m (53.64%) which is desirable for fish culture. In addition, 79.09% and 20.91% ponds were seasonal and perennial respectively. Khan (1986) stated that fish culture efficiency depends on the size and the depth of

ponds. 74.56% farmers were recorded culture fish in their own pond while in contrast, 20% ponds had multiple ownership. Multiple pond ownership is one of the major constraints for the pond aquaculture (Hossain et al., 2002).

**Table 5.** Characteristics and pattern of ownership of ponds at Gazipur Sadar upazila (n=110)

Pond Area (Dec.)	%	Pond Depth (m)	%	Pond type	%	Pond Ownership	%
Small (1-4)	60	Low (1-2)	53.64	Seasonal	79.09	Own	74.56
Medium (5-8)	22.73	High (>2)	46.36	Perennial	20.91	Leased	5.44
Large (>8)	17.27	-	-	-	-	Multiple	20

Source: Field survey, 2017

### Pond management

Different pond management practices found in the study area are mentioned in Table 6. In the study area, farmers were found to use organic fertilizers (compost, cow dung and chicken manure) and inorganic fertilizers (urea and TSP). Application of fertilizer is very important for increasing natural food

(phytoplankton, zooplankton and benthic organisms), in that way to augment fish production. From the study, it was clear that 49.09% fish farmers applied different kinds of commercial floating and sinking pelleted feed while 31.82% farmers used loose feed (non pelleted feed, rice bran, wheat bran, mustard oilcake etc.) Most of the farmers were not well concern about the use of recommended amount of feed.

**Table 6.** Percentage of different kind of fertilizers, feed and chemicals (n = 110)

Fertilizer	%	Feed	%	Chemical	%	Gear	%
Organic	23.64	Loose feed	31.82	Lime	41.82	Seine net	58.18
Inorganic	20	Commercial pellet feed	49.09	Lime and salt	6.36	Cast net	40
Both	56.36	Both	19.09	Other chemicals	10	Hook	1.81
				No Chemicals	40.91	Push net	0.91

Source: Field survey, 2017

Lime and salt were the most used chemicals in the study area. Other chemicals and drugs used by the farmers include timsen, KMnO<sub>4</sub>, oxycol, and renamycin. However, 40.91% farmers did not use any chemicals and drugs. Lime, salt, potassium permanganate, sumithion, malathion, formalin,

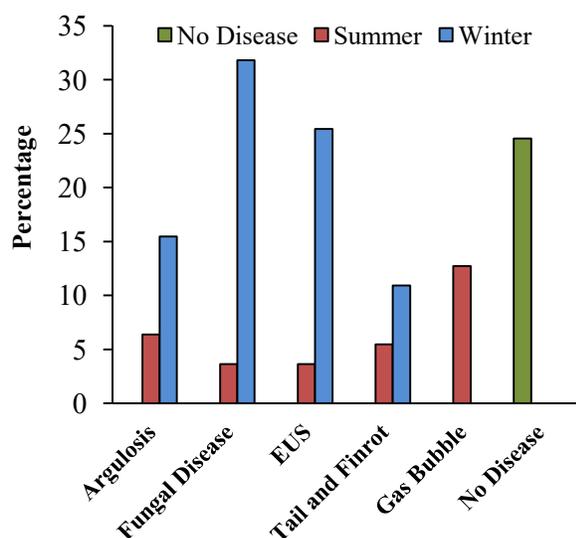
bleaching powder, methylene blue, zeolite and malachite green are the most commonly used chemicals in Bangladesh (Jilani et al., 2012; Rasul et al., 2017). The use of antibiotics in the intensive farming has led to multiple drug resistance among the

pathogens and some associated risks (Boyd and Massout, 1999).

In the study area, farmers were found to use different types of fishing gear from those seine net used mostly and then followed by cast net, hooks and push net. Farmers widely use the similar types of harvesting nets in Bangladesh which were found in the study area.

#### **Diseases**

In the study area, farmers reported the occurrence of diseases like fungal disease, epizootic ulcerative syndrome (EUS), argulosis, tail and fin rot and gas bubble disease during the culture (Figure 4).



**Figure 4.** Season-wise different disease occurrence in the fish farms of Gazipur Sadar upazila.

Fungal diseases (31.82%) were mostly reported disease in that area. Most of the diseases occurred in the winter season while gas bubble disease manifested in the summer season. About one-fourth of the respondent (24.55%) did not report the occurrence of diseases in their ponds. The farmers were found to take some preventative measures such as pond drying, liming, water exchange, removal of aquatic weeds and undesirable fishes to reduce disease outbreak. Fish disease and its management is a big challenge in

commercial fish farming in Bangladesh. Along with the reported diseases edwardsiellosis, red sopt, gill rot, parasitic disease are the most common freshwater fish diseases in Bangladesh (Aftabuddin *et al.*, 2016).

#### **Present emerging problems**

Gazipur Sadar upazila has a huge proportion of inland open water bodies especially floodplains (71.01%). However, the production from this sector comprises only 0.42 MT/ha/year where pond production contributes about 4 times. Only 150 ha area of floodplains was taken under fry release program until the year 2017 while rest of the area (98.54%) solely relies on captured fisheries. A huge area of capture fisheries of common property water-bodies is exposed to open access in Bangladesh, which is a big threat (Hossain *et al.*, 2015). In addition, the open water bodies have no exercise of aquaculture. Seasonal water-bodies also had comparatively low fish production rate (2.19 MT/ha) than the ponds. Open universal access and the indiscriminate use of these resources resulted in overexploitation which reduces fish production and diversity significantly. Seasonal floodplains retain water for 5-6 months/year during the monsoon, which is very rich in nutrients and identified as an excellent feeding, breeding and nursery grounds for the aquatic animals (Graaf, 2003). Floodplains comprise a major portion of our inland open water resources and could enrich national fish production significantly with a little enforcement of management and aquaculture initiatives (Rahman *et al.*, 2012).

In addition, the major problems faced by the pond fish farmers in the study area were low quality seed, insufficient loan facilities, lack of technical knowledge, multiple ownership of pond etc. (Table 7). Though industrial pollution remains in low risk until now rapid growing industries in the study area could lead a serious problem in near future. Similar types of pond farming constraints were found by Mazumder *et al.* (2013) which are major hinders for the progress of pond fish farming in Bangladesh.

**Table 7.** Problems faced by fish farmers during pond fish farming (n = 110)

Rank	Problems	Percentage
1	Inadequate supply of quality fish seed	90.90
2	Lack of technical knowledge	83.64
3	Lack of training from DoF and NGO	80.90
4	Lack of loan facility	74.55
5	High cost of commercial fish feed	73.64
6	Poaching and vandalism	72.73
7	Scarcity of culture water in the dry season	68.18
8	Bad water quality	65.45
9	Higher interest on loan	59.09
10	Problem of ownership	56.36
11	Poor transport facilities	54.55
12	Diseases	45.45
13	Political problem	43.63
14	Labor shortage	35.45
15	Natural calamities	13.64
16	Industrial pollution	9.09

**Recommendations to increase fish production**

In the upazila, the total demand for fish was calculated by 15530 MT which is quite high than the production of fish (14492.7 MT) in 2016-17. To boost the fish production rate huge area of floodplains and seasonal water bodies need to take under proper management. WFC (2005) reported that if 25% of seasonal water resources could bring under community-based fisheries management then national fish production will be increased many folds over the existing production. Therefore, to achieve maximum benefits from the inland open water resources in the study area the following suggested actions should be implemented.

- Initiatives to bring private own floodplains under aquaculture program
- Community-based fisheries management program for the sustainable use of common property water-bodies
- Establishment of sanctuaries and harvesting regulations

However, to remove the existent problems in pond fish farming the farmers suggested a number of following initiatives that could be implemented by Government organizations (GO), NGOs, and private organizations.

- Assurance of good quality seeds by increasing the number of hatcheries and nurseries
- Soft loan facilities for the fish farmers with a low-interest rate
- Need-based training on advanced fish culture and adequate supply of technologies
- Regular monitoring of fish farming activities by the skilled manpower from DoF and other extension departments
- Initiatives to proper utilization of derelict water bodies and adoption of integrated culture techniques
- Development of a coactive community and improvement of the transportation system to resolve the marketing problems
- Pollution mitigation especially in the industrial area

**Conclusion**

From the present study, it is evident that Gazipur Sadar upazila is very rich with versatile aquaculture resources that could make that one of the ideal freshwater fish production areas of Bangladesh. However, this study has revealed very poor utilization of inland open water-bodies and existence of some major constraints in pond fish production in the Gazipur Sadar upazila. The fish production will reach high beyond the fish demand in the study area if the huge area of inland water bodies could bring under proper management and aquaculture technologies and existing pond fish farming production

could be raised. Therefore, Governmental and Non-governmental initiatives are crucial to resolve existing problems and to ensure higher fish production.

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